



Break the Waste Cycle

Producer Responsibility Policies to Move
the U.S. Toward Zero Waste

NCPIRG
Education Fund



FRONTIER GROUP

Break the Waste Cycle

Producer Responsibility Policies to Move the U.S.
Toward Zero Waste

NCPIRG
Education Fund



FRONTIER GROUP

WRITTEN BY:

ADRIAN PFORZHEIMER, FRONTIER GROUP
ALEXANDER TRUELOVE, U.S. PIRG EDUCATION FUND

OCTOBER 2020

ACKNOWLEDGMENTS

NCPIRG Education Fund and Environment North Carolina Research & Policy Center wish to thank Sydney Harris and Scott Cassel of the Product Stewardship Institute and Heather Trim of Zero Waste Washington for providing review and insights for this report. Thanks also to Tony Dutzik, Jamie Friedman, Gideon Weissman and Susan Rakov of Frontier Group for editorial support, and James Horrox of Frontier Group and Abi Bradford, formerly of Frontier Group, for work on early drafts of this report.

The authors bear responsibility for any factual errors. Policy recommendations are those of NCPIRG Education Fund and Environment North Carolina Research & Policy Center. The views expressed in this report are those of the authors and do not necessarily reflect the views of our funders or those who provided review.

© 2020 NCPIRG Education Fund. Some rights reserved. This work is licensed under a Creative Commons Attribution Non-Commercial No Derivatives 3.0 Unported License. To view the terms of this license, visit creativecommons.org/licenses/by-nc-nd/3.0.

NCPIRG Education Fund With public debate around important issues often dominated by special interests pursuing their own narrow agendas, NCPIRG Education Fund offers an independent voice that works on behalf of the public interest. NCPIRG Education Fund, a 501(c)(3) organization, works to protect consumers and promote good government. We investigate problems, craft solutions, educate the public, and offer North Carolinians meaningful opportunities for civic participation. For more information about NCPIRG Education Fund or for additional copies of this report, please visit ncpirgedfund.org.



Environment North Carolina Research & Policy Center is a 501(c)(3) organization. We are dedicated to protecting North Carolina's air, water and open spaces. We investigate problems, craft solutions, educate the public and decision-makers, and help the public make their voices heard in local, state and national debates over the quality of our environment and our lives. For more information about Environment North Carolina Research & Policy Center or for additional copies of this report, please visit www.environmentnorthcarolinacenter.org.

FRONTIER GROUP Frontier Group provides information and ideas to help citizens build a cleaner, healthier, and more democratic America. We address issues that will define our nation's course in the 21st century – from fracking to solar energy, global warming to transportation, clean water to clean elections. Our experts and writers deliver timely research and analysis that is accessible to the public, applying insights gleaned from a variety of disciplines to arrive at new ideas for solving pressing problems. For more information about Frontier Group, please visit www.frontiergroup.org.

Layout: To the Point Collaborative, tothepointcollaborative.com

Cover photo: Scharfsinn via Shutterstock

| Contents

- EXECUTIVE SUMMARY 4
- INTRODUCTION 7
- THE PROBLEM WITH AMERICA'S CONSUMPTION SYSTEM 9
 - THE LINEAR MATERIALS ECONOMY IS AT THE ROOT OF ENVIRONMENTAL CHALLENGES 9
 - A GROWING RECYCLING CRISIS 10
- PRODUCER RESPONSIBILITY PROGRAMS INCENTIVIZE A SHIFT TO A CIRCULAR ECONOMY 13
 - PRODUCER RESPONSIBILITY PROGRAMS HAVE A TRACK RECORD OF SUCCESS..... 14
 - CALIFORNIA'S USED MATTRESS RECOVERY AND RECYCLING ACT 14
 - FRANCE'S TEXTILE AND CLOTHING RECOVERY PROGRAM..... 15
 - U.S. PAINT RECOVERY AND RECYCLING PROGRAMS..... 16
 - PRODUCER RESPONSIBILITY IS PARTICULARLY URGENT FOR PACKAGING WASTE..... 17
 - BRITISH COLUMBIA'S PROGRAM FOR PACKAGING AND PAPER..... 17
- PROPOSED U.S. PROGRAMS FOR PACKAGING WASTE 19
- POLICY RECOMMENDATIONS 22
- NOTES 25

| Executive summary

THE U.S. THROWS OUT enough plastic every 16 hours to fill the Cowboys football stadium, and that amount is increasing.¹ Our society continually produces goods designed to be used once or temporarily and then thrown away. Most discarded materials are then landfilled or incinerated, creating pollution and requiring producers to extract more natural resources to make new materials.²

This waste is by design. Producers have the ability to make products that are more durable and more easily fixed when they break, as well as packaging that is less wasteful and more readily reused or recycled. They simply choose not to. The reason is clear: As long as individuals, governments, our environment and future generations – not producers – bear the costs of our throwaway society, those who design and make the products we buy have no incentive to change.

Holding producers responsible for the waste they create can incentivize a shift to a circular economy – one in which less waste is produced, products are built to last and easy to repair, and remaining materials are recycled or composted. Such a system would create zero waste, eliminating the need for landfills and trash incinerators, conserving natural resources and reducing pollution.

Producer responsibility programs around the world have existed for decades and

have successfully increased collection and recycling rates for the products they cover. With the growing urgency of the climate crisis, the rising impact of plastic pollution, and the continuing impacts of China's waste import ban on America's recycling system, **U.S. cities and states, as well as the federal government, should adopt thoughtfully designed producer responsibility programs – especially for packaging and printed products.**

Producer responsibility is a proven approach to reducing waste and improving recycling.

Under producer responsibility programs, manufacturers – not individuals or taxpayers – are responsible for the waste their products create, and bear responsibility for the collection and proper recycling of those products at the end of their useful lives. This incentivizes producers to design their products to be more environmentally friendly throughout their lifecycle.³

Programs that make producers responsible for waste typically cover products that are hazardous, hard to recycle or compost, or that generate a lot of waste. These include batteries, paint, mercury thermostats, carpet, pesticides, tires, and pharmaceuticals. Many states have programs in place for these items.

Responsibility for disposal may take the form of producers physically collecting

their products at the end of their lives, or supporting the collection and disposal process financially through payments to a producer responsibility organization (PRO) that funds and sometimes operates the collection and processing of material on producers' behalf. It can also be a combination of both.

Producer responsibility programs in the United States have made a difference in encouraging recycling and reducing waste.

- **California's Used Mattress Recovery and Recycling Act** requires mattress manufacturers that sell their products in California to create an effective system to collect and refurbish or recycle used mattresses. Manufacturers and retailers are required to register with the Mattress Recycling Council (MRC), the nonprofit stewardship organization that implements the program.⁴ Retailers must also offer to pick up consumers' old mattresses when they purchase new ones and transport the old mattresses to a recycling facility. Since it came into being in 2016, the MRC's "Bye Bye Mattress" program in California has recycled more than 5 million mattresses.⁵

Producer responsibility is particularly important when it comes to addressing waste from packaging, paper and single-use plastics.

- Containers and packaging account for roughly 30 percent of municipal solid waste (MSW), with 80.1 million tons of these materials thrown away in 2017.⁶ These materials clog landfills and incinerators, especially following the recent decision by several foreign countries – most notably China – to stop accepting most U.S. waste exports, dramatically increasing the cost of recycling for many U.S. communities.⁷

- Producer responsibility has been a success in boosting recycling rates for containers and packaging. In British Columbia, for example, where producer responsibility legislation for packaging and printed paper (PPP) came into effect in 2011, the stewardship organization Recycle British Columbia collected 78 percent of the PPP material producers sold in 2018, and recycled 90 percent of the amount collected.⁸ In contrast, an estimated 50 to 57 percent of material was recovered before the law went into effect.⁹

Several U.S. jurisdictions are considering producer responsibility programs for packaging. These proposals are often augmented by other policies – such as minimum recycled content standards for packaging – that support and enhance the value of producer responsibility. Some examples include:

- **Washington:** In May 2019, Washington adopted legislation directing the drafting of a study on how to reduce the volume of plastic packaging sold in the state; make it all recyclable, reusable or compostable; and make it with at least 20 percent recycled content by 2025.¹⁰ A plan with recommendations for a producer responsibility policy framework was submitted to the State Department of Ecology in September 2020.¹¹
- **Maine:** A bill introduced in January 2020 requires the establishment of a stewardship organization that will collect fees from producers of packaging material, calculated according to the toxicity and percentage of recycled content in the material. The fees will be used to reimburse municipalities for costs incurred in recycling and waste management.¹² The bill did not pass this year, but is expected to be reintroduced in 2021.

- **California:** In December 2018, the California Circular Economy and Plastic Pollution Reduction Act was introduced, requiring manufacturers of single-use plastic packaging and food-ware to reduce or recycle these materials by 75 percent, and to make them all recyclable or compostable by 2030.¹³ This bill did not pass during California's latest two-year legislative session, but is expected to be reintroduced. In the meantime, a ballot initiative requiring producers to pay a fee on single-use plastic packaging has collected enough signatures for the 2022 ballot.¹⁴
- **Federal:** February 2020 saw the introduction of federal legislation to hold producers accountable for wasteful products, reduce packaging, and phase out single-use plastic products. The Break Free From Plastic Pollution Act would place the financial burden of waste management and the clean-up of plastic pollution on the companies that manufacture and sell those products, and require producers to design their products in such a way as to minimize their environmental impacts, among other requirements.¹⁵
- Require producers to bear all of the end-of-life costs of their products, including waste collection, hauling, recycling, composting, landfilling, incineration and litter cleanup costs.
- Adjust any fees to incentivize producers to use recycled content in their products and design products that last and are easy and economical to repair, recycle or compost.
- Incentivize the repair or reuse of products where possible, and the recycling or composting of products that have reached the end of their useful lives.
- Set high standards for oversight and transparency at every stage of the process to ensure that producers are complying with requirements.

