National Recycling Strategy

Part One of a Series on Building a Circular Economy for All

November 15, 2021

A Letter from EPA Administrator Michael S. Regan

Introducing the *2021 National Recycling Strategy*

We have both an opportunity and an obligation to protect and preserve our natural resources for the next generation. We've all heard the phrase "Reduce, Reuse, Recycle." It's been taught in schools; we've heard it on TV; and EPA, along with so many other organizations, have been saying it for years. But those three words can only take us so far —it's time to transform the United States recyling system.

Our current recycling system is at a crossroads and desperately needs creative energy to better serve the needs of the American people. Some are confused about what materials can be recycled. In many areas of the country, our recycling infrastructure is antiquated. Markets for recyclables vary greatly, and we have no standardized way to measure system performance. Living near recycling facilities also takes a toll on already overburdened communities when materials are not properly managed. Black, Latinx, Indigenous, and low-income communities continue to be disproportionately impacted by higher pollution levels, which result in adverse health and overall quality of life impacts. And, to top it off, according to eminent scientists on the International Resource Panel, natural resource extraction and processing make up half of all global greenhouse gas (GHG) emissions that drive the climate crisis.

We need a transformative vision for our waste management system – one that is inclusive, more equitable, and reflects the urgency of the climate crisis.

That is why I am proud to introduce the *2021 National Recycling Strategy*, a critical effort in work to build a circular economy for all. A circular economy is an industrial system that is restorative or regenerative by design. It is a change to the linear model from which resources are mined, made into products, and then thrown away. A circular economy reduces materials use, redesigns materials and products to be less resource-intensive, and recaptures "waste" as a resource to manufacture new materials and products.

The strategy responds to our recycling system's challenges through actions outlined under five objectives:

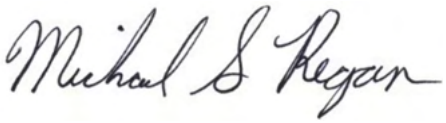
- improve markets for recycled commodities,
- increase collection and improve materials management infrastructure,
- reduce contamination in the recycled materials stream,
- enhance policies and programs to support circularity, and
- standardize measurement and increase data collection.

The *2021 Strategy* is designed to increase equitable access to recycling services, reduce environmental impacts on underserved communities, and stimulate economic development. However, we know recycling on its own isn't enough. This is part one in a series of strategies to help us re-envision how we use materials more broadly. Accomplishing President Biden's ambitious climate change goals begins with designing products to be sustainable, reducing the creation of waste with local communities in mind, maximizing reduce, reuse, and recycle, and minimizing the impacts of waste management.

When we recycle, we reduce the amount of trash sent to landfills, reduce pollution and emissions that contribute to climate change, save natural resources, such as timber and water, and keep our environment healthy by reducing the need to create new materials. We also help our economy by using domestic materials, supporting American manufacturing, and creating jobs in the recycling and manufacturing industries.

To go beyond "Reduce, Reuse, and Recycle," and to pave the way for sustainable management of our precious resources, it will take all of us working together. We call on all Americans to help meet this moment – businesses, state and local governments, Tribal Nations, and individuals. By making simple changes every day, we can create a more sustainable future for our country and the world.

I am confident that with the significant stakeholder support and interest in the development of the *2021 Strategy*, we can accomplish these ambitious goals and achieve transformational change together. We invite you to join us at www.epa.gov/recyclingstrategy.



Michael S. Regan
Administrator, U.S. Environmental Protection Agency

Disclaimer

The *National Recycling Strategy* represents potential actions by all stakeholders and does not imply approval for any specific action under Executive Order 12866 or the Paperwork Reduction Act. All potential federal government activities included in the *2021 Strategy* are subject to budgetary constraints, interagency processes, stakeholder input and other approvals, including the weighing of priorities and available resources by the Administration in formulating its annual budget and by Congress in legislating appropriations. This document is not intended, nor can it be relied upon, to create any rights enforceable by any party in litigation with the United States. This document does not impose legally binding requirements. Mention of case studies, public, private or nonprofit entities, trade names, or commercial products or services in this document does not and should not be construed to constitute an endorsement or recommendation of any such product or service for use in any manner.

Acknowledgments

EPA coordinated the development of the National Recycling Strategy to identify the actions needed to create a strong, resilient, cost-effective and less impactful U.S. recycling system – a key element of a circular economy. Development of the *National Recycling Strategy* was a collaborative effort. EPA would like to thank the following groups for their input:

- The America Recycles pledge signatories, whose activities informed the development of the *National Framework for Advancing the U.S. Recycling System*, upon which this *2021 Strategy* was built.
- Federal offices and agencies, including the Council on Environmental Quality (CEQ), the Federal Trade Commission (FTC), the National Science Foundation (NSF), the U.S. Agency for International Development (USAID), the U.S. Department of Agriculture (USDA), the U.S. Department of Commerce (DOC) (including the International Trade Administration [ITA], National Oceanic and Atmospheric Administration [NOAA], and the National Institute of Standards and Technology [NIST]), the U.S. Department of Defense (DOD), the U.S. Department of Energy (DOE), the U.S. Department of State (DOS), the U.S. General Services Administration (GSA), and the U.S. Trade Representative (USTR).
- EPA's state, tribal and local partners, including the Association of State and Territorial Solid Waste Management Officials (ASTSWMO), Environmental Council of the States (ECOS), South Carolina Department of Commerce, the U.S. Conference of Mayors, the National Tribal Caucus, and the Tribal Waste and Response Steering Committee.
- Recycling professional and industry associations and private companies, including the Institute of Scrap Recycling Industries (ISRI), the National Waste and Recycling Association (NWRA), the Solid Waste Association of North America (SWANA), and Waste Management (WM).
- Non-profit organizations, including the Environmental Research and Education Foundation (EREF), GreenBlue Institute, Keep America Beautiful (KAB), the National Recycling Coalition, The Recycling Partnership (TRP), and the U.S. Chamber of Commerce Foundation (USCCF).
- Private citizens; state, tribal and local governments; academia; non-governmental organizations; industry associations; private companies; the National Environmental Justice Advisory Council (NEJAC); and others for their comments on the draft *National Recycling Strategy*.

Table of Contents

Executive Summary

The *National Recycling Strategy* is focused on enhancing and advancing the national municipal solid waste (MSW) recycling system and identifies strategic objectives and stakeholder-led actions to create a stronger, more resilient and cost-effective U.S. MSW recycling system. It is part one of a series dedicated to building a circular economy for all. This substantially revised version of the *National Recycling Strategy* focuses on improving the nation's MSW recycling system and broadens the vision to include the full impact of materials while also recognizing the need to achieve environmental justice priorities. The *National Recycling Strategy* reflects the work of many stakeholders – including the public, companies, and non-governmental and community-based organizations – and input from other federal agencies, states, tribes and local governments.

The U.S. MSW recycling system currently faces a number of challenges, including confusion about what materials can be recycled, recycling infrastructure that has not kept pace with today's diverse and changing waste stream, reduced markets for recycled materials, and varying methodologies to measure recycling system performance. The *National Recycling Strategy* identifies actions to address these challenges and builds on the collaborative efforts by stakeholders from across the recycling system that began under the 2019 *National Framework for Advancing the U.S. Recycling System*.

Advancing MSW recycling alone will not achieve a circular economy for the United States; recycling is only one action in the toolkit. Work is necessary to broadly encompass areas not addressed here, including product redesign, source reduction and reuse. Recycling efforts in the United States comprise more than just the processing of MSW at materials recovery facilities (MRFs) and include many other materials, such as electronics, textiles and food waste. Future strategies will address these and other aspects of a circular economy for all.

A circular economy, as defined in the Save Our Seas 2.0 Act, means an economy that uses a systems-focused approach and involves industrial processes and economic activities that are restorative or regenerative by design, enable resources used in such processes and activities to maintain their highest value for as long as possible, and aim for the elimination of waste through the superior design of materials, products, and systems (including business models). It is a change to the model in which resources are mined, are made into products, and then become waste. A circular economy reduces materials use, redesigns materials and products to be less resource-intensive, and recaptures "waste" as a resource to manufacture new materials and products. Circularity is embraced within the sustainable materials management (SMM) approach that EPA and other federal agencies have pursued since 2009. A circular economy approach under the SMM umbrella demonstrates continuity in our emphasis on

reducing life-cycle impacts of materials, including climate impacts; reducing the use of harmful materials; and decoupling materials use from economic growth. The *2021 Strategy* recognizes the need to implement a circular economy approach for all – reducing the creation of waste with local communities in mind and implementing materials management strategies that are inclusive of communities with environmental justice concerns.

The *National Recycling Strategy* is aligned with and supports implementation of the National Recycling Goal to increase the recycling rate to 50 percent by 2030. The *2021 Strategy* includes five strategic objectives to create a more resilient and cost-effective national recycling system:

A. Improve Markets for Recycling Commodities.
B. Increase Collection and Improve Materials Management Infrastructure.
C. Reduce Contamination in the Recycled Materials Stream.
D. Enhance Policies to Support Circularity.
E. Standardize Measurement and Increase Data Collection.

Objective A: Improve Markets for Recycling Commodities

We need to improve markets for recyclable materials and recyclable products and better integrate recycled materials into product and packaging designs.

A1. Promote market development.
A2. Produce an analysis of different types of end markets that considers resilience, environmental benefits and other relevant factors for decision makers.
A3. Increase manufacturing use of recycled material feedstocks in domestic manufacturing.
A4. Increase demand for recycled materials through policies, programs, initiatives and incentives.
A5. Continue to support research and development of technologies and products that will expand market opportunities.
A6. Explore possible ratification of the Basel Convention and encourage environmentally sound management of scrap and recyclables traded with other countries.

Objective B: Increase Collection and Improve Materials Management Infrastructure

Investment and innovation are necessary to improve the efficiency of materials processing infrastructure, increase collection of materials and create a more resilient recycling system.

B1. Improve understanding of available recycling infrastructure and needs.

B2. Increase awareness and availability of public and private funding and incentives and effective strategies to access the funding.

B3. Continue to fund research, development, demonstration and deployment of new technologies and processes for recycling.

B4. Increase consideration of recoverability and sustainability in the design of products.

B5. Optimize processing efficiencies at materials recovery facilities.

B6. Increase collection of recyclable materials.