Effective producer responsibility programs can play an important role in moving the United States toward a circular, zero-waste economy. In adopting those programs, **states and the federal government should:**

- Integrate producer responsibility programs into an overall approach to waste reduction that:
 - First and foremost, **reduces** the amount of waste generated;
 - **Encourages the reuse, repair and refurbishment** of products whenever possible;
 - **Recycles or composts** all remaining materials, and;
 - Landfills or incinerates as little material as possible.

| Introduction

WATER SOLD in disposable plastic bottles is cheap. Should it be?

To produce a disposable water bottle, oil and gas are drilled or fracked. Fracking can cause earthquakes, oil drilling can cause spills, and both can contaminate water.¹⁶ The oil or gas is then transported to a refinery – perhaps through a pipeline or on an oil tanker that may leak or spill along the way. Oil and gas refineries are highly polluting facilities and a major source of air pollution, releasing particulate pollution, nitrogen oxides and volatile organic compounds that are major contributors to smog.¹⁷ Byproducts from the refinery are then shipped to a plastic manufacturing plant, which also releases toxic air pollution.¹⁸

The plastic is then likely transported to another factory to be manufactured into a plastic bottle, and then to another to be filled with water. The bottle of water is then packaged up with others (often in more plastic) and shipped – often over long distances – to a distributor and finally to a convenience store. Someone will buy the bottle of water and after drinking it, will toss the bottle. The environmental and public health costs resulting from the production of the bottle will not be factored into its price.

Nor will the cost of disposing of the waste the bottle has become. A local municipality will likely have to pay to collect and transport the bottle to a waste management facility. Unless the bottle is made of a high-value plastic, it will likely be landfilled or incinerated, creating toxic air and water pol-

lution. If the bottle is landfilled or littered, it will break down into microplastic particles over tens to hundreds of years. Those microplastics will persist and accumulate in the environment, some finding their way into the food we eat and the water we drink.¹⁹

Even the small amount of plastic that is recycled will likely be recycled into a less-durable product like insulation or fabric, so the process will need to start again to create new bottles that will eventually become waste.

The growing challenges of plastic pollution, climate change and rising recycling costs demand new solutions to America's waste problems.

Producers can change this model. They can make products out of more durable or recyclable materials and provide consumers with better options for returning and recycling those products before they become waste.

Why don't they do it? Because currently, producers can offload the costs of poor product design decisions onto taxpayers, the environment and future generations, leaving them with no incentive to make more sustainable decisions.

Thankfully, there is a solution: a concept called “extended producer responsibility,” or simply “producer responsibility.” Numerous successful programs in the United States and around the world hold producers fully or partially responsible for the waste their products become – and, in many cases, hold producers to higher standards for the sustainability of the things they make and sell. These producer responsibility programs, if well-designed, can play an important role in shifting from a one-way to a circular materials economy – one characterized by zero waste.

This paper reviews the experience with producer responsibility programs in the United States and around the world, highlighting programs that work as well as the ways in which those programs can be more effective in reducing waste.

The growing challenges of plastic pollution, climate change and rising recycling costs demand new solutions to America’s waste problems. Producer responsibility programs can be part of the solution.

The problem with America's consumption system

THE U.S. THROWS OUT immense amounts of stuff – nearly 1.5 million pounds every day. Most material is landfilled or incinerated.²⁰ To fill the continuous demand for new throwaway products, industries extract more and more natural resources. Extract, produce, consume, landfill or incinerate, and repeat. This system is called a “linear materials economy” and is essentially a one-

way street that converts natural resources into waste and pollution.

The linear materials economy is at the root of environmental challenges

The linear consumption and throwaway system contributes to many of the world's most important environmental problems. The activities it perpetuates – extracting

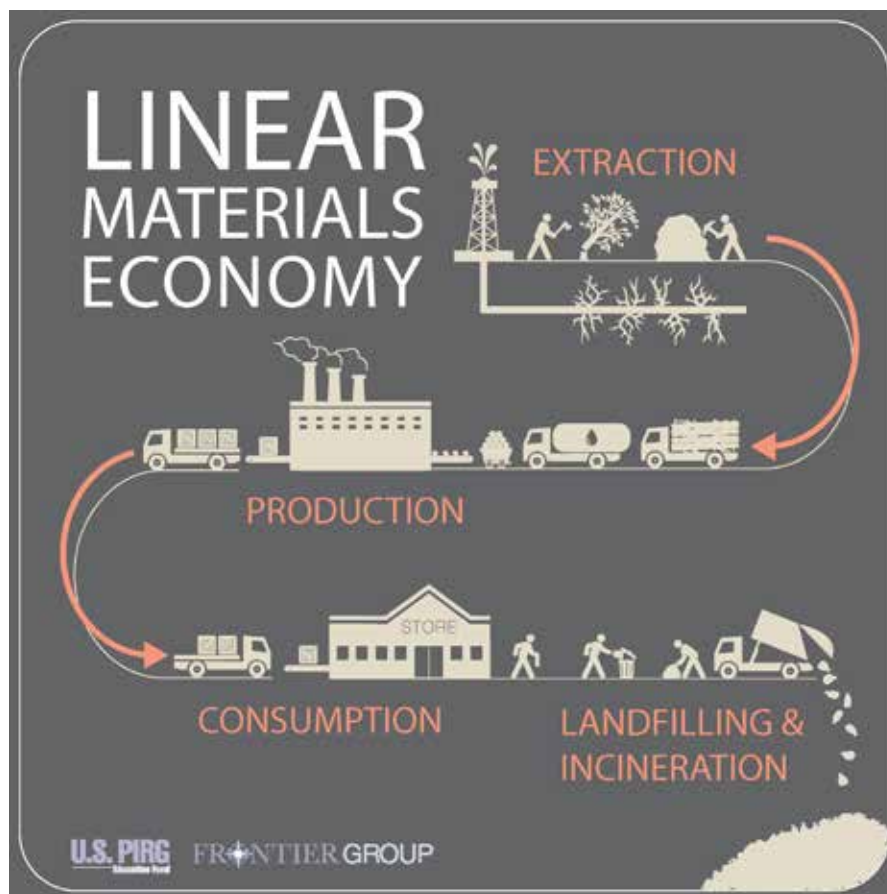


Figure 1. In a linear materials economy, resources are extracted and ultimately landfilled or incinerated

resources, producing goods, disposing of waste, and transporting materials at every stage of the process – collectively produce 42 percent of U.S. greenhouse gas emissions, contributing significantly to the climate crisis.²¹ Our linear economy also creates air, water and ocean pollution, contributes to the loss of natural areas and habitats, and depletes natural resources.²²

Many products and materials are hard or impossible – or even hazardous – to recycle or compost, making them difficult and costly for municipalities to manage safely.²³ Plastics have especially high environmental costs, due to the pollution from producing oil and gas and processing petrochemical feedstocks.

Since this system is so harmful to our health, environment and future – why does the U.S. produce, consume and throw out more and more materials in this manner every year?²⁴ The core reason is that the producers and consumers that drive this system do not bear the full cost or responsibility for the impacts of the products they make or buy, so they have no direct, financial incentives to conserve or to shift to less harmful practices.

A growing recycling crisis

In a linear economy, after a product's value has been extracted, the costs of its disposal are usually offloaded. Until a few years ago, U.S. recyclers would sort out the most valuable materials from the recycling stream and ship the remaining mixed, lower-value bales of recyclables to other countries. About one third of collected U.S. recyclables were exported, with half of that material going to China – 700,000 tons of plastic in 2016 alone.²⁵ The U.S. counted this exported material as recycled, but in reality, China and other countries were extracting the materials that they could economically recycle and landfilling and incinerating the rest.²⁶

These countries became increasingly concerned about the environmental impacts of this practice. Facing widespread pollution and a backlog of 60-70 billion tons of waste, China announced that it would no longer accept most imported scrap and recyclable materials starting in 2018.²⁷ China's announcement was followed by similar policies in Malaysia, Vietnam and Thailand.²⁸

Since these countries began enforcing their waste import restrictions, U.S. recyclers have been left to deal with huge quantities of materials that are lacking domestic end-markets or for which commodity values have plummeted. As a result, many recyclers have significantly increased how much they charge municipalities to take their recycling. This has caused many municipalities across the country to start to limit their recycling programs or to stop them all together.²⁹ The COVID-19 pandemic exacerbated this trend, shifting patterns of waste generation from the commercial to residential sector while further straining municipal budgets. From March to April of 2020, trash and recycling collected in U.S. cities was up an average of 20 percent even as nearly 90 curbside recycling programs were cut.³⁰

China shutting its doors to waste and scrap was a major disruption that heightened awareness of the core problems with the nation's recycling system. First, the U.S. generates far too much waste. Second, too much of that waste is impossible or uneconomical to recycle. This is partly due to the U.S. having limited recycling infrastructure and partly due to the lack of markets for recycled material.³¹ Too much of our waste is low-quality plastic that cannot be recycled or can only be recycled once or a few times before it becomes too degraded.³² Lastly, in single-stream recycling, where paper, plastic, glass and metal are commingled, much of the material that might be economically recycled is contaminated with non-recyclable material.³³

ELECTRONIC DEVICES, E-WASTE, AND PRODUCER RESPONSIBILITY

Producer responsibility must be a core principle guiding the design of all products. But producer responsibility may look different for different types of products. Electronics, durable goods, and single-use packaging may require different programs and policy approaches to best achieve zero waste.

Electronics are highly complex objects. Each iPhone contains 75 elements, harvested at substantial environmental cost from all over the world.³⁴ Recycling these back into recoverable materials is a highly energy intensive and polluting process.³⁵ The most sustainable option is therefore to focus on repairing and retaining electronic devices to extend their useful life as long as possible. This benefits consumers and has a doubly beneficial effect on the environment, avoiding waste in both manufacturing and the disposal process. If Americans held onto our phones one year longer on average, the emissions reductions would be equivalent to taking 636,000 cars off the road each year.³⁶

Producers contribute to this waste through planned obsolescence that encourages replacement of electronic devices every year or two. Planned obsolescence is often baked into product design – for example, where screws or snap covers used to be, now there is glue. Many products are impossible to fix without destroying them.³⁷ Throwaway tech culture has led to electronics waste becoming the world's fastest-growing solid-waste stream.³⁸

To reduce their impact on the environment and the public, producers should be held responsible for ending the cycle of planned obsolescence by designing products that can be used as long as possible and fixed when they break. Unfortunately, many electronics manufacturers do the opposite, restricting access to parts, diagnostic software or repair documentation, so that only their authorized

dealers have the necessary materials to do many repairs.³⁹ This can be expensive and inconvenient, and is helping create an alarming trend where consumers choose the path of least resistance and simply replace their devices.

Defending consumers' right to right to repair the devices they own, including by third-party fixers not authorized by the manufacturer, would go a long way towards extending the lives of many devices. Another sustainable option is encouraging and empowering the refurbishing of electronics for resale in secondary markets.

Without requirements for reuse, mandatory take-back programs for electronics – an effective tool for addressing waste from single-use and limited-use products, as well as hazardous materials – can have the perverse effect of helping manufacturers to accelerate the cycle of planned obsolescence by removing usable electronics from the market.

The best producer responsibility programs for electronics will prioritize repair and reuse, while also encouraging the recycling of electronics that have reached the end of their useful lives.⁴⁰ This is particularly important because e-waste makes up 70 percent of all hazardous material in landfills despite being just 2 percent of the solid waste stream.⁴¹ 23 states have producer responsibility laws for electronic products, facilitating their diversion to specialized recycling facilities.⁴² Pairing these requirements with explicit policies guaranteeing the right to repair electronics and encouraging refurbishment and reuse can provide the most effective strategy to reduce pollution from the production and use of electronics. Producer responsibility programs should be designed with the specific risks, characteristics and needs of every type of product in mind.

Rebuilding the old recycling system is not the solution to the nation's waste problems. More fundamental system solutions are needed that encourage waste reduction, reuse, repair and genuine recycling.

Producer responsibility programs incentivize a shift to a circular economy

PROGRAMS HAVE EXISTED for decades in the U.S. and elsewhere that seek to make producers responsible for waste. These producer responsibility programs shift responsibility for disposal of waste products from municipalities to producers, either by requiring producers to physi-

cally collect their products at the end of their life, requiring them to pay for the collection and disposal process through fees paid to a producer responsibility organization that collects and processes materials on the producers' behalf, or a combination of both.



Figure 2. In a circular economy all materials are reduced, reused, repaired, recycled or composted – replacing the need for extraction, landfilling and incineration

Making producers responsible for the full costs and impacts of their products – from extraction to disposal – can incentivize them to shift to less harmful and costly practices. Doing so can help create a “circular” or “closed-loop” economy. In a circular economy, zero waste is landfilled or incinerated – all materials are reused, replacing the need for extraction activities.

The decisions producers make in designing products determine the degree to which those products are able to be reused or recycled, and help shape the impact on the environment when those products are disposed of.

Currently, municipalities – using tax dollars – bear most of the costs of waste collection and disposal.⁴³ Making producers responsible for the full environmental and public health costs of their products – from extraction to production to disposal – can incentivize them to redesign their products. They will be more likely to use recycled instead of virgin materials and to create less wasteful and less hazardous products. This shift would move America toward a circular economy that conserves natural resources and natural areas; minimizes air, water and global warming pollution; and produces zero waste.

Producer responsibility programs have a track record of success

Producer responsibility programs have typically covered products that are hazardous, hard to recycle or compost, or that generate a lot of waste. These include batteries, mattresses, mercury thermostats, carpet, pesticides, tires, pharmaceuticals, paint, electronics, packaging and textiles.⁴⁴ Across the U.S., 119 producer responsibility laws have been adopted in 33 states, addressing 14 types of consumer products.⁴⁵ Internationally, a wide range of producer responsibility programs have

been put in place across the European Union, Japan, Korea, Chile, Canada and elsewhere.⁴⁶

Programs that make producers responsible for waste have successfully diverted waste from landfills and have shifted certain waste costs from municipalities to producers.⁴⁷ Some programs have been even more impactful – incentivizing producers to make their products longer-lasting and easy to reuse, and their packaging lightweight and recyclable.⁴⁸ These successes demonstrate that expanding such policies to more regions and products can help instigate the shift to a circular economy.

The following examples show how producer responsibility programs work in practice and illustrate the benefits they can deliver for the environment, public health, consumers and communities.

California’s Used Mattress Recovery and Recycling Act

Bulky furniture and appliances can be difficult for consumers to recycle and ideal for producer responsibility programs. Legislation in California requiring mattress manufacturers to take responsibility for refurbishing or recycling their products has successfully increased recycling of used mattresses.⁴⁹

Every year, almost 4.5 million mattresses and 4.5 million box springs are landfilled or incinerated in the U.S., equating to around 250 million pounds of mattress material.⁵⁰ This creates pollution and necessitates further extraction activities to produce new mattresses. Mattresses are also heavy and bulky, making them difficult and expensive to collect, transport, and pay to drop at landfills and incinerators. Because of this, people often illegally dump their mattresses, creating an additional cleanup cost for municipalities.⁵¹ But more than 80 per-

cent of a mattress can be recycled into new consumer products and industrial parts.⁵²

To address this problem, in 2014, California passed its Used Mattress Recovery and Recycling Act. Under this act, mattress manufacturers were required to “develop, finance, and implement a convenient and cost-effective program to recover and recycle used mattresses.”⁵³ This requirement has resulted in increased recycling rates.⁵⁴

To comply with this requirement, mattress manufacturers established a program operated by the nonprofit Mattress Recycling Council (MRC), which also operates programs in Connecticut and Rhode Island.⁵⁵ MRC establishes sites where consumers can return their old mattresses and works to increase public awareness of the service.⁵⁶ Manufacturers and retailers are required to register with MRC and collect a recycling fee from consumers when they purchase a new mattress or box spring. Retailers must offer to pick up consumers’ old mattresses when they purchase new ones and transport them to a recycling facility. If a retailer has accumulated at least 100 units, MRC will provide the additional service of transporting them to a recycling facility. MRC then contracts with facilities to refurbish and recycle the mattresses. The organization also cooperates with CalRecycle, a branch of the California Environmental Protection Agency that helps enforce the program’s requirements and hold producers accountable.⁵⁷

California requires MRC to submit an annual report on the program’s effectiveness. The most recent report shows that the program has successfully increased mattress recycling.⁵⁸ In 2018, MRC collected 1.4 million mattresses in California – a 10 percent increase from the previous year.⁵⁹ MRC also diverted 47 million pounds of mattress material from landfills, 65 percent of which was recycled, rather than turned

into waste or biofuel – an increase of 6 percentage points over the 2017 recycling rate.⁶⁰ The program also expanded its infrastructure across California, increasing the number of no-cost collection sites from 163 to 190.⁶¹ There are now permanent collection sites or collection events in all of California’s 58 counties.⁶²

Other states and the U.S. as a whole can adopt programs similar to California’s and divert mattresses from landfills and incinerators to refurbishment and recycling facilities. Such programs could also be adopted for other bulky items such as furniture, carpets and major appliances. Future policies should continue to require retailers to collect used products when consumers are buying new ones, and should consider ways to incentivize producers to incorporate waste reduction into the design process.

France’s textile and clothing recovery program

France’s producer responsibility program for clothing and textile waste has led to an increase in the collection and recycling of used clothing and could be a model for the U.S.