Objective C: Reduce Contamination in the Recycled Materials Stream

Reducing contamination in the recycled materials stream will improve the quality of the recycled material, enabling more material to be recycled and reducing discarded material.

C1. Enhance education and outreach to the public on the value of recycling and how to recycle properly.

C2. Ensure resources are available for education and outreach initiatives.

Objective D: Enhance Policies and Programs to Support Circularity

Different policies and programs can be effective in increasing circularity. Efforts under this area aim to increase coordination, availability and accessibility of information on recycling programs and policies at the federal, state, tribal and local levels.

D1. Strengthen federal coordination to support and encourage actions to improve the U.S. recycling system.

D2. Conduct an analysis of different policies that could address recycling challenges.

D3. Conduct a study on reflecting environmental and social costs in product pricing.

D4. Increase awareness of and continue voluntary public-private partnerships.

D4. Share best practices on policies, programs, funding opportunities and outreach through a free, publicly accessible online clearinghouse.

D6. Coordinate domestic and international interests.

Objective E: Standardize Measurement and Increase Data Collection

Different definitions and measurement practices create challenges in setting goals and tracking progress. We need more consistent methodologies to measure recycling system performance.

- **E1.** Develop and implement national recycling system definitions, measures, targets and performance indicators.
- **E2.** Create a tracking and reporting plan.
- **E3.** Create recycled content measures.
- **E4.** Coordinate domestic and international measurement efforts.
- **E5.** Increase data availability and transparency about recyclable materials generated and the materials manufacturers need.

Next Steps

Over the coming few months, EPA will work collaboratively with stakeholders to develop a plan for implementing the 2021 Strategy. EPA will ensure communities have a seat at the table and are involved in both developing the implementation plan and executing the actions in this strategy. EPA is also committing to develop a new goal to reduce the climate impacts from materials use and consumption, which will complement existing national goals on recycling and the reduction of food loss and waste. EPA plans to collaborate across all levels of government, including tribal nations, and with public and private stakeholders to achieve these ambitious goals.

Introduction: Reframing Recycling and the Case for a Circular Economy Approach

Natural resource extraction and processing activities account for approximately 50 percent of total global greenhouse gas (GHG) emissions (International Resource Panel, 2019), and global resource consumption has tripled over the past four decades (United Nations Environment Programme, 2016). Reducing GHG emissions from the production, use, consumption and disposal of materials can help countries meet the Paris Agreement 1.5˚C target. The Ellen MacArthur Foundation (2019a) reported that applying circular economy strategies in five key materials (cement, aluminum, steel, plastics and food) can achieve reductions in GHG emissions – 9.3 billion metric tons of carbon dioxide equivalent in 2050 globally – equivalent to cutting current emissions from all transport to zero.

A "circular economy," as defined in the Save Our Seas 2.0 Act, refers to a systems-focused approach and involves industrial processes and economic activities that are restorative or regenerative by design, enable resources used in such processes and activities to maintain their highest values for as long as possible, and aim for the elimination of waste through superior design of materials, products and systems (including business models). (See Figure 1.) It is a change to the model in which resources are mined, are made into products, and then become waste. A circular economy reduces materials use, redesigns materials to be less resource intensive, and recaptures "waste" as a resource that can serve as feedstock to manufacture new materials and products. Circularity is already embraced in the SMM approach that the United States has pursued since 2009. A circular economy approach under the SMM umbrella demonstrates continuity in our emphasis on reducing life-cycle impacts of materials, reducing the use of harmful materials and decoupling materials use from economic growth. The *2021 Strategy* recognizes the need to implement a circular economy approach for all – reducing the creation of waste with local communities in mind and implementing materials management strategies that are inclusive of communities with environmental justice concerns.

Sustainable Materials Management (SMM) Program

EPA's SMM program aims to reduce the environmental impacts of materials across their life cycle and broadly covers materials use in the United States. EPA's activities are covered in the *EPA Sustainable Materials Management Program Strategic Plan for Fiscal Years 2017 – 2022* (U.S. EPA, 2015). EPA has several long-standing programs and efforts underway to advance SMM. See www.epa.gov/SMM for more information.

The United States seeks to coordinate domestic and international policies that support this approach to ensure that U.S. knowledge and approaches contribute to international discussions on circular economy, as well as leveraging the data, information, tools and experience of the international community to support domestic efforts to achieve sustainability goals.

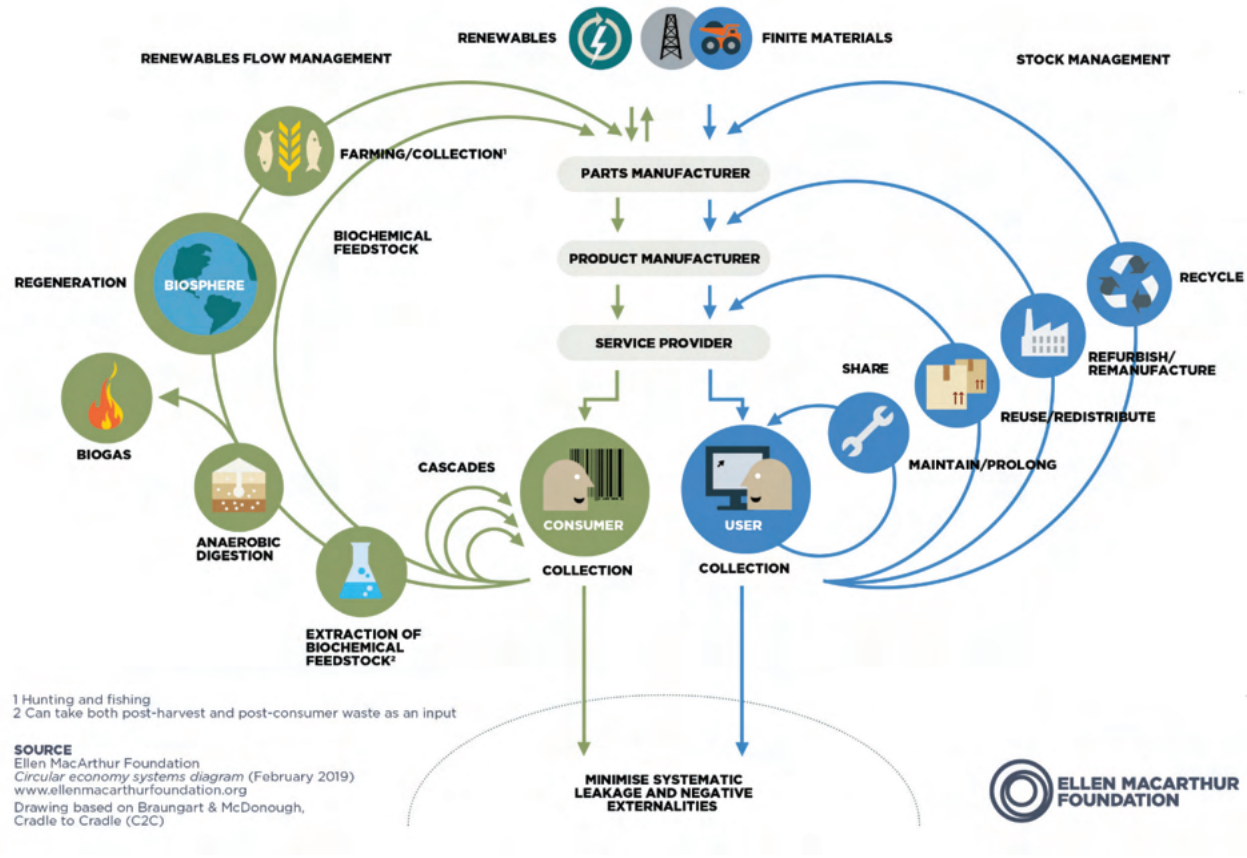


Figure 1. Diagram of circular economy (Ellen MacArthur Foundation, 2019b)

The *National Recycling Strategy*, which is part one of a series on building a circular economy for all, is focused on enhancing and advancing the national MSW recycling system, including plastics, glass, metals and paper. The purpose of the *National Recycling Strategy* is to identify deliberate objectives and stakeholder-led actions to create a stronger, more resilient, less impactful and more cost-effective U.S. MSW recycling system. This strategy responds in part to Congress' request in 2019 for EPA to develop a "national recycling strategy to strengthen and sustain the current system with recommendations for voluntary actions" (U.S. House of Representatives, 2019). The United States recognizes that MSW recycling is one contribution to a circular economy approach, but it is a critical first step since it serves as a key mechanism for returning materials to the supply chain.

Improvements to the U.S. waste management system through implementation of circular economy approaches and increased recycling may offer opportunities to address environmental, social justice and civil rights concerns. Waste management has long been associated with the environmental justice movement; in fact, the event that catalyzed the environmental justice movement was a nonviolent sit-in protest against a polychlorinated biphenyl landfill in Warren County, North Carolina, in 1982. The seminal studies on environmental justice by the Government Accountability Office and United Church of Christ showed that hazardous waste management practices have

profound implications for communities in which they are located (Chavis and Lee, 1987; U.S. Government Accountability Office, 1983). Waste can impact communities where waste management facilities are concentrated, including impacts to human health, ecosystem services, property values, aesthetic and recreation values, and land productivity itself. Adverse environmental factors from waste can compound social and economic conditions and lead to higher levels of chronic health issues. Communities with environmental justice concerns, who already shoulder the burden of disposal facilities (Tishman Environment and Design Center, 2019), are most impacted by these issues.

Unsafe waste management practices can also disproportionately impact disadvantaged communities abroad. Some countries continue to strengthen their recycling and waste management systems and may face challenges to ensure that scrap and recyclables are managed in an environmentally sound manner, especially in communities with environmental justice concerns. By promoting a circular economy and a recycling system that ensures sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all, the *2021 Strategy* can support U.S. efforts to achieve Goal 8 of the UN's Sustainable Development Goals. A circular economy and recycling systems must also promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable and inclusive institutions at all levels, which is Goal 16 of the Sustainable Development Goals. U.S. efforts under the *2021 Strategy* also aim to contribute toward that goal.

Environmental benefits of advancing the U.S. recycling system include decreasing pollution and conserving energy. In 2018, approximately 292 million tons of MSW were generated in the United States, of which approximately 69 million tons were mechanically recycled and 25 million tons were composted. Together, 32.1 percent of MSW (about 94 million tons) was mechanically recycled or composted, preventing over 193 million metric tons of carbon dioxide equivalent from entering the atmosphere (U.S. EPA, 2020a).

Woman placing a plastic bottle into a recycling bin.

Economic benefits of recycling include increasing national security and resiliency by tapping a domestic source of materials – including the retention of key critical minerals needed to manufacture vital products, support American manufacturing, and create jobs in the recycling and manufacturing industries. For example, EPA's *Recycling Economic Information Report for the United States* shows that in 2012, recycling and reuse activities accounted for approximately 681,000 jobs, $37.8 billion in wages, and $5.5 billion in tax revenues (U.S. EPA, 2020b). Recycling turns waste into economic opportunity.

Increasing MSW recycling is one aspect of a circular economy approach since it serves as a mechanism for reducing environmental and social impacts of materials use, keeps valuable resources in productive use rather than in landfills, and creates jobs. EPA, in coordination with other federal agencies and interested stakeholders, intends to release subsequent strategies that will encompass other activities beyond the recycling of MSW, reflecting the need for sustainable product design, reducing waste generation, and materials reuse activities critical to realizing circularity. Subsequent strategies will address other key materials, such as plastics, food, cement and concrete, and electronics. EPA will also bolster this reframed focus by developing a new goal to reduce the climate impacts from materials use and consumption, which will complement existing national goals on recycling and the reduction of food loss and waste. In the meantime, existing efforts will continue to address these material streams, some of which are discussed more in depth in Appendix A. EPA is also promoting water circularity under the National Water Reuse Action Plan.

Many stakeholders submitted comments on whether to include chemical recycling in the scope of the *National Recycling Strategy*. All options, including chemical recycling, should be discussed when considering methods for sustainably managing materials. Therefore, chemical recycling is part of the scope of this strategy and further discussion is welcome.

Developing the *National Recycling Strategy*

In 2018, in response to recent international policy changes and other challenges, EPA began an effort to focus on recycling challenges in the United States, which led to the inaugural America Recycles Day Summit in 2018. One year later, EPA published the *National Framework for Advancing the U.S. Recycling System* (the *National Framework*) to highlight the four main challenges the U.S. recycling system must address to be effective: promoting education and outreach, enhancing infrastructure, strengthening materials markets and enhancing measurement. It also identified specific voluntary actions, ongoing and planned, that EPA and recycling stakeholders would take to improve the effectiveness and resiliency of America's recycling system (U.S. EPA, 2019).

Building on the *National Framework* and EPA's long history of providing data, tools, information and other resources to support recycling in the United States, EPA coordinated the development of the *National Recycling Strategy* to identify the actions

Robotic arms sorting different types of materials.

needed to create a strong, resilient, cost-effective and less impactful U.S. recycling system – a key element of a circular economy. EPA, working with stakeholders and other federal agencies, is resolved to meet the challenges that the U.S. recycling system faces head on and chart the course for the development of more sustainable solid waste and recycling systems. This strategy aligns with and supports implementation of the National Recycling Goal to increase the U.S. recycling rate to 50 percent by 2030[1].

The *National Recycling Strategy* builds on the principles set by the *National Framework* on MSW recycling. The following key sources of information, ideas and collaborative input also informed the development of this strategy:

- **Federal Agency Input.** EPA received input from other federal agencies in the development of the *National Recycling Strategy*, including the Council on Environmental Quality (CEQ), the Federal Trade Commission (FTC), the National Science Foundation (NSF), the U.S. Agency for International Development (USAID), the U.S. Department of Agriculture (USDA), the U.S. Department of Commerce (DOC) (including the International Trade Administration [ITA], National Oceanic and Atmospheric Administration [NOAA], and the National Institute of Standards and Technology [NIST]), the U.S. Department of Defense (DOD), the U.S. Department of Energy (DOE), the U.S. Department of State (DOS), the U.S. General Services Administration (GSA), and the U.S. Trade Representative (USTR).
- **State, Tribal and Local Agency Input.** EPA obtained input from the Environmental Council of the States (ECOS), the Association of State and Territorial Solid Waste Management Officials (ASTSWMO), South Carolina Department of Commerce, U.S. Conference of Mayors, the National Tribal Caucus, and the Tribal Waste and Response Steering Committee.
- **Non-Profit Organizations.** EPA received feedback from several non-profit organizations including the Environmental Research and Education Foundation (EREF), GreenBlue Institute, Keep America Beautiful (KAB), the National Recycling

1 EPA will issue an updated Recycling Measurement Guide in 2022 and will then assess the national recycling goal.

Coalition, The Recycling Partnership (TRP), and the U.S. Chamber of Commerce Foundation (USCCF).

- **EPA's America Recycles Network.** In April 2020, EPA conducted a survey of the America Recycles Network members to identify relevant actions that could make meaningful improvements to America's recycling system. Their ideas and suggestions have been incorporated into the *National Recycling Strategy* (visit https://www.epa.gov/americarecycles/forms/america-recycles-pledge to see the current list of America Recycles Pledge signatories).

- **Public Comment Period.** EPA sought input from the public on the draft *National Recycling Strategy* through a federal docket (EPA-HQ-OLEM-2020-0462) in the fall of 2020. Outreach also included a publicly accessible, recorded webinar providing an overview of the draft strategy in October 2020 and discussion and dialogue with participants at the November 2020 America Recycles Summit. EPA received considerable input that the draft strategy was too narrow in scope and that it should be broadened to embrace a circular economy approach. EPA considered all input received during the public comment period in the finalization of the *National Recycling Strategy* (see Appendix B for an overview of the comments that were received and how they were addressed).

- **Consultation with EPA's National Environmental Justice Advisory Council.** At their June 2021 meeting, EPA's National Environmental Justice Advisory Council (NEJAC) provided feedback on the *National Recycling Strategy*. The NEJAC highlighted that recycling is not always seen as a good thing in communities where recycling facilities are located. They also emphasized concerns with the siting of incineration facilities. In addition, the NEJAC highlighted that plastics are often not effectively recycled and there is confusion on what plastics are recyclable. Based on NEJAC and other feedback, EPA revised the *National Recycling Strategy* to reflect the need for an environmental justice assessment of U.S. non-hazardous solid waste management infrastructure. This assessment will help convey potential impacts of existing nonhazardous solid waste management on overburdened communities and inform new facility siting and other decisions. EPA also ensured that the strategy reflected actions to clarify product labeling regarding recycling and will further consider these comments on plastic products in developing a post-consumer materials management and water management strategy under the Save Our Seas 2.0 Act.

Just as successful coordination between public and private stakeholders was instrumental in developing this document, successful implementation of this strategy will require coordinated involvement and commitment across all levels of government and stakeholders in the America Recycles Network. In addition to implementation, EPA is committed to working across the Agency and the federal government, working with communities, and leveraging the expertise of the America Recycles Network when coordinating future strategy updates.

Overview of the MSW Recycling Process as a Component of a Circular Economy

One aspect of a circular economy approach is to recapture "waste" as a resource that can serve as feedstock to manufacture new materials through recycling. While the recycling process often differs by commodity and locality, there are essentially four main steps: generation, collection, processing and remanufacturing into a new product. Figure 2 depicts a simplified materials flow of the recycling process.

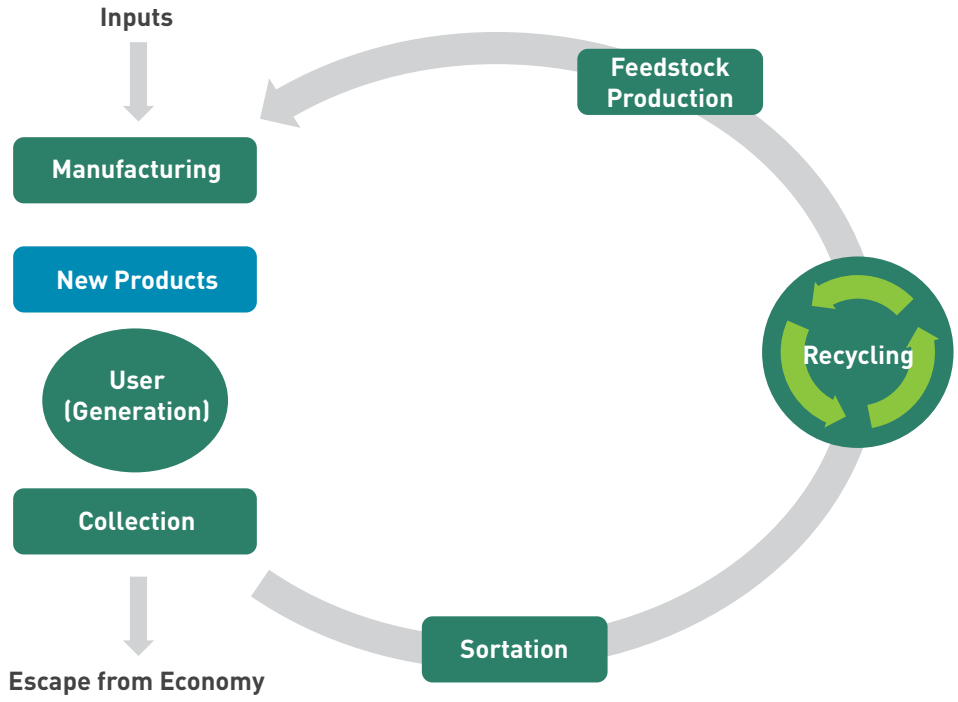


Figure 2. Conceptual Material Flow of the U.S. Recycling System

- **Generation:** Materials are generated by residents (e.g., households), public spaces (e.g., parks), institutions (e.g., universities), and commercial businesses (e.g., retail stores).
- **Collection:** Materials are collected by a private hauler or government entity through curbside collection, transfer stations, onsite collection, drop-off centers, take-back locations, stewardship programs and/or scrap yards.
- **Secondary Processing:** The collector transports the materials to a processing facility, such as a MRF or paper processor. At the processing facility, the recyclables are sorted, cleaned of physical contaminants, reduced in size, and prepared for transport to a milling facility or directly to a manufacturing facility. Some commodities may require more processing for additional sorting, size reduction and decontamination. For example, glass and plastic are often sent to facilities where they are processed into manufacturing feedstocks.