Textile waste is increasing due to the growing “fast fashion” model, which encourages consumers to buy cheap, trendy clothing that does not last very long.⁶³ Textile production is highly toxic due in part to the pesticides used to grow cotton and the plastic microfibers that wash out of synthetic fabrics and into the water system.⁶⁴ The industry is responsible for an estimated 10 percent of global carbon emissions and is one of the world’s worst industrial polluters.⁶⁵ Furthermore, most textile waste is landfilled and incinerated – necessitating further extraction and production activities when clothing could be reused or recycled instead.⁶⁶

To tackle this problem, in 2007 France instituted the first program that makes producers responsible for clothing and textile waste.⁶⁷ This program makes all manufacturers of new clothing and textiles responsible for recycling or proper disposal.⁶⁸ Textile and clothing producers can meet France's requirement either by paying fees to the nonprofit producer responsibility organization (PRO) that manages materials for many producers, or by establishing their own take-back program, which must be approved by the French government.⁶⁹

The PRO assesses producer fees every year based on the amount of clothing each producer sells, with discounted rates for products that use recycled content. The PRO has used the collected fees to increase collection points for used clothing and textiles, doubling the number of on-street collection bins between 2011 and 2016.⁷⁰ Part of its program is to increase consumer awareness – for example by creating a website and app that show consumers the nearest collection point. The PRO also subsidizes charities and other organizations that collect and sort used textiles and funds innovative projects that seek to create a closed-loop textile industry.⁷¹

France's program has increased the amount of material collected – three times as much material was collected nationwide in 2016 as compared with 2006.⁷² In 2015, around 65 percent of all textiles collected were reused (for example as second-hand clothing) – the majority of them exported to the second-hand market in Africa and the remainder resold in France. The remainder of the materials were down-cycled (9 percent to produce rags and 24 percent to produce insulation materials) and about 6 percent either incinerated or sent to landfill.⁷³

France's program has successfully increased the collection of used clothing, but it faces challenges. Most of France's textiles were

resold or exported in 2015, but this may not continue because the quality of clothing is decreasing and markets for used clothing are shrinking.⁷⁴ African and Asian countries are demanding better quality clothing and want to build their own textile economies. Some have banned or are considering banning used clothing imports altogether.⁷⁵ This demonstrates the need to reduce the amount of clothing being produced and wasted in the first place. Recycling textiles into new textiles is difficult and expensive, and technology is limited.⁷⁶ France's program seeks to address this by funding projects that innovate new textile recycling methods, reducing the costs of working with recovered material.⁷⁷

U.S. paint recovery and recycling programs

Most people buy more paint than they need to ensure that they have enough for their project, and as a result, approximately 10 percent of house paint sold in the U.S. each year is not used.⁷⁸ Most communities do not have effective programs to collect and recycle this paint, however, so many instruct residents to dry out the paint and throw it in the trash. This can be hazardous because if done improperly, paint can be toxic to the environment and harmful to fish and wildlife.⁷⁹ Reusing and recycling paint instead can reduce potential pollution, as well as the need to extract resources and produce new paint.⁸⁰

To address this problem, 10 states and the District of Columbia have passed producer responsibility laws that make paint producers responsible for paint waste.⁸¹ Under these programs, consumers pay a recycling fee when they buy new paint, which funds the nonprofit PaintCare. Instead of returning these fees to the consumer when they recycle paint, PaintCare uses them as funding to manage the recycling process and promote leftover paint collection sites.⁸²

In PaintCare locations, individuals, households and businesses can take unwanted leftover paint to one of the nonprofit's more than 1,750 drop-off sites, where it is sorted and processed for reuse, recycling or safe disposal.⁸³ In its first decade, PaintCare reports that they have collected more than 38 million gallons of leftover paint (80 percent of it latex paint and 20 percent oil-based) and provided more than 3,500 direct large-volume pick-ups from painting contractors and other businesses disposing of 200 gallons or more.⁸⁴ In doing so, the program has saved millions of dollars in local government spending on collection and processing of leftover paint and provided a more convenient recycling experience for consumers.⁸⁵

PaintCare provides a glimpse of what a comprehensive household hazardous waste program could achieve. Critical to the success of any such program would be to set increasing requirements for the percentage of the collected waste that must be recycled. For example, less than 5 percent of collected oil-based paint is reused. Classified as a hazardous waste in the U.S., and extremely expensive to recycle, most is converted to fuel or incinerated, which are both toxic processes.⁸⁶ Such a requirement could incentivize producers to switch to or develop safer alternatives.

Producer responsibility is particularly urgent for packaging waste

Producers of all products should be responsible for the waste that their products create, but there is a particularly urgent need to shift responsibility for single-use packaging, paper products and foodware waste to producers. Waste from packaging and disposable products is a growing environmental problem. The recent challenges to the U.S. recycling system following China's decision to ban the importation of most waste mean that the nation must take a new approach

Germany recycled 97 percent of all packaging waste in 2015.

to reducing waste and revamping recycling. Packaging waste has increased during the COVID-19 pandemic, underscoring the need for proven policy strategies.⁸⁷

Programs that make producers responsible for packaging waste have existed for decades and have successfully increased collection and recycling rates. These programs have been around since the 1980s and are now widespread in all European Union member states, as well as South Korea and several Canadian provinces.⁸⁸ These programs have helped achieve high collection and recycling rates, with "significant tonnages" of materials being recovered for recycling instead of being sent to landfill.⁸⁹ In Germany, which has a separate collection system for household packaging waste, around 97 percent of all packaging waste was recycled in 2015.⁹⁰

British Columbia's program for packaging and paper

British Columbia has consistently been at the forefront of Canada's efforts to hold producers responsible, with a current total of 22 product stewardship programs for the collection and disposal of waste.⁹¹ In May 2011, British Columbia added packaging and printed paper (PPP) to the list, making businesses distributing these materials responsible for their collection and recycling. This shifted the cost of recycling from taxpayers to producers and has increased recycling rates.

Recycle BC (RBC), a non-profit organization representing many different producers, began operating in May 2014. This stewardship agency now runs the only program in

Canada under which producers bear full financial and managerial responsibility for residential recycling of PPP products.⁹² RBC has a target program recycling rate of 75 percent, which it has consistently reached.⁹³

RBC is funded by nearly 1,200 packaging and paper producers.⁹⁴ Those producers are required to report the volume of PPP material they sell each year and pay a fee based on weight to cover the cost of collection and processing of PPP, which RBC coordinates. RBC currently manages residential recycling for 98 percent of British Columbia's population, with collection programs in 176 communities.⁹⁵ Most packaging – including paper, cardboard, plastic containers and paper cups – is picked up through curbside service. Plastic bags and polystyrene foam (what most of us call Styrofoam) packaging are collected at recycling depots run by private companies contracted by RBC. Glass containers are either taken to depots or placed in a separate bin for collection to avoid broken glass contaminating other recyclables.⁹⁶

British Columbia's producer responsibility program for packaging and printed paper has expanded coverage and increased recycling collection. In 2019, RBC reported recovering 78 percent of the PPP material producers sold and recycling 90 percent of that collected material.⁹⁷ That's an improvement to the recycling system before producer responsibility for PPP went into effect, when an estimated 50 to 57 percent of packaging and paper materials were recovered.⁹⁸

Proposed U.S. programs for packaging waste

THE FEDERAL GOVERNMENT and several states have begun to consider policies that make producers responsible for packaging, paper, and single-use product waste. In 2019, Washington and Maine passed the first laws on the issue, outlining frameworks, requirements and deadlines to develop or study state producer responsibility programs.⁹⁹ Legislators in California, other states, and the U.S. Congress are also currently pursuing bills that aim to make producers responsible for packaging waste.

More than a dozen states have seen some legislative activity around producer responsibility for paper and packaging.¹⁰⁰ This momentum has been stalled by the coronavirus pandemic, which has sent many state legislatures into extended recesses. Still, several states are in a strong position to propose and pass well-studied and practicable producer responsibility legislation in the near future.

WASHINGTON

On May 21, 2019, Governor Jay Inslee of Washington signed a law aiming to reduce plastic packaging in the state and to require a study of ways to reduce plastic waste.¹⁰¹ The law directs Washington's Department of Ecology to commission a report on current plastic packaging waste amounts, types, and management practices in the state. The report must also lay out a plan with recommendations for how to reduce the quantity of plastic packaging sold in the state; make it all recyclable, reusable or

compostable; and make it with at least 20 percent recycled content by 2025. The plan and recommendations were submitted to the Department of Ecology in September 2020.¹⁰²

The report lays out three primary recommendations, the first of which is establishing a producer responsibility policy framework for all consumer packaging and paper.¹⁰³ The framework should make "producers responsible for achieving specific management and environmental outcomes for the consumer packaging they supply into Washington State." The report also recommends a deposit return system, or bottle bill, for all beverage containers, as well as recycled content requirements for all plastic packaging. Ideally, all of these policies would be implemented together, helping create a supply and market for recycled materials that would support the entire recycling system.¹⁰⁴

The report also calls for manufacturers to have full financial and operational responsibility for meeting state standards for managing packaging waste, whether individually or through a collaborative producer responsibility organization. Although the report was charged with the management of plastic packaging, it recommends applying producer responsibility to all types of packaging, to avoid unintended market distortions. Furthermore, the report suggests a system that drives innovation by setting strong performance targets that increase over time.¹⁰⁵

MAINE

In May 2019, Governor Janet Mills of Maine signed a law that directed the state's Department of Environmental Protection (DEP) to draft a template bill that would make producers pay for all packaging materials sold in the state.¹⁰⁶ This draft was submitted to a legislative committee and formed the basis of a bill introduced in January 2020.¹⁰⁷

Producer responsibility systems can drive innovation by setting strong performance targets that increase over time.