- **Manufacturing:** After all necessary processing has been completed, recyclables are made into new products at a manufacturing establishment, such as a paper mill or can/bottle manufacturing facility.
- **Escape from the Economy:** When materials are not recycled or reused, the remaining value of those materials no longer perpetually contributes to the economy. While few materials are infinitely recyclable, the goal of a circular economy approach is to prolong the useful lifespan of non-toxic resources for as long as possible. By recycling materials, resources remain in the economy for buying, selling and manufacturing. Although not pictured here, there are additional material losses at various points in the recycling process. For example, contamination can result in material value escaping from the economy.

Drivers, Opportunities, and Challenges Facing the U.S. Recycling System

Two major global trends are motivating major changes to the U.S. recycling system. First, changes to global trade are shifting the markets for recycled materials and further amplifying the need for new markets and improved infrastructure across the United States. Second, increasing awareness of the extent and impacts of mismanaged waste in the environment are increasing demands for accountability and transparency in the economy, particularly for the management of materials at the end of their life. A system that extracts value from those secondary materials is critical to extending the economic benefit of natural resources.

Recycling bin in a park in downtown Washington, D.C.

The *2019 National Framework for Advancing the U.S. Recycling System* articulated a number of challenges facing MSW recycling, including confusion about what materials can be recycled, which often leads to placing recyclables in the trash or throwing trash in the recycling bin or cart; recycling infrastructure that has not kept pace with today's diverse and changing waste stream; reduced markets for recycled materials; and varying methodologies to measure recycling system performance. The *2021 Strategy* builds on existing successes and efforts to advance the U.S. recycling system that are being undertaken by federal, state, local and tribal governments; non-profit organizations; communities; and multiple industries. It seeks to identify the critical technology, policy, financial and programmatic issues that must be addressed to enhance the effectiveness and resilience of our recycling system as a critical component of a circular economy approach.

Goals, Strategic Objectives and Actions

On November 17, 2020, at the America Recycles Summit, EPA announced the National Recycling Goal to increase the U.S. recycling rate to 50 percent by 2030 to galvanize action to further strengthen the U.S. recycling system. The national goal and future metrics will provide the benchmarks needed to evaluate the success of the

COVID-19 Impacts

The COVID-19 public health emergency continues to affect recycling programs and markets for recyclables. With more people working from home, residential trash and recyclable collections have increased while commercial trash and recyclables have decreased (Staub, 2020). This has changed the composition of recyclables – for example, less office paper is being generated. Nationwide, office and school closures have lowered the supply of printing and writing paper for recycling; however, the increases in e-commerce and home grocery delivery have resulted in a surge of packaging paper. Containerboard mills are running at 95 percent operating rates, and the need for corrugated boxes has substantially raised old corrugated container (OCC) prices. The higher prices have lifted residential mixed-paper prices (Miller, 2020). Recyclers are also finding an increase in the prevalence of contaminants, such as masks and latex gloves, in the recycling bin, which is further challenging recycling operations to economically and efficiently process recyclables (Sangal, 2020).

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal

On January 1, 2021, amendments to the Basel Convention to control exports and imports of plastic scrap and waste took effect. Such international actions, while limiting U.S. export markets for recyclable material, offer new incentives to develop domestic market opportunities.

Plastics and SOS 2.0

Plastics are increasingly receiving attention domestically and internationally due to concerns about marine litter. In 2020, Congress passed the Save Our Seas 2.0 Act, which focuses on preventing, reducing and recycling marine litter (such as plastics). The Act supports investments in post-consumer materials management infrastructure, as well as education.

collective efforts to significantly improve the nation's recycling system. In 2021, EPA, in coordination with other interested stakeholders, intends to finalize the methodology for calculating the recycling rate, including finalizing which material streams will be included.

EPA also intends to initiate efforts to establish a goal related to climate impacts associated with the production, use, consumption and disposal of materials. This new goal will not only support a circular economy, but it will also complement the existing National Recycling Goal and the national goal to reduce food loss and waste. It will also contribute towards global climate change efforts and demonstrate U.S. leadership internationally in connecting innovative resource efficiency initiatives with goals to address climate change.

The *2021 Strategy* identifies five strategic objectives that will contribute to strengthening the U.S. recycling system. These objectives serve as the organizing framework under which specific actions are organized:

A. Improve Markets for Recycling Commodities.
B. Increase Collection and Improve Materials Management Infrastructure.
C. Reduce Contamination in the Recycled Materials Stream.
D. Enhance Policies and Programs to Support Circularity.
E. Standardize Measurement and Increase Data Collection.

The following sections describe the strategic objectives and actions.

Objective A: Improve Markets for Recycled Commodities

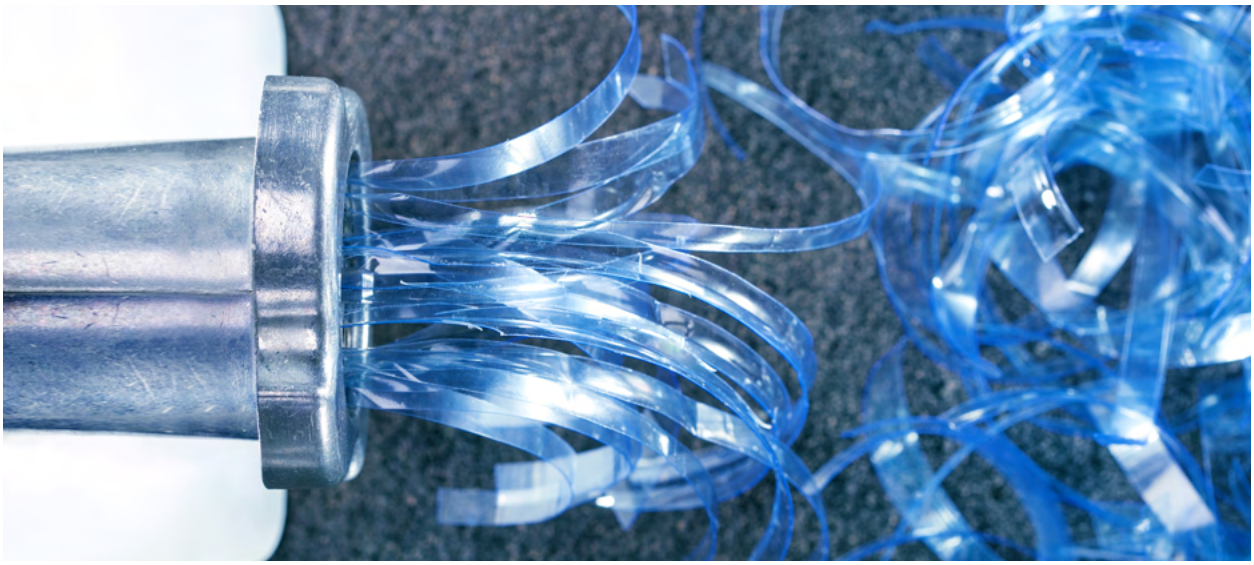
To move towards circularity, we need to improve and increase markets for recyclable materials and recyclable products, in addition to better integrating recycled materials into product and packaging designs. The decrease in available markets for recyclable materials has impacted the economics of recycling both within the United States and worldwide. It is also important to ensure that markets for recyclables do not further harm the environment or place additional burdens on communities near manufacturing, processing or recycling facilities – some of which may already face environmental justice concerns.

The benefits of increasing the environmentally sound use of recycled materials can include local job creation; additional resiliency to market disruptions; cost savings to local municipalities from improved, more robust recycling markets; increased opportunities for consumers to "buy recycled" and support recycling markets; new markets for less-often-recycled materials; and reduced environmental impacts over the life cycle of the product. It is also important to ensure that recyclables are managed in an environmentally sound manner when sent for further processing so that communities with environmental justice concerns are not adversely affected by recycling practices.

A1. Promote market development.

A1.1. Conduct market development workshops and dialogues to spur market development for recycled materials, educate stakeholders on the value of secondary materials and identify solutions to recycling system challenges. Coordinate dialogues among private and public recycling programs, manufacturers, and other relevant stakeholders on actions that can be taken to strengthen markets for recycled materials at the state, regional and local levels, including smaller markets and rural areas. Market development workshops – such as those held by EPA, the Northeast Recycling Council (NERC), and the Southeast Recycling Development Council (SERDC) in 2019 – are one mechanism to bring together targeted stakeholders to engage in discussions about specific market development issues.

A1.2. Support regional market development entities. Ensure funding for state or regional market development entities (existing entities or entities that need to be established), such as the Washington Recycling Development Center, NERC and SERDC, among others. Regional market development entities are positioned to focus on state and regional efforts and priorities and leverage existing materials marketplaces.



Recycled plastic being cut through a recycling machine.

A1.3. Produce an analysis of market development opportunities suited to rural areas. Rural areas face unique challenges to developing and sustaining markets. Building markets in rural areas would stimulate local job creation from the development of small-scale manufacturers that use locally generated materials.

A1.4. Create market development toolkits for communities. Collect case study success stories, ideas and resources on improving markets and compile them into a reference. Consulting the toolkit could be a first step to helping communities address their local market development challenges. Initiate community engagement and introduce market development concepts to communities facing environmental justice concerns so they can consider recycling markets as a potential redevelopment option.

A2. Produce an analysis of different types of end markets that considers recycled material consumption, resilience, environmental benefits and other relevant factors for decision makers.

Markets vary in their ability to consume recycled material content, their economic viability, their stability, and how much the use of recycled materials in these product categories benefits the environment. An analysis of end markets and their requirements can inform decision makers about the value, costs, social impacts and potential benefits (environmental, social and economic) associated with investing in activities to strengthen the nation's recycling system.

A3. Increase manufacturing use of recycled material feedstocks in domestic markets.

A3.1. Increase awareness of regional feedstocks available to local manufacturers. Often, manufacturers or other possible users of recycled products are not aware of the recycled material feedstock in their area or the potential to use that material. Communities do not always generate enough recycled material to make it worthwhile to transport the material long distances to other manufacturers who might be able to use it. One way to help strengthen and increase the use of recycled material as feedstock is ensuring that manufacturers in the regions where it is generated can take advantage of the available supply.

A3.2. Form a plan to develop the needed capacity and improvement of domestic markets to use recycled materials generated in the United States. This could include combining infrastructure and feedstock data from Actions A3 and B1 with manufacturers who use/potentially use recycled materials. Explore ways to ensure that a consistent supply of feedstock is available to manufacturers.

A4. Increase demand for recycled materials through policies, programs, initiatives and incentives.

A4.1. Identify strategies for addressing materials with less-mature markets. Consider ways to help less-mature markets across the country reach maturity. Focus on materials with limited markets that could have the greatest environmental impacts. Explore ways to incentivize partnerships between feedstock producers and users and connect markets across regions.

Machines break and combine glass in a recycling facility. This broken glass, called cullet, can be mixed with sand, limestone and other raw materials to produce molten glass, which is used to create new bottles and jars.

A4.2. Identify strategies to address barriers to using recycled content in products. Identify barriers to recycled content use in products. This includes supply chain, contamination, economics, legislation/policies, technological limits to recycled content, product safety requirements (e.g., U.S. Food and Drug Administration approvals), perceptions of inferior quality, and product performance specifications. Collaborate with governments, academia, public interest groups, environmental organizations and manufacturers to find strategies to tackle those barriers. Develop programs for the private sector to increase recycling, like the Buy Recycled Business Alliance, and help manufacturers find ways to bring municipal materials into their facilities for use. Consider the use of existing – and, where needed, development of – third-party certifications for recycled/secondary materials.

Paper cup made from recycled paper.

A4.3. Develop messaging about buying sustainable products made with recycled content. Determine best approaches and strategies to develop effective messaging campaigns encouraging producers and the public to close the recycling loop by buying new sustainable products made from recycled materials. To increase awareness among consumers, identify producers of recycled products and consider a "recycled content" label, so consumers can clearly understand what portion of the materials in the product is recycled.

A4.4. Host dialogues with manufacturers and other stakeholders to learn what policies, programs and incentives would promote greater use of recycled content in products. Encourage communication among governments, manufacturers and stakeholders to identify programs, challenges, incentives and policies that fit best within their market to increase recycled content use in products.

A4.5. Encourage institutions, corporations and governments to adopt procurement policies to purchase more sustainable materials made with recycled content. Through their purchasing power, governments and other entities can increase demand for products made with recycled content. This action could include updating existing guidelines, such as EPA's *Comprehensive Procurement Guidelines*, or creating new guidelines for buying products with post-consumer recycled content, taking into consideration existing private sector standards and certifications.

A4.6. Create a "Demand Challenge" partnership program to encourage the use of recycled materials in products. A voluntary recognition program (led by the federal government or other entities) could encourage companies to increase their use of secondary materials both through purchasing power (buying recycled) and incorporating recycled materials into their manufactured products.

A5. Continue to support research and development of technologies and products that will expand market opportunities.

Research and development can create new markets by finding novel ways to use secondary materials as feedstocks and developing technology to allow the recycling of difficult-to-recycle materials. Funding projects and building new partnerships with universities, industry and others will both advance secondary materials use and expand markets for materials and products.

A6. Explore possible ratification of the Basel Convention, and encourage environmentally sound management of scrap and recyclables traded with other countries.

A6.1. Support the Basel Convention. Some countries continue to strengthen their recycling and waste management systems and may face challenges to ensure that scrap and recyclables are managed in an environmentally sound manner, especially in communities with environmental justice concerns. The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal requires parties to control the transboundary movements of certain materials and hazardous waste covered by the Convention, and to take measures to not allow certain exports if parties have reason to believe the exports would not be managed in an environmentally sound manner.

Currently, EPA has authority under the U.S. Resource Conservation and Recovery Act to control transboundary movements of most hazardous recyclables and waste, but not all Basel-controlled waste. The United States signed the Basel Convention in 1990 and the Senate gave its advice and consent to ratification in 1992. The United States should explore options for strengthening U.S. participation in the Basel Convention, including options that would enable ratification.

A6.2. Encourage environmentally sound management practices to support protection of human health and the environment. The United States supports environmentally sound management of scrap and recyclable materials. In conjunction with exploring options for strengthening U.S. participation in the Basel Convention, EPA should identify ways to enhance practices to ensure that environmentally sound management of scrap and recyclable materials can benefit circular economy approaches.

Objective B: Increase Collection and Improve Materials Management Infrastructure

Recycling infrastructure – the equipment associated with the collection, conveyance, sorting, processing and reintroduction of recyclables feedstock into the manufacturing process – in the United States has not kept pace with the rapidly changing recyclables stream, and products are not designed with current infrastructure in mind. Access to recycling opportunities also varies, so access to the benefits of recycling subsequently varies among communities. Investment and innovation are necessary to increase collection opportunities, improve sorting materials, increase the efficiency of materials processing infrastructure, increase the collection of materials and create a more resilient recycling system. Examples of efficiencies that can be attained through additional investment include decreasing the cost of sorting recyclable materials; decreasing the amount of residuals that are removed from the recycling stream to produce properly sorted recyclable products; improving the quality and quantity of recyclables exiting the materials-sorting process; and increasing the proportion of recyclable materials post-sort compared to the amount of recyclables entering the MRF.

Anticipated benefits from infrastructure investment include adoption of innovative technologies for processing equipment, increases in materials for manufacturers, and economic benefits and job creation from expanding recycling capacity, particularly in underserved and rural communities.

B1. Improve understanding of available recycling infrastructure and needs.

B1.1. Create a national map of existing recycling infrastructure to depict available recycling system capacity. Building on existing information, develop a map of recycling infrastructure that includes key elements of the recycling system, from available collection points (e.g., drop-off centers, scrap yards, MRFs), sortation and secondary processing facilities (e.g., MRFs, baling operations, scrap yards, plastics reclaimers, pulp mills, glass beneficiation facilities), and, ultimately, manufacturing centers that use the recycled materials (e.g., plastic/products manufacturers, paper/paperboard mills, steel/aluminum mills, glass product/packaging manufacturers).

B1.2. Conduct a needs assessment of recycling infrastructure in the United States. Using information from the national map and other sources, conduct a needs assessment of the nation's recycling infrastructure that includes social equity in accessing recycling services. Then produce an outline of recommendations for infrastructure improvements and an investments/cost analysis to implement the improvements.

B1.3 Conduct an environmental justice assessment of non-hazardous solid waste management infrastructure in the U.S. National-scale data and

analysis of existing non-hazardous solid waste management infrastructure (e.g. landfills, incinerators, transfer stations, MRFs, chemical recycling facilities) is needed to understand whether non-hazardous solid waste management infrastructure disproportionately impacts communities. Such data, when considered along with community-level information, can help communities address environmental justice when siting new infrastructure. The data will also allow the United States to track progress nationally.

B1.4. Improve recycling infrastructure. Use the information from Actions B1.1, B1.2 and B1.3 to make improvements to the recycling infrastructure, ensure access to recycling is widespread, and ensure environmental justice is considered in the siting of new infrastructure. When recovery facility and collection equipment is upgraded, considerations should be taken so that the upgraded equipment is also safer and healthier for recovery facility collection workers. Create a list of milestones for MRFs to complete within a 10-year timeframe. Consider pilot programs for communities to make collection-related improvements, such as new bins, trucks, dual or multi-stream collection systems, and personal protective equipment (PPE).

B2. Increase awareness and availability of public and private funding and incentives and effective strategies to access the funding.

B2.1. Increase public and private funding opportunities. Additional sources of funding would help implement the infrastructure additions and upgrades that are identified as part of Action B1. Rapidly evolving sorting technology and advances in alternate forms of recycling technologies also increase the costs of maintaining up-to-date facilities. Funding could take the form of tax credits, grants, loans, subsidies or other types of funding at a local, state or national level; it should consider and prioritize direct and indirect benefits to under-resourced communities, to the extent allowed by law.

B2.2. Compile and share available funding sources and related resources. Public and private funding sources to support enhancements to infrastructure exist, but they are dispersed and not easily identifiable for many seekers of funding. Best practices and successful models addressing key issues – such as environmental impacts, collection costs, processing costs and revenue from material sales – should be compiled and made publicly accessible.

B3. Continue to fund research, development, demonstration and deployment of new technologies and processes for recycling.

Funding through grants and other mechanisms would support identification and evaluation of strategies and new technologies that could be scaled up and replicated across the country – both for existing materials that are difficult to process and for future materials. New technology and processes can improve manufacturing and

processing efficiencies, resulting in environmental and cost-competitive gains. Partners include universities, private industry and other research organizations.

B4. Increase consideration of recoverability and sustainability in the design of new products.

Manufacturers of products and packaging may not be aware of the impacts their material and design choices have on the ability of consumers, reuse markets, MRFs and secondary processing facilities to recover, reuse and recycle their materials. Material design and selection should consider both the intended useful lifetime and the impacts of the materials on established recycling systems. Strategies that should be explored are the use and promotion of tools such as design guides for recycling and upstream analyses of a material's/product's recoverability; collaborative dialogues among MRFs, retailers, product designers, chemists, academia and manufacturers; technical support programs; "design for environment" educational materials; information about secondary materials that are in demand; design incentives for manufacturers; purchasing specifications; consensus standards; and other outreach campaigns and tools.

B5. Optimize processing efficiencies at materials recovery facilities.

Create a universal guide for contamination audits at MRFs and perform optimization assessments to identify how MRFs can improve their processing efficiency. Explore regionalization strategies, such as the "hub-and-spoke" model, that can also optimize efficiencies and reduce costs.

B6. Increase collection of recyclable materials.

B6.1. Engage in outreach efforts to increase participation in recycling. Increasing the supply of collected materials will support end markets that are currently supply-constrained and companies that are scaling up new technologies to recycle more types of materials. Many companies have recently made significant commitments to increase the recyclability and recycling of consumer products and packaging, as well as increasing the amount of recycled content incorporated into them.

B6.2. Provide data and analyses to support increased collection of recyclables. Analyses could include a close look at each state's waste and recyclables profile and then use the information to improve recycling. An analysis of single-stream and source-separated recycling with recommendations and metrics could help decision makers choose the most effective option for their communities.

B6.3. Implement incentives, policies and programs that result in increased collection. Drawing upon the policy analysis in Action D2, decision makers can implement policies best suited to increase the collection of recyclable materials in their communities. Incentives could be explored to encourage retailers to become collection points for some types of materials.