The original bill included provisions to establish a nonprofit stewardship organization to collect fees from packaging producers based on the amount by weight of packaging materials they sell or distribute in Maine. In addition to weight, these fees would be calculated to reflect the use of recycled content in packaging material and toxicity of the material, with higher fees for materials that are toxic or otherwise not easily recyclable. It's important to note that fees based solely on weight don't actually discourage plastic packaging.¹⁰⁸ Ideally, fee design will reward lightweight packaging that is both easy to recycle and made from recycled materials.

The fees collected from producers would be used to reimburse municipalities for costs incurred in the process of recycling and waste management, as well as to invest in waste reduction and recycling educa-

tion and infrastructure. The bill includes incentives for producers to meet performance goals for toxicity and recyclability, and stipulates that the stewardship agency would cover the costs of data collection and reporting to determine whether they have done so. The law excludes small producers of packaging, as well as containers that are already covered by the state's bottle bill.

This bill lays the foundation for the DEP to develop an effective stewardship program. It is key that the program will charge producers more for hard-to-recycle items and less for valuable recyclables to encourage them to redesign their packaging. The bill has not yet passed a delayed legislative session.

CALIFORNIA

In December 2018, Senator Ben Allen introduced the California Circular Economy and Plastic Pollution Reduction Act. This bill would establish a statewide framework and set goals to reduce waste from single-use products and packaging, and to ensure that products are effectively recycled.¹⁰⁹ The bill passed the California Senate in May 2019, but in the final hours of the state's 2020 legislative session on August 31, it fell four votes short of clearing the Assembly.¹¹⁰ In August 2020, several organizations submitted signatures for a ballot initiative similar to the bill that will appear on the November 2022 ballot.¹¹¹

The bill would have required a 75 percent reduction of the waste generated from single-use packaging and single-use products sold or distributed in California by 2030. From that year onward, all single-use packaging and products would have to be made from recyclable or compostable material. It would have required the California Department of Resources Recycling and Recovery

(CalRecycle) to develop incentives and policies to encourage in-state manufacturing of these products using recycled material generated in California. Manufacturers of single-use plastic packaging or single-use plastic foodware, such as plates, bowls and utensils, would have been required to demonstrate a recycling rate of at least 30 percent by 2026, 40 percent by 2028 and 75 percent by 2030.¹¹²

California's proposed program, likely to be reintroduced, would be another strong step for producer responsibility in the U.S. The bill prioritized reducing packaging and single-use plastics and set ambitious and swift targets to increase recycling rates. It would also have incentivized producers to use recycled material in their products, helping to close the loop in the circular economy.

FEDERAL

In February 2020, U.S. Senator Tom Udall (D – N.M.) and U.S. Representative Alan Lowenthal (D – Calif.) unveiled federal legislation that would hold corporations accountable for wasteful products, reduce wasteful packaging, phase out unnecessary single-use plastic products altogether and reform the waste and recycling collection system. The Break Free From Plastic Pollution Act would, among other things, place the financial burden of waste management and the cleanup of plastic pollution on the companies that manufacture and sell those products, and require producers to design their products in such a way as to minimize the environmental impacts of extraction, manufacture, use and end-of-life management.¹¹³

The bill would make producers responsible for the full end-of-life costs of some types of packaging and single-use products. It would also establish minimum recycled content requirements for drink containers, packag-

ing and food-service products, ban the most commonly littered single-use plastics such as bags, cups, straws, utensils and polystyrene foam (what most of us call Styrofoam), and establish a national-level bottle bill. Any non-refunded money from the latter, as well as proceeds from fees on paper and non-reusable carry-out bags, would go into a federal fund for projects and research to increase collection infrastructure and reduce pollution. This bill would also establish a standardized labeling system for plastic products that informs consumers on how to dispose of them properly.

This proposal is the most comprehensive plan to tackle single-use plastic and packaging waste of any discussed here. In addition to making producers responsible for waste, it seeks to directly reduce waste by banning the least-recyclable single-use plastics. It also proposes a national bottle bill – the most recognizable recycling model for packaging in the U.S. This proposal also sets goals to make plastics recyclable and made from recycled content – helping to support the overall recycling system.

| Policy recommendations

MAKING PRODUCERS RESPONSIBLE for waste is an important step toward a circular economy. Effective policies can incentivize producers to reduce their use of packaging and build products that are less hazardous, built to last, and are easy to repair, recycle or compost.

To be successful, programs should make producers responsible for all waste costs associated with their products – including waste collection, transportation and management, and litter clean-up costs. Fees charged to producers should be adjusted based on how long a product is designed to last, how easy it is to repair, recycle or compost, and how hazardous it is. Such eco-modulated fees, widespread in Europe and Canada, encourage producers to design less harmful products.

The federal government and individual states should implement policies that make producers responsible for the waste created by their products. Such policies are particularly important for products that are hazardous, difficult to recycle or compost, or that generate a lot of waste. These include batteries, mattresses, mercury thermostats, carpet, pesticides, tires, pharmaceuticals, paint, electronics, packaging and textiles.

To establish effective policies that make producers responsible for waste, policymakers should follow these best practices:

1. **Establish a waste hierarchy and make sure that policies prioritize the more-desired outcomes over the less-desired.**
 - a. First and foremost, **reduce** the amount of waste generated;
 - b. **Reuse, repair and refurbish** products whenever possible;
 - c. **Recycle or compost** all remaining materials;
 - d. Landfill and incinerate as little as possible.

Following this waste hierarchy is important to ensure that producer responsibility programs avoid unintended consequences. For example, California's initial policy to make producers responsible for carpet waste enabled too much incineration and did not result in a meaningful increase in recycling. Because of this, California updated the policy in 2017 to discourage incineration and to set goals for how much carpet is recycled, which increases over time.¹¹⁴

2. **Pair programs that make producers responsible for waste with other waste-reduction strategies.**
 - a. Bottle bills and other deposit-based programs are among the most widely deployed forms of producer responsibility, and new laws should complement rather than replace them.

- b. Push forward with bans on the least recyclable and compostable and most hazardous products.
3. **Require producers to establish effective collection, recycling and composting systems for products that do not currently have them.**
 - a. Set increasing requirements for the percentage of distributed products that must be collected.
 - b. Set increasing requirements for the percentage of collected materials that must be reused, repaired, refurbished, recycled or composted. This can necessitate that producers redesign products that are not readily repairable, recyclable or compostable.
 4. **Require producers to pay fees that cover all of their products' end-of-life costs, including waste collection, hauling, recycling, composting, landfilling, incineration and litter cleanup costs.** The fees should also cover the operating costs of the entity that sets, collects and distributes these fees and the full costs of the oversight agencies.
 5. **Require producers to use recycled content in their products to make sure that recycled materials are reused.** Increasing the collection and recycling of materials only reduces waste if the recycled materials are used. Utilizing recycled materials reduces the need to extract new materials and closes the loop in the circular economy.
 6. **Adjust fees to encourage producers to design products that last and are easy and economical to reuse, repair, recycle or compost.**
 - a. Charge producers more for products that are hazardous or hard to repair, recycle or compost, to avoid landfilling and incineration.
 - b. Charge producers less for products that are proven to be reused or recycled.
 - c. Charge producers more if their products enter the waste stream more quickly than other manufacturers' products in that category.
7. **Make it easy for consumers to properly dispose of their products.** Make collection sites accessible and available year-round. Educate consumers about how to properly dispose of their products and consider simplified labeling.
 8. **Avoid reinventing the wheel.** If effective systems or secondary markets do exist to collect, repair, refurbish, recycle or compost materials, keep them in place and simply require producers to start funding them.
 9. **Incentivize consumers to return their products for recycling or composting instead of throwing them in the trash.** This can be achieved in a variety of ways, including the following:
 - a. Ban products covered by producer responsibility programs from landfills and trash incinerators, or attach heavy penalties.
 - b. Charge consumers more for trash disposal than for alternatives through "save money and reduce trash" (SMART) programs, which charge consumers less if they throw out less trash.
 - c. Charge consumers a deposit when they buy a product that can be returned for recycling, as bottle bills do.
 - d. Offer a reward if consumers return a product for recycling, as some states currently do for mercury thermostats.

10. Support the right to reuse, repair, and reprogram. Allowing third-party repair of products to extend their lifespan is good for consumers, and reduces waste from throwing away fixable devices and manufacturing new ones.

- a. Support transparency requirements about obsolescence timelines. Software support should be designed to last the likely lifespan of the hardware, and its duration should be disclosed.
- b. Enable reuse of internet-connected devices. Third-party tools that add to or convert an old, unsupported device should be protected.

11. Set high standards for oversight and transparency at every stage of the process to ensure that producers are complying with requirements and reporting accurately, and to ensure that fees are assessed correctly.

Producer responsibility laws can be complex. State and national organizations such as the California Product Stewardship Council and the Product Stewardship Institute have resources and services available that can help policymakers enact effective policies that make producers responsible for waste.

Notes

1. The U.S. discarded 35,370,000 tons of plastic in 2017 / 365 days * 2,000 lbs/ton = 193.8 million lbs of plastic/day / 33.6 lbs/cubic yard of loose plastic waste = 5.8 million cubic yards of plastic/day / 3.85 million cubic yards in the Cowboys stadium = filled 1.5 times/day or every 16 hours. The U.S. discarded 35,370,000 tons of plastic in 2017: U.S. Environmental Protection Agency, *Advancing Sustainable Materials Management: 2016 and 2017 Tables and Figures*, Table 1, November 2019; loose plastic waste weighs 33.6 lbs/cubic yard on average, calculated from all non-compacted and non-baled plastic waste categories in: U.S. Environmental Protection Agency, *Volume-to-Weight Conversion Factors*, April 2016, available at https://www.epa.gov/sites/production/files/2016-04/documents/volume_to_weight_conversion_factors_memo_randum_04192016_508fml.pdf; the Cowboys stadium is 104 million cubic feet in volume * 0.037 cubic yards/cubic feet = 3.85 million cubic yards: Design & Build, *Cowboys Stadium*, accessed 9 January 2020, archived at <http://web.archive.org/web/20200109212523/https://www.designbuild-network.com/projects/cowboysstadium/>; the U.S. has discarded more plastic every year measured from 1960 – 2017: U.S. Environmental Protection Agency, *Advancing Sustainable Materials Management: 2016 and 2017 Tables and Figures*, Table 1, November 2019.

2. 139.59 million tons of waste was landfilled and 34.03 million tons incinerated, totaling 173.62 million tons or 65 percent of the 267.79 million tons of waste generated in 2017: U.S. Environmental Protection Agency, *Advancing Sustainable Materials Management: 2016 and 2017 Tables and Figures*, Tables 1-4, November 2019, archived at http://web.archive.org/web/20191118171815/https://www.epa.gov/sites/production/files/2019-11/documents/2016_and_2017_facts_and_figures_data_tables_0.pdf.

3. OECD, *Extended Producer Sustainability*, accessed 20 August 2020, archived at <https://web.archive.org/web/20200121201934/http://www.oecd.org/environment/waste/extended-producer-responsibility.htm>.

4. Mattress Recycling Council, *California Law*, accessed 6 August 2020, archived at <https://web.archive.org/web/20200806001314/https://mattressrecyclingcouncil.org/programs/california/>.

5. Mattress Recycling Council, *MRC'S Bye Bye Mattress Program Surpasses 5 Million Mattresses Recycled in California*, 13 January 2020, archived at <https://web.archive.org/web/20200823221020/https://mattressrecyclingcouncil.org/mrcs-bye-bye-mattress-program-surpasses-5-million-mattresses-rrecycle-in-california/>.

6. U.S. Environmental Protection Agency, *Containers and Packaging: Product-Specific Data*, accessed 12 September 2020, archived at <https://web.archive.org/web/20200820214819/https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/containers-and-packaging-product-specific-data>.

7. Michael Corkery, "As Costs Skyrocket, More U.S. Cities Stop Recycling," *New York Times*, 16 March 2019, archived at <https://web.archive.org/web/20200710144357/https://www.nytimes.com/2019/03/16/business/local-recycling-costs.html>.

8. John Coyne, Recycle BC, *Recycle BC 2019 Annual Report*, June 2020, archived at <http://web.archive.org/web/20200914223824/https://recyclebc.ca/wp-content/uploads/2020/06/RecycleBC2019-Final.pdf>.

9. Multi Material BC, *Packaging and Printed Paper Stewardship Plan*, 8 April 2013, archived at <https://web.archive.org/web/20170703081334/https://recyclebc.ca/wp-content/uploads/2017/03/MMBC-PPP-Stewardship-Plan-Apr8-2013.pdf>.

10. Washington Senate Bill 5397, *Plastic Packaging – Evaluation and Assessment*, Chapter 460, Laws of 2019, effective 28 July 2019, archived at <http://web.archive.org/web/20190612064832/http://lawfilesexternal.wa.gov/biennium/2019-20/Pdf/Bills/Session%20Laws/Senate/5397-S2.sl.pdf>.

11. Cascadia Consulting Group et. al., *Recommendations for Managing Plastic Packaging Waste in Washington*, 14 September 2020, archived at http://web.archive.org/web/20200924161126/https://www.ezview.wa.gov/Portals/_1962/Documents/PlasticsPackaging/Recommendations%20for%20Managing%20Plastic%20Packaging%20Waste%20in%20Washington_09142020.pdf.
12. LD 2104, *An Act to Support and Increase the Recycling of Packaging*, Sess. of 2020 (Me. 2020), accessed 17 September 2020, archived at http://web.archive.org/web/20200514060648/https://www.mainelegislature.org/legis/bills/bills_129th/billtexts/HP150001.asp.
13. AB-1080, *Solid waste: packaging and products*, Sess. of 2019-2020 (Cal. 2019), archived at https://web.archive.org/web/20200220234842if_/https://leginfo.ca.gov/faces/billTextClient.xhtml?bill_id=201920200AB1080; see also: Mark Murray and Nick Lapis, "SB 54 and AB 1080 (Allen and Gonzalez) The California Circular Economy and Plastic Pollution Reduction Act," *Californians Against Waste*, accessed 5 February 2020, archived at <http://web.archive.org/web/20191212213922/https://www.cawrecycles.org/sb-54-ab-1080-bill-page>.
14. "California Initiative to Fight Plastic Pollution Submits Petitions to Qualify for Statewide Ballot," *Waste360*, 12 August 2020, archived at <http://web.archive.org/web/20200812153539/https://www.waste360.com/plastics/california-initiative-fight-plastic-pollution-submits-petitions-qualify-statewide-ballot>.
15. Senator Tom Udall, *Break Free from Plastic Pollution Act*, accessed 30 July 2020, archived at <https://web.archive.org/web/20200802205737/https://www.tomudall.senate.gov/imo/media/doc/Press%20Packet.pdf>.
16. Earthquakes: Sarah Witman, "More Earthquakes May Be the Result of Fracking Than We Thought," *Eos*, 8 February 2018, archived at <http://web.archive.org/web/20200927020200/https://eos.org/research-spotlights/more-earthquakes-may-be-the-result-of-fracking-than-we-thought>; spills: Alana Miller, Frontier Group, and Adam Garber, PennEnvironment Research and Policy Center, *Fracking Failures 2017, Oil and Gas Industry Environmental Violations in Pennsylvania*, Spring 2017, available at <https://pennenvironment.org/sites/environment/files/reports/Fracking%20Failures%202017%20report%20vPRINT.pdf>.
17. Elizabeth Ridlington, Frontier Group, and Kelsey Lamp, Environment America Research & Policy Center, *Offshore Drilling, Onshore Damage: Broken Pipelines, Dirty Refineries and the Pollution Impacts of Energy Infrastructure*, Fall 2019, p.18, available at https://environmentamerica.org/sites/environment/files/reports/EA_Offshore_drilling_scrn.pdf.
18. Nick Cunningham, "A Fracking-Driven Industrial Boom Renews Pollution Concerns in Pittsburgh," *Yale Environment 360*, 21 March 2019, archived at <http://web.archive.org/web/20200717100147/https://e360.yale.edu/features/a-fracking-driven-industrial-boom-renews-pollution-concerns-in-pittsburgh>.
19. National Geographic Resource Library, *Microplastics*, accessed 13 February 2020, archived at <https://web.archive.org/web/20200213204351/https://www.nationalgeographic.org/encyclopedia/microplastics/>.
20. In 2017, U.S. homes and businesses threw out 267,790,000 tons of trash * 2,000 pounds/ton / 365 days/year = 1,467,342,465.8 pounds/day: U.S. Environmental Protection Agency, *Advancing Sustainable Materials Management: 2016 and 2017 Tables and Figures*, November 2019, archived at http://web.archive.org/web/20191118171815/https://www.epa.gov/sites/production/files/2019-11/documents/2016_and_2017_facts_and_figures_data_tables_0.pdf.
21. U.S. Environmental Protection Agency, *Documentation for Greenhouse Gas Emission and Energy Factors Used in the Waste Reduction Model (WARM)*, March 2015, available at https://archive.epa.gov/epawaste/conservation/tools/warm/pdfs/WARM_Documentation.pdf; see also: Abigail Bradford et al., Frontier Group, *Trash in America: Moving from Destructive Consumption to a Zero-Waste System*, February 2018, p.12.
22. Abigail Bradford et al., Frontier Group, *Trash in America: Moving from Destructive Consumption to a Zero-Waste System*, February 2018, p.12.
23. H. Jouhara et al., "Municipal Waste Management Systems for Domestic Use," *Energy*, Volume 139, 485-506, <https://doi.org/10.1016/j.energy.2017.07.162>, November 2017.

24. U.S. homes and businesses have produced more waste every year since 2010 that the EPA has tracked: U.S. Environmental Protection Agency, *Advancing Sustainable Materials Management: 2016 and 2017 Tables and Figures*, November 2019, archived at http://web.archive.org/web/20191118171815/https://www.epa.gov/sites/production/files/2019-11/documents/2016_and_2017_facts_and_figures_data_tables_0.pdf.

25. One third; Cassandra Profita and Jez Burns, "Recycling Chaos in U.S. as China Bans 'Foreign Waste'," *NPR*, 9 December 2017, archived at [https://web.archive.org/web/20200219233057/https://www.npr.org/2017/12/09/568797388/recycling-chaos-in-u-s-as-china-bans-foreign-waste;700,000 tons: Christopher Joyce, "Where Will Your Plastic Trash Go Now That China Doesn't Want It?"](https://web.archive.org/web/20200219233057/https://www.npr.org/2017/12/09/568797388/recycling-chaos-in-u-s-as-china-bans-foreign-waste;700,000%20tons%3AChristopher%20Joyce%2C%20%22Where%20Will%20Your%20Plastic%20Trash%20Go%20Now%20That%20China%20Doesn%27t%20Want%20It%3F%22) *NPR*, 13 March 2019, archived at <http://web.archive.org/web/20200621082837/https://www.npr.org/sections/goatsandsoda/2019/03/13/702501726/where-will-your-plastic-trash-go-now-that-china-doesnt-want-it>.