Objective C: Reduce Contamination in the Recycled Materials Stream

Reducing contamination in the recovered materials stream is necessary to improve the quality of the recycling stream and produce the valuable secondary materials that drive markets. Contamination can occur at various times throughout the recycling process and negatively affects the ability of a MRF or secondary processing facility to produce high-quality, clean recycled materials that serve as feedstock for new materials and products. Efforts under this objective may expand to other ways to improve the quality of the recycling stream as contamination decreases.

Anticipated benefits of reducing contamination in the recycling stream will enable more material to be recycled and increase the value and quality of recycled materials and feedstock. Higher-quality recycled material will increase the available supply of recycled material and support strengthening markets for recycled materials.

C1. Enhance education and outreach to the public on the value of recycling and how to recycle properly.

C1.1. Develop messaging and educational materials about the importance and value of recycling. While it is generally understood that recycling is one action people can take to help protect the environment, additional messaging and educational materials emphasizing the environmental, social and economic benefits of recycling as a key aspect of a circular economy approach need to be produced and made available to state, local and tribal governments. For example, the America Recycles Network published a jobs infographic to help consumers understand the economic benefits of recycling. Communications and materials will be developed to reach and ensure access to diverse audiences, including persons with limited English proficiency and persons with disabilities. Title VI of the Civil Rights Act

Pressed plastic bottles in bales.

Bales of cardboard awaiting shipment.

requires that recipients of financial assistance from EPA and other federal agencies provide meaningful access to their programs and activities for persons with limited English proficiency. Executive Order 13166, "Improving Access to Services for Persons with Limited English Proficiency," requires that EPA and other federal agencies also provide meaningful access to their programs and activities for persons with limited English proficiency. Sections 504 and 508 of the Rehabilitation Act ensure meaningful access for persons with disabilities. Under Section 504, EPA is obligated to provide reasonable accommodations such that persons with disabilities – including applicants, participants, personnel of other federal entities and members of the public – can meaningfully access and participate in EPA-sponsored programs and activities. Section 508 requires EPA to make electronic information and websites accessible. Section 504 also applies to federal financial assistance recipients.[2]

C1.2. Develop common recycling messages on key issues to promote awareness, increase recycling participation and ensure a more consistent stream of recyclable material. Common messages about key recycling issues are critical to reducing contamination by making sure the public understands the consequences of contamination and how to recycle properly. For example, the America Recycles Network published an infographic and developed a social media campaign to highlight positive recycling messages. A variety of educational messages are necessary to be responsive to and reflective of diverse communities.

2 Title VI , 42 U.S.C. 2000(d) et seq.; Sections 504 and 508 of the Rehabilitation Act of 1973, as amended, 29 U.S.C. § 794; Lau v. Nichols, 414 U.S. 563, 568-69 (1974) (finding that the government properly required language services to be provided under a recipient's Title VI obligations not to discriminate based on national origin); Executive Order 13166 of August 11, 2000, "Improving Access to Services for Persons with Limited English Proficiency," at https://www.federalregister.gov/documents/2000/08/16/00-20938/improving-access-to-services-for-persons-with-limited-english-proficiency.

C1.3. Identify effective ways to educate the public about recycling, test those methods with pilot educational campaigns and then incorporate them into a national program. There are a variety of approaches and strategies to develop effective messaging campaigns. For example, one approach, community-based social marketing, emphasizes direct contact among community members and the removal of structural barriers, since research suggests that such approaches are most likely to inspire behavior change (McKenzie-Mohr, 2011). Ultimately, the approach should be tailored to meet the needs and budget of the community.

C1.4. Enlist the assistance of traditional and social media, governments, MRFs, waste haulers, and product manufacturers to disseminate messaging. It is important to elevate the awareness of the importance of recycling and develop new educational materials and campaigns. This can be supported and advanced by traditional and social media, governments, MRFs, waste haulers, and product manufacturers to increase the impact of the messaging. For example, several states and local governments already create recycling toolkits, direct mailers, "oops" cart tags, and brochures. In schools, information about recycling can be taught to children, who then repeat the messaging at home. Connecting governments and product manufacturers is another strategy for amplifying and more broadly disseminating messaging through traditional and social media.

C1.5. Improve consistency of labels for recyclable products, recycling bins and trash bins. Consistent labels, signage, symbols and messaging for recyclable products, recycling bins and trash bins could reduce consumer confusion about what products can be recycled and which bins are appropriate for different recyclable materials. Likewise, clarifying existing labels that are confusing to consumers – for example, the resin identification code – could make recycling easier. Labels should be accurate and not misleading.

C1.6. Develop a plan to assist state and local governments with contamination. State and local governments often do not have the resources to effectively address recycling contamination problems. A comprehensive strategy will help state and local governments reduce contamination of recyclables caused by incorrect materials being placed in recycling containers.

C2. Ensure resources are available for education and outreach initiatives.

Education, outreach and information resource hubs will need resources to ensure that they are sustainable and effective. In-kind resources, funding or other types of support will need to be leveraged or created.

Objective D. Enhance Policies and Programs to Support Circularity

Different policies and programs can be effective in increasing circularity. Extended producer responsibility (EPR) policies – policies that place a shared responsibility for end-of-life product management on producers and other entities involved in the product chain – advanced recovery fees, and landfill bans are all examples of policy drivers that are intended to increase materials recovery at the state and local levels. However, governments need to know when to use them and what conditions make them successful. Efforts under this area aim to increase coordination, availability and accessibility of information on recycling programs and policies at the federal, state, tribal and local levels.

Anticipated benefits of enhancing policies to support circularity include better-informed, effective and efficient policies that lead to increased recycling.

D1. Strengthen federal coordination to support and encourage actions to improve the U.S. recycling system.

To support and encourage action to address the challenges facing the U.S. recycling system, federal partners could formalize their collaboration through a workgroup dedicated to identifying opportunities to leverage existing programs and funding. The federal government is uniquely positioned to advance recycling via policies, procurement, and management of waste and recyclables generated at federal facilities. Actions could include developing a common policy statement supporting the National Recycling Goal and other collaborative efforts to achieve it.

Workers sorting through trash in a recycling facility.

D2. Conduct an analysis of different policies that could address recycling challenges.

Governments and other entities have adopted various policy approaches to address the challenges facing the recycling system. Conducting an analysis of different policies for their effectiveness could help inform decision makers nationally. Examples of policies to include in the analysis are:

- Recycled content requirements for products.
- Taxes on virgin materials.
- Bottle bills.
- Take-back programs.
- EPR requirements.
- Fees for recycling incorrectly.
- Landfill fees.
- Packaging fees.
- Policies favoring natural resource use.
- Recycling mandates.
- Pay-as-you-throw.
- Consumer incentives.
- Bans on contaminants in products.
- Bans on producing/using specific materials.
- Bans on certain materials in landfills.
- National recyclability standards.
- Minimum standards on MRFs to recover certain materials.
- Minimum quality/contamination standards for MRF outputs.
- Dual stream versus single stream collection.
- Policies/incentives to divert materials from landfills.
- Data reporting requirements.
- Policies to support infrastructure development (permitting requirements, regulations, stakeholder engagement, etc.).

D3. Conduct a study on reflecting environmental and social costs in product pricing.

In 2020, the Government Accountability Office recommended that EPA develop an implementation plan for conducting a study and developing recommendations for administrative or legislative action regarding the necessity and method of imposing disposal or other charges on packaging, containers, vehicles and other manufactured goods to reflect the cost of final disposal, the value of recoverable components of the item, and any social costs associated with nonrecycling or uncontrolled disposal, as required by the Resource Conservation and Recovery Act.

D4. Increase awareness of and continue voluntary public-private partnerships.

Public-private partnerships are a proven, effective way to leverage government and private-sector commitments and translate them into results. For example, WasteWise is one of EPA's longest-standing partnership programs and has involved thousands of organizations, ranging from corporations and businesses to educational institutions and governments. Since 1994, WasteWise participants have prevented more than 247 million tons of waste from going to landfills and avoided 459 million metric tons of carbon dioxide equivalent, which is equivalent to the emissions from more than 97.5 million passenger vehicles. We should leverage existing successful partnerships and consider creating new ones to advance recycling and sustainability.

D5. Share best practices on policies, programs, funding opportunities and outreach through a free, publicly accessible online clearinghouse.

Workers in an assembly line sorting recycled materials.

Through the America Recycles Network, the U.S. Chamber of Commerce Foundation launched an online, virtual clearinghouse as part of its "Beyond 34" initiative, which is aimed at increasing the recycling rate in the United States by providing a scalable model to optimize recycling and recovery systems. The clearinghouse was created to include information about effective education and outreach campaigns; existing reports about recycling policies in other countries; information on free, open-source, downloadable labels for recycling bins; lessons learned from COVID-19; MRF contract information and best practices for governments contracting for processing services; and more. The clearinghouse can act as a vehicle to share and amplify solutions to recycling challenges. Regular mechanisms for updating and maintaining accurate information need to be identified.

D6. Coordinate domestic and international interests.

Countries around the world are working to implement circular economy strategies, consensus standards and policies. Coordinating U.S. circular economy interests with other countries will allow the United States to support a resource-efficient and circular economy approach to managing scrap and recycling.

Objective E: Standardize Measurement and Increase Data Collection

Measurement forms the bedrock of achieving the National Recycling Goal to increase the recycling rate to 50 percent by 2030 and the objectives described within the *2021 Strategy*. Different definitions and measurement practices create challenges to setting goals and tracking progress. Stakeholders across the recycling system agree that more consistent measurement methodologies are needed to measure recycling system performance. More standardized metrics will provide a powerful tool to create effective milestones and track progress as the *National Recycling Strategy* is implemented.

Benefits of standardizing methodologies and collecting measurement data include improved data availability and granularity for a range of recyclables, being able to track progress clearly and make adjustments on the road to achieving the National Recycling Goal, being able to compare data across different jurisdictions, and minimizing data gaps.

E1. Develop and implement national recycling system definitions, measures, targets and performance indicators.

Recycling definitions, measures, targets and performance indicators will help advance the understanding of how the recycling system is performing. This effort will improve data availability and granularity for a range of recyclables and support tracking and measuring progress nationally. EPA will continue to collaborate with interested stakeholders to develop standardized definitions, measurement methodologies, baselines and targets for future metrics and the National Recycling Goal. Action E1 should include work by other entities, including consensus standards bodies, to identify and develop additional metrics.