26. Erin McCormick, "Americans' Plastic Recycling is Dumped in Landfills, Investigation Shows," *The Guardian*, 21 June 2019, archived at <https://web.archive.org/web/20200213201955/https://www.theguardian.com/us-news/2019/jun/21/us-plastic-recycling-landfills>.

27. Muyu Xu, David Stanway, "China Plans to Cut Waste Imports to Zero by Next Year: Official," *Reuters*, 28 March 2019, available at <https://www.npr.org/sections/goatsandsoda/2019/03/13/702501726/where-will-your-plastic-trash-go-now-that-china-doesnt-want-it>; see also note 26.

28. Jerri-Lynn Scofield, "Waste Watch: US Dumps Plastic Rubbish in Southeast Asia," *Naked Capitalism*, 7 October 2018, archived at <https://web.archive.org/web/20200213230016/https://www.nakedcapitalism.com/2018/10/waste-watch-us-dumps-plastic-rubbish-southeast-asia-surge.html>.

29. Cole Rosengren et al. "How Recycling has Changed in All 50 States," *WasteDive*, updated 15 November 2019, archived at <https://web.archive.org/web/20200213230213/https://www.wastedive.com/news/what-chinese-import-policies-mean-for-all-50-states/510751/>.

30. Brian Love and Julie Rieland, "COVID-19 is Laying Waste to Many US Recycling Programs," *Phys.org*, 23 June 2020, archived at <http://web.archive.org/web/20200626113718/https://phys.org/news/2020-06-covid-recycling.html>.

31. Cheryl Katz, "Piling Up: How China's Ban on Importing Waste Has Stalled Global Recycling," *Yale Environment 360*, 7 March 2019, archived at <https://web.archive.org/web/20200213230506/https://e360.yale.edu/features/piling-up-how-chinas-ban-on-importing-waste-has-stalled-global-recycling>.

32. Lillygol Sedaghat, "7 Things You Didn't Know About Plastic (and Recycling)," *National Geographic*, 4 April 2018, archived at <http://web.archive.org/web/20191216184405/https://blog.nationalgeographic.org/2018/04/04/7-things-you-didnt-know-about-plastic-and-recycling/>.

33. See note 31.

34. Madison Margolin, "The Periodic Table of iPhone Elements," *Vice*, 29 November 2016, archived at http://web.archive.org/web/20200612012610/https://www.vice.com/en_us/article/nz7kwm/the-periodic-table-of-iphone-elements.

35. Peter Holgate, "The Model For Recycling our Old Smartphones is Actually Causing Massive Pollution," *Vox*, 8 November 2017, archived at <http://web.archive.org/web/20200519010038/https://www.vox.com/2017/11/8/16621512/where-does-my-smartphone-iphone-8-x-go-recycling-afterlife-toxic-waste-environment>.

36. Nathan Proctor, U.S. PIRG, *The Fix is in*, March 2020, available at <https://uspigredfund.org/feature/us/fix>

37. Chris Welch, "Microsoft Surface Duo teardown: an Engineering Marvel that's a Chore to Repair," *The Verge*, 11 September 2020, archived at <http://web.archive.org/web/20200912172825/https://www.theverge.com/21433060/microsoft-duo-teardown-pictures-displays-battery-hinge>.

38. Alana Semuels, "The World Has an E-Waste Problem," *Time*, 23 May 2019, <https://time.com/5594380/world-electronic-waste-problem/>.

39. See note 36.

40. Electronics Take Back Coalition, *Ten Lessons Learned From State E-Waste Laws*, accessed 20 August 2020, available at <http://www.electronicstakeback.com/wp-content/uploads/Lessons-Learned-from-State-E-waste-laws.pdf>.

41. Neil Gladstone, "The United States has a Colossal E-Waste problem. This is Why," *Digital Trends*, 27 February 2020, <https://www.digitaltrends.com/cool-tech/e-waste-recycling-united-states/>.

42. See note 40.

43. James Anderson, "Paying and Scraping in Pursuit of Zero Waste," *Next City*, 22 April 2019, archived at <https://web.archive.org/web/20200606115622/https://nextcity.org/features/view/paying-and-scraping-in-pursuit-of-zero-waste>.

44. Kelly Maile, "Building Capacity for EPR in the US," *Waste Today*, 11 October 2019, available at <https://www.wastetodaymagazine.com/article/extended-producer-responsibility-us-product-stewardship-institute/>; see also: Product Stewardship Institute, Framework Legislation for Extended Producer Responsibility Programs, archived at <https://web.archive.org/web/20200213214618/https://www.productstewardship.us/page/Framework-Legislation>.

45. States and products: Kelly Maile, "Building Capacity for EPR in the US," *Waste Today*, 11 October 2019, available at <https://www.wastetodaymagazine.com/article/extended-producer-responsibility-us-product-stewardship-institute/>; laws: Alana Semuels, "To Fix America's Broken Recycling System, States Want Companies to Foot the Bill," *Time*, 26 February 2020, archived at <http://web.archive.org/web/20200422032348/https://time.com/5790656/fixing-recycling-in-america/>.

46. Organisation for Economic Co-operation and Development, *The State of Play on Extended Producer Responsibility (EPR): Opportunities and Challenges*, June 2014, archived at <http://web.archive.org/web/20170204182730/https://www.oecd.org/environment/waste/Global%20Forum%20Tokyo%20Issues%20Paper%2030-5-2014.pdf>.

47. Scott Cassel and Resa Dimino, "Assessing the ROI of EPR," *Resource Recycling*, 2 May 2017, archived at <https://web.archive.org/web/20200218234242/https://resource-recycling.com/recycling/2017/05/02/assessing-roi-epr/>.

48. Reducing waste: Ryan Trainer, Mattress Recycling Council, *2018 California Annual Report*, 1 July 2019, archived at <https://web.archive.org/web/20200219204231/https://mattressrecyclingcouncil.org/wp-content/uploads/MRC-2018-web2.pdf>; ease of recycling: Alana Semuels, "To Fix America's Broken Recycling System, States Want Companies to Foot the Bill," *Time*, 26 February 2020, archived at <http://web.archive.org/web/20200422032348/https://time.com/5790656/fixing-recycling-in-america/>.

49. Mattress Recycling Council, *MRC Marks Millionth Mattress Milestone*, 27 January 2017, archived at <http://web.archive.org/web/20181214000505/http://mattressrecyclingcouncil.org/80/mrc-marks-millionth-mattress-milestone/>.

50. Nationwide Mattress Recycling, *Environment*, accessed 13 February 2020, archived at <http://web.archive.org/web/20200223020153/http://www.nationwidemattressrecycling.net/environment.cfm>.

51. Mattress Recycling Council, *Illegal Dumping is Everyone's Problem*, accessed 13 February 2020, archived at <https://web.archive.org/web/20200213215859/https://mattressrecyclingcouncil.org/illegaldumping/>.

52. Mattress Recycling Council, *Why Recycle?*, accessed 21 August 2020, archived at <http://web.archive.org/web/20200816161855/https://mattressrecyclingcouncil.org/why-recycle/>.

53. Cal. Public Resources Code § 42985, *Used Mattress Recovery and Recycling Act*, accessed 22 September 2019, available at http://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=PRC§ionNum=42985.

54. See note 49.

55. Ibid.

56. Ryan Trainer, Mattress Recycling Council, *2017 California Annual Report*, 1 July 2018, archived at <https://web.archive.org/web/20200206000629/https://www.calrecycle.ca.gov/docs/cr/mattresses/mrreports/2017/2017annualrpt.pdf>.

57. Ibid.

58. Ryan Trainer, Mattress Recycling Council, *2018 California Annual Report*, 1 July 2019, archived at <https://web.archive.org/web/20200219204231/https://mattressrecyclingcouncil.org/wp-content/uploads/MRC-2018-web2.pdf>.

59. Ibid.

60. Ibid.

61. Ibid.

62. Ibid.

63. Mohammad Abdullatif Bukhari, et al. "Developing a National Programme for Textiles and Clothing Recovery," *Waste Management & Research*, vol. 36, no. 4, 321–331, doi:10.1177/0734242X18759190, April 2018.

64. James Conca, "Making Climate Change Fashionable – The Garment Industry Takes on Global Warming," *Forbes*, 3 December 2015, archived at <http://web.archive.org/web/20200705053134/https://www.forbes.com/sites/jamesconca/2015/12/03/making-climate-change-fashionable-the-garment-industry-takes-on-global-warming/>.

65. Ibid.

66. U.S. Environmental Protection Agency, *Facts and Figures about Materials, Waste and Recycling: Textiles: Material-Specific Data*, archived at <https://web.archive.org/web/20200213220303/https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/textiles-material-specific-data>.

67. See note 63.

68. Ibid.

69. Ibid.

70. Ibid.

71. Ibid.

72. Ibid.

73. Ibid.

74. Ibid.

75. Ibid.

76. Ibid.

77. Ibid.

78. Abt Associates Inc., *Quantifying the Disposal of Post-Consumer Architectural Paint*, April 2007, available at https://archive.epa.gov/sectors/web/pdf/paint_quantity_report.pdf

79. Tina Porwal, "Paint Pollution Harmful Effects on Environment," *Social Issues and Environmental Problems*, Vol.3 (Iss.9:SE), September 2015, available at http://granthaalayah.com/Articles/Vol3Iss9SE/88_IJRG15_S09_150.pdf; see also Cal Maritime, California State University, *Latex Paint: Disposal Guidelines*, accessed 3 September 2020, archived at https://web.archive.org/web/20200213221914/https://www.csum.edu/c/document_library/get_file?uuid=4a7ceccf-99bb-4675-8cbe-ddd117f89b0e&groupId=9027836.

80. Product Stewardship Institute, *Paint*, accessed 5 February 2020, archived at <https://web.archive.org/web/20200206001704/https://www.productstewardship.us/page/Paint>.

81. PaintCare, *PaintCare States*, accessed 22 September 2020, archived at <https://web.archive.org/web/20200924173557/https://www.paintcare.org/paintcare-states/>.

82. See note 80.

83. PaintCare Inc., *About*, accessed 19 February 2020, archived at <https://web.archive.org/web/20200219232414/https://www.paintcare.org/about/>.

84. "PaintCare Celebrates 10 Years of Paint Recycling," *Paint & Coatings Industry*, 22 November 2019, archived at <https://web.archive.org/web/20200213222555/https://www.pcimag.com/articles/106801-paintcare-celebrates-10-years-of-paint-recycling>.

85. "PaintCare Celebrates 10 Programs in 10 Years," *American Coatings Association*, June 2019, archived at <https://web.archive.org/web/20200213222856/https://www.paint.org/coatingstech-magazine/articles/paintcare-celebrates-10-programs-10-years/>.

86. Scott Cassel and Kristin Aldred Cheek, "EPR Achievements: The Case of Paint in the U.S.," *Coatings World*, 11 November 2019, archived at https://web.archive.org/web/20200206002944/https://www.coatingsworld.com/issues/2019-11-01/view_technical-papers/epr-achievements-the-case-of-paint-in-the-us/.

87. Emma Newburger and Amelia Lucas, "Plastic waste surges as coronavirus prompts restaurants to use more disposable packaging," *CNBC*, 28 June 2020, archived at <http://web.archive.org/web/20200803145812/https://www.cNBC.com/2020/06/28/coronavirus-plastic-waste-surges-as-restaurants-use-more-disposable-packaging.html>.

88. Canada: Jonathan Arnold, Smart Prosperity Institute, *Extended Producer Responsibility in Canada*, October 2019, available at <https://institute.smartprosperity.ca/sites/default/files/eprprogramsincanadaresearchpaper.pdf> p3; S. Korea: Hyein Heo, Organisation for Economic Co-operation and Development, *Case Study for OECD Project on Extended Producer Responsibility Republic of Korea*, 22 May 2014, available at http://www.oecd.org/environment/waste/OECD_EPR_case_study_Korea_revised_140522.pdf; EU: "Chapter 1. Extended Producer Responsibility – An Overview," in *Extended Producer Responsibility: Updated Guidance for Efficient Waste Management* (Paris: OECD Publishing, 2016), available at <https://www.oecd-ilibrary.org/sites/9789264256385-4-en/index.html?itemId=/content/component/9789264256385-4-en>.

89. EPR Canada, *2016 Extended Producer Responsibility Summary Report*, September 2017, archived at <http://web.archive.org/web/20200214174534/http://www.eprcanada.ca/reports/2016/EPR-Report-Card-2016.pdf>, p.4.

90. Dr. Andreas Jaron and Christina Kossmann, German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), *Waste Management in Germany 2018*, March 2018, archived at http://web.archive.org/web/20200806191011/https://www.bmu.de/fileadmin/Daten_BMU/Pool/Broschueren/abfallwirtschaft_2018_en_bf.pdf.

91. Chaz Miller, Resource Coalition, *Recycle British Columbia's Extended Producer Responsibility for Packaging and Paper: An Assessment of its Impact*, March 2019, p.4; archived at http://web.archive.org/web/20190714165915/http://www.crrcnorth.org/uploads/pdf/Recycle_BC_White_Paper_2-19.pdf.

92. See note 89.

93. John Coyne, "Recycle BC 2019 Annual Report," *Recycle BC*, June 2020, archived at <http://web.archive.org/web/20200914223824/https://recyclebc.ca/wp-content/uploads/2020/06/RecycleBC2019-Final.pdf>.

94. Ibid.

95. Recycle BC, *About Recycle BC*, accessed 17 September 2020, archived at <https://web.archive.org/web/20200601170250/https://recyclebc.ca/about-recyclebc/>.

96. Recycle BC, *Changes to Glass Collection from May 19 2014*, accessed 3 September 2020, available at https://recyclebc.ca/wp-content/uploads/2017/03/Changes_To_Glass_Collection.pdf.

97. See note 93.

98. See note 9.

99. Washington: "Laws Addressing Recycling Crisis Signed by Washington Governor Jay Inslee," *San Juan Islander*, 22 May 2019, archived at <https://web.archive.org/web/20200220004138/https://sanjuanislander.com/news-articles/environment-science-whales/environment/29249/laws-addressing-recycling-crisis-signed-by-washington-governor-jay-inslee> (see bill text here: <http://lawfilesexternal.wa.gov/biennium/2019-20/Pdf/Bills/Senate%20Passed%20Legislature/5397-S2.PL.pdf?q=20200219163847>); Maine: Colin Staub, "State Paves Way for Packaging EPR," *Resource Recycling*, archived at <https://web.archive.org/web/20200205230939/https://resource-recycling.com/recycling/2019/06/11/state-paves-way-for-packaging-epr/>, 5 February 2020.

100. E.A. Crunden, "With EPR Bills Frozen Due to Coronavirus in Many States, Proponents Still See Path Forward," *Waste Dive*, 24 April 2020, archived at <http://web.archive.org/web/20200714215951/https://www.wastedive.com/news/epr-coronavirus-covid-19-extended-producer-responsibility-maine-new-york-california/576612/>

101. "Laws Addressing Recycling Crisis Signed by Washington Governor Jay Inslee," *San Juan Islander*, 22 May 2019, archived at <https://web.archive.org/web/20200220004138/https://sanjuanislander.com/news-articles/environment-science-whales/environment/29249/laws-addressing-recycling-crisis-signed-by-washington-governor-jay-inslee> (see bill text here: <http://lawfilesexternal.wa.gov/biennium/2019-20/Pdf/Bills/Senate%20Passed%20Legislature/5397-S2.PL.pdf?q=20200219163847>).

102. Cascadia Consulting Group et. al., *Recommendations for Managing Plastic Packaging Waste in Washington*. 14 September 2020, archived at http://web.archive.org/web/20200924161126/https://www.ezview.wa.gov/Portals/_1962/Documents/PlasticsPackaging/Recommendations%20for%20Managing%20Plastic%20Packaging%20Waste%20in%20Washington_09142020.pdf.

103. Ibid.

104. Ibid.

105. Ibid.

106. H.P. 1041 - L.D. 1431, *Resolve, To Support Municipal Recycling Programs*, Sess. of 2019 (Me. 2019), archived at <http://web.archive.org/web/20200221003636/https://mainelegislature.org/legis/bills/getPDF.asp?paper=HP1041&item=3&snum=129>; see also: Colin Staub, "State Paves Way for Packaging EPR," *Resource Recycling*, 5 February 2020, archived at <https://web.archive.org/web/20200205230939/https://resource-recycling.com/recycling/2019/06/11/state-paves-way-for-packaging-epr/>.

107. See note 12.

108. Peter Berg et. al., "The Drive Toward Sustainability in Packaging—Beyond the Quick Wins," *McKinsey*, 30 January 2020, available at <https://www.mckinsey.com/industries/paper-forest-products-and-packaging/our-insights/the-drive-toward-sustainability-in-packaging-beyond-the-quick-wins>.

109. Mark Murray and Nick Lapis, "SB 54 and AB 1080 (Allen and Gonzalez) The California Circular Economy and Plastic Pollution Reduction Act," *Californians Against Waste*, accessed 5 February 2020, archived at <http://web.archive.org/web/20191212213922/https://www.cawrecycles.org/sb-54-ab-1080-bill-page>.

110. Megan Smalley, "California Senate Passes Plastic Pollution Reduction Act," *Recycling Today*, 30 May 2019, accessed 5 February 2020, archived at <https://web.archive.org/web/20200206010251/https://www.recyclingtoday.com/article/california-pass-plastic-pollution-reduction-act-2030/>; Colin Staub, "Expansive Plastic Waste Bill Fails Again," *Resource Recycling*, 9 September 2020, archived at <http://web.archive.org/web/20200912234613/https://resource-recycling.com/recycling/2020/09/09/expansive-plastic-waste-bill-fails-again/>.

111. See note 14.

112. AB-1080, *Solid Waste: Packaging and Products*, Sess. of 2019-2020 (Cal. 2019), archived at https://web.archive.org/web/20200220234842if_/https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201920200AB1080.

113. See note 15.

114. Jared Paben, "Lawmakers Approve Carpet Stewardship Reforms," *Resource Recycling*, 26 September 2017, archived at <https://web.archive.org/web/20200213231440/https://resource-recycling.com/recycling/2017/09/26/lawmakers-approve-carpet-stewardship-reforms/>.