E2. Create a tracking and reporting plan.

The plan would allow for consistent tracking and reporting of recycling activities on a regional and national scale. This plan would also address how to integrate accountability into efforts and measure progress in achieving our goals. It would optimize the value of datasets by minimizing gaps in data and improving data collection.

E3. Create recycled content measures.

Explore national post-consumer content measures and third-party specification programs to make it easier to verify and compare recycled content in products. This information can help consumers make informed decisions about their purchases and provide a national barometer of use of recycled materials in products.

E4. Coordinate domestic and international measurement efforts.

Countries' abilities to recycle materials are often compared, particularly in the context of sharing best practices and effectiveness of policies. Enhancing measurement efforts could provide U.S. recycling stakeholders with the additional information necessary to compare domestic recycling efforts to those of other countries and make domestic improvements as needed.

E5. Increase data availability and transparency about recyclable materials generated and the materials manufacturers need.

E5.1. Gathering data. Data about the amount of recycled material generated, type of materials, location of materials, energy use and impacts of materials often are not readily available or easy to find and need to be gathered and provided. Compile nationwide information on buying recycled products, including federal/state/local government purchases and state and local laws and policies.

E5.2. Improving data availability and transparency. Improving the availability, granularity (local, regional, national), transparency, type and format of data about recycled materials would help governments, industry and others make recycling market development decisions. For example, it could enable potential buyers and sellers of materials to be more easily matched.

E5.3. Improve the accessibility of data for product design and procurement. Create a feedback mechanism to inform product designers and procurement decision makers about how materials are being collected, sorted and processed at the end of their lives. A directory of material suppliers could allow buyers to give feedback to sellers about the types and qualities of materials they need.

Next Steps: Implement the Actions Identified in the *National Recycling Strategy* and Develop Subsequent Strategies

EPA will develop an implementation plan that will provide more specificity about the actions and their organizational leads. EPA will integrate equity and environmental justice principles and priorities into all aspects of implementing the *National Recycling Strategy*, as well as considering these principles in developing future strategies. The implementation plan will identify the resources and investments needed, balancing the risk reductions with costs; clarify the roles and responsibilities of participating entities; and articulate EPA's role in implementing the *National Recycling Strategy* and integrating new activities into the Agency's existing programs and activities. EPA will help facilitate the implementation of actions in this strategy and provide routine status updates to interested stakeholders.

The National Recycling Goal and Strategy Nexus

The National Recycling Goal and the *National Recycling Strategy* are integrated and support the ultimate goal of improving recycling and increasing circularity within the United States. The methodology to measure the recycling goal and its key metrics is under development and expected to be finalized later this year. In the development of the implementation plan, EPA will bring the recycling goal and *National Recycling Strategy* together into a comprehensive plan. As EPA moves beyond recycling to develop additional strategies, EPA also will develop a new goal to reduce the climate impacts from materials production, consumption, use and disposal that will complement the focus on a circular economy approach. This new goal will complement the National Recycling Goal, as well as the U.S. goal to halve food loss and waste by 2030.

Stakeholder Involvement

Successful implementation of the *National Recycling Strategy* is highly dependent upon commitment and involvement from stakeholders across the recycling chain – haulers, waste management companies, non-profit organizations, governments, academia, industry, community members and others. All interested parties are welcome to participate. During the public comment period, some organizations signaled their interest in being involved in the implementation of the *National Recycling Strategy*. EPA will follow up with those organizations and reach out to others to start work on implementing the actions. EPA, in coordination with others, intends to develop and release an implementation plan for the *National Recycling Strategy* that summarizes these initial commitments in 2021. Appendix C summarizes ongoing recycling work across the federal government that could be leveraged to implement the *National Recycling Strategy*.

Develop Additional Strategies to Reflect Further Actions Necessary for a Comprehensive Circular Economy Approach in the United States

As EPA begins implementing the *National Recycling Strategy*, EPA will also start developing strategies that go beyond the recycling of MSW. Other areas of consideration are sustainable product design, waste generation reduction and materials reuse activities critical to a circular economy approach. Activities will be expanded to include other materials, such as electronics, industrial waste, cement and concrete, and food. EPA will ensure communities have a seat at the table and are involved in future strategies.

References

- Chavis, B.F. Jr. and C. Lee. 1987. Toxic Wastes and Race in the United States. Commission for Racial Justice, United Church of Christ.
- Ellen MacArthur Foundation. 2019a. Completing the Picture: How the Circular Economy Tackles Climate Change. https://www.ellenmacarthurfoundation.org/publications. Accessed March 3, 2021.
- Ellen MacArthur Foundation. 2019b. Circular Economy System Diagram. https://www.ellenmacarthurfoundation.org/circular-economy/concept/infographic. Accessed March 4, 2021.
- International Resource Panel. 2019. Global Resources Outlook 2019: Natural Resources for the Future We Want. A Report of the International Resource Panel. United Nations Environment Programme. Nairobi, Kenya.
- Law, K.L., N. Starr, T.R. Siegler, J.R. Jambeck, N.J. Mallos, and G.H. Leonard. 2020. The United States' Contribution of Plastic Waste to Land and Ocean. Science Advances, 6, October 30, 2020.
- McKenzie-Mohr, D. 2011. Fostering Sustainable Behavior: An Introduction to Community-Based Social Marketing (Third Edition). New Society Publishers, Limited.
- Miller, C. 2020. The Plague of Uncertainty: The Pandemic's Unpredictable Impacts on Recycling and Its Markets (Commentary). Published May 29, 2020.
- Resource Conservation and Recovery Act. 1976. Public Law No. 94-580.
- Sangal, A. 2020. Discarded Masks and Gloves are Becoming a Health Hazard as People Dump Them on Streets. CNN. https://www.cnn.com/2020/04/21/us/coronavirus-ppe-masks-gloves-environment-hazard-trnd/index.html. Accessed August 18, 2020.
- Staub, C. 2020. City Data Shows COVID-19 Impacts on Recycling Tonnages. Resource Recycling. https://resource-recycling.com/recycling/2020/04/28/city-data-shows-covid-19-impacts-on-recycling-tonnages/. Accessed July 29, 2020.
- Tishman Environment and Design Center. 2019. Local Policies for Environmental Justice: A National Scan. The New School, New York, NY.
- United Nations Environment Programme. 2016. Global Material Flows and Resource Productivity. An Assessment Study of the UNEP International Resource Panel.

- U.S. EPA. 2015. EPA Sustainable Materials Management Program Strategic Plan for Fiscal Years 2017 – 2022. https://www.epa.gov/smm/epa-sustainable-materials-management-program-strategic-plan-fiscal-years-2017-2022. Accessed July 7, 2020.
- U.S. EPA. 2017. Environmental Justice Timeline. https://www.epa.gov/environmentaljustice/environmental-justice-timeline. Accessed March 4, 2021.
- U.S. EPA. 2019. National Framework to Advance the U.S. Recycling System. Washington, D.C. EPA530-F-19-008.
- U.S. EPA. 2020a. Advancing Sustainable Materials Management: 2018 Fact Sheet. Washington, D.C. EPA. EPA530-F-20-007.
- U.S. EPA. 2020b. Recycling Economic Information (REI) Report. Washington, D.C. EPA530-R-20-003.
- U.S. Government Accountability Office. 1983. Siting of Hazardous Waste Landfills and their Correlation with Racial and Economic Status of Surrounding Communities. Washington, D.C. GAO/RCED-83-168.
- U.S. Government Accountability Office. 2020. Recycling: Building on Existing Federal Efforts Could Help Address Cross-Cutting Challenges. Washington, D.C. GAO-21-87.
- U.S. House of Representatives. 2019. Department of the Interior, Environment, and Related Agencies Appropriations Bill, 2020. Washington, D.C. House Report 116-100, 116th Cong., pp 88. https://www.congress.gov/congressional-report/116th-congress/house-report/100/1. Accessed May 4, 2021.

Appendix A: Examples of Existing National Efforts for Specific Materials

EPA's SMM program has broadly covered materials use in the United States, and EPA's activities have been covered in the *EPA Sustainable Materials Management Program Strategic Plan for Fiscal Years 2017 – 2022*. EPA has several long-standing programs and efforts underway to advance SMM, including the sustainable management of food, advancing SMM in the built environment (our nation's roads, bridges and infrastructure), and electronics management. These programs will be leveraged, as necessary, to move activities under the *2021 Strategy* forward.

Sustainable Management of Food

Food not used for its intended purpose is managed in a variety of ways, such as being donated to feed people, creating animal feed, composting, anaerobic digestion, or being sent to landfills or combustion facilities. The following are examples of national efforts to reduce wasted food:

- The U.S. Department of Agriculture (USDA), EPA, and the U.S. Food and Drug Administration (FDA) established an interagency agreement in October 2018 and renewed the agreement – affirming their shared commitment to work towards the national goal of reducing food loss and waste by 50 percent by the year 2030 – in December 2020. The agencies agreed to coordinate food loss and waste actions such as education and outreach, research, community investments, voluntary programs, public-private partnerships, tool development, technical assistance, event participation, and policy discussion on the impacts and importance of reducing food loss and waste. The agencies also developed a federal interagency strategy to prioritize and coordinate their efforts in six action areas.
- The 2018 Wasted Food Report describes an enhanced measurement methodology used to calculate national wasted food estimates and provides detailed estimates of generation and management by sector. The report includes estimates for the commercial, residential and institutional sectors, as well as the industrial sector (i.e., food and beverage manufacturing and processing). Improved data and measurement ensure the efficiency and effectiveness of sustainable management of food approaches and allow EPA to better focus support of state, municipal and tribal efforts.
- The ReFED Insights Engine is a data and solutions hub for food loss and waste, designed to provide anyone interested in food waste reduction with the information and insights they need to take meaningful action to address the problem. The ReFED Insights Engine provides an analysis of a range of potential solutions based on their impact potential (amount of food waste diverted, GHG

emissions reduced, meals recovered, jobs created and net economic benefit); the investment required and the potential return on investment; and potential barriers. ReFED has also created a framework for implementing the solutions in the Insights Engine in its new *Roadmap to 2030: Reducing U.S. Food Waste*, which looks at the entire food supply chain and identifies seven key action areas for the food system to focus its food waste reduction efforts over the next 10 years.

SMM in the Built Environment

The built environment is a part of nearly every aspect of our lives – from the homes we live in to the buildings we work in and the factories and businesses that are the engine of the American economy. According to the International Resource Panel (IRP), globally, the greatest increases in consumption of materials is construction minerals, ores and industrial minerals. As construction increases, new solutions are necessary to maximize the use of available resources, minimize negative environmental impacts and avoid unnecessary costs. However, there is not an unlimited source of these essential materials, so it is critical to consider all available resources to continue to grow and prosper. Byproducts generated by industrial processes such as road and building construction and demolition, iron and steel production, metal casting, and electricity production can be recovered, reused and recycled, further reducing GHG emissions and creating jobs. For example:

- According to EPA's estimates, 600 million tons of construction and demolition (C&D) debris were generated in the United States in 2018, which is more than twice the amount of generated municipal solid waste. Over 455 million tons of C&D debris were directed to next use, and just under 145 million tons were sent to landfills.
- The C&D materials recycling and reuse sector accounts for the greatest share of jobs created in EPA's *Recycling Economic Information* report.

EPA collaborates with a wide range of stakeholders to find innovative solutions to address infrastructure needs while generating jobs and increasing competitiveness. EPA provides data and technical assistance to support decision-making about materials use and recovery. For example, EPA released a life-cycle assessment of single-family residential construction in the U.S., which identified the most impactful areas associated with the life cycle of single-family homes and identified materials management strategies that could be undertaken to reduce those impacts. In addition, EPA's *Methodology for Evaluating Beneficial Uses of Industrial Non-Hazardous Secondary Materials* presents EPA's approach for evaluating a wide range of industrial non-hazardous secondary materials and their associated beneficial uses.

Electronic Waste

Electronic waste is a growing part of the waste stream as electronics become more integrated into our daily lives. Recycling these products once they reach the end of their life both protects the environment and allows us to recover valuable materials for reuse in new products. EPA promotes responsible electronics recycling through its voluntary SMM Electronics Challenge. The challenge focuses on electronics manufacturers, brand owners and retailers, encouraging them to send used electronics (collected from the public, businesses and within their own organizations) to third-party certified electronics refurbishers and recyclers. The program also recognizes significant achievements to incorporate sustainability and life-cycle thinking into products, programs and services. The challenge aims to:

- Increase rates of responsible electronics recycling and reuse.
- Promote data transparency and accountability by making data publicly available.
- Reduce negative environmental effects across the life cycle of electronics.

In 2020, challenge participants reused or recycled 176,494 tons of electronics and avoided the equivalent of nearly 500,000 metric tons of carbon dioxide emissions.

Appendix B: Summary of Public and Federal Comments and EPA's Response

Comment Statistics

EPA received 156 comment letters from the public. Commenters included private citizens, non-governmental organizations (NGOs), government agencies (e.g., local, county, tribal and state agencies), Congress, recycling service providers and consultants, recycling and waste management trade associations, academia, and other industry trade associations and groups (including those for raw material and packaging manufacturers). EPA also received comments from six other federal agencies and the United States Government Accountability Office.

During the public comment period, 47 America Recycles Network members submitted comments, which represented 30 percent of total commenters. Key America Recycles Network members that submitted comments include The Recycling Partnership, National Waste and Recycling Association, Solid Waste Association of North America, Institute of Scrap Recycling Industries, Association of State and Territorial Solid Waste Management Officials, GreenBlue Institute, The Sustainable Packaging Coalition, Environmental Research and Education Foundation, U.S. Conference of Mayors, and Waste Management. Senator Thomas R. Carper also submitted comments.

Support for the *National Recycling Strategy*

Overall, commenters were supportive of a *National Recycling Strategy* to create a stronger, more resilient and cost-effective U.S. municipal solid waste recycling system. All commenters mentioned that they supported the development of a *National Recycling Strategy*, and many highlighted that it was an important part of sustainable materials management and a circular economy.

Responses to the Key Questions

EPA asked six key questions that it hoped commenters would respond to during the comment period. Summaries of these responses are provided here.

Of the proposed actions, which are the most important and would have the greatest positive impact at the local, regional and national level?

Commenters expressed support for the three overarching objectives – 1) Reducing Contamination, 2) Increasing MRF Processing Efficiency, and 3) Improving Markets for Recyclables – with a slight prioritization of Objective 3 over the other two. In addition, one commenter stated that the most important objective should be to

increase collection of recyclables, which was not one of the three objectives identified in the draft strategy. Some commenters identified actions they thought were the most important; the most frequent actions identified were:

- Action 2.3: Continue to fund research and development of new technologies and processes that result in environmental gains from improvements in manufacturing and processing efficiencies.
- Action 2.1: Improve understanding of available recycling infrastructure and needs.
- Action 2.4: Increase consideration of the sorting process in the design of new products.
- Action 3.5: Increase demand for recycled materials through policies, programs, initiatives and incentives, focusing on materials with less-mature markets.
- Action 1.1: Enhance education and outreach to consumers on the value of recycling and how to recycle properly.
- Action 1.2: Increase coordination, availability and accessibility of information on recycling programs and policies at the federal, state, tribal and local levels.
- Action 2.2: Increase awareness of available public and private funding and incentives and effective strategies to access the funding.
- Action 2.5: Develop and implement national recycling system definitions, measures, targets and performance indicators.

What are the key implementation steps and milestones necessary to successfully implement these actions?

Commenters expressed the need to implement strong policy actions, establish metrics for measuring success and identifying gaps, increase education and outreach to consumers, increase access to funding, increase collection, provide additional funding opportunities, and establish federal incentives.

Is your organization willing to lead an action or collaborate with others to implement the actions? What factors would your organization take into account when considering whether to lead an action?

Many organizations noted that they were willing to work with EPA or others on actions in the *National Recycling Strategy*. 17 commenters indicated a willingness to lead an action. Most of these commenters did not specify an action that they would like to lead but indicated a general willingness to take on a leadership role.

What are the most important roles and/or actions for federal agencies to lead?

Commenters identified the following as the most important roles and/or actions for federal agencies to lead:

- Establish national policies and programs, including educational programs and guidelines for consistent recycling across the U.S.
- Coordinate with stakeholders and other federal agencies.
- Take regulatory action.
- Ensure consistent access to recycling programs across the nation.
- Provide funding to local and regional programs.
- Maintain nationwide data to track progress on the *National Recycling Strategy*.
- Provide a database of recycling resources.
- Establish roles for various stakeholders in the *National Recycling Strategy*.
- Support the development of recycling markets.

Are there other actions that should be included in the National Recycling Strategy?

Commenters suggested additional objectives or actions that they felt were important to include in the *2021 Strategy*. Many of them were very specific and aimed at refining/defining actions. Other suggestions were much broader and would have a pronounced effect on the *National Recycling Strategy* if incorporated. A sample of these themes includes:

- Expanding the scope of the *National Recycling Strategy* to reflect a circular economy approach and/or include waste reduction, reuse and/or waste-to-energy.
- Explicitly incorporating environmental justice and equity into the *National Recycling Strategy*.
- Expanding the scope of the *National Recycling Strategy* beyond municipal solid waste to include construction and demolition materials, coal combustion residuals, non-hazardous secondary materials, textiles, solar panels, wind turbines, batteries, propane tanks, electronics, and organics (food and yard waste).
- Expanding the scope of the *National Recycling Strategy* beyond mechanical recycling to include advanced/chemical recycling.
- Incorporating extended producer responsibility into the *National Recycling Strategy*.
- Adding an objective/actions to increase the access to and collection of recyclable materials.
- Elevating measurement, data collection and analysis from actions to an objective.
- Striving to create a uniform national recycling system.
- Developing a dedicated funding system for recycling.

Other Comments

In addition, commenters had many specific recommendations on the proposed actions within the draft strategy. Many offered expansions to the scope of existing actions, and others suggested completely new actions. In other instances, commenters provided information or considerations that could be useful in the implementation of the proposed actions.

How EPA Addressed the Comments

Based on input received during the public comment period, EPA modified the scope of the *2021 Strategy* to better reflect how improving recycling is a key component of a circular economy and emphasized that while this strategy focuses on traditional MSW recycling, future strategies will more fully address other key issues critical to achieving a circular economy. For example, EPA anticipates issuing subsequent strategies to include additional activities geared toward source reduction and materials reuse and waste streams, such as organics, electronic waste and industrial materials (e.g., construction and demolition debris).

To address comments on specific actions, when possible, EPA incorporated the new ideas into existing actions or created new actions. Many commenters requested that policies, programs or topics be incorporated into actions. In these cases, EPA tried to provide additional examples of the work that could fall underneath each action, but it was not always practical to list every possibility. Similarly, some comments focused on providing information that could be used to implement an action, and EPA will ensure those suggestions are carried forward as the Agency moves into the development of the implementation plan for the *National Recycling Strategy*. EPA has compiled the additional information and suggestions and categorized them by their action numbers. Moving forward, EPA will ensure that the entities engaged in implementing each action are provided with those comments.

EPA has also strived to better integrate equity and environmental justice into the *2021 Strategy*, based on comments received. The *2021 Strategy* indicates that all objectives and actions should be implemented with an environmental justice lens that ensures equity in the strategy outcomes. In addition, EPA enhanced language on increasing access to recycling facilities, which is often lacking in under-resourced and rural communities. The *2021 Strategy* now reflects that various educational messages are needed to be responsive to and inclusive of diverse communities. Lastly, the *2021 Strategy* now reflects that when recovery facility and collection equipment is upgraded, considerations should be taken so that it is also made safer and healthier for recovery facility and collection workers.

Appendix C: Federal Partner Recycling Profiles

EPA collaborates across the federal government on recycling. Various federal agencies play a role in supporting the recycling system. The following information reflects some actions several agencies are taking to support recycling.

Agency name: Federal Trade Commission (FTC)

Physical location: Washington, D.C.

Agency's mission: To prevent business practices that are anticompetitive or deceptive or unfair to consumers; to enhance informed consumer choice and public understanding of the competitive process; and to accomplish this without unduly burdening legitimate business activity.

Context and applicability to recycling: The FTC addresses recycling issues through the agency's *Guides for the Use of Environmental Marketing Claims* (16 C.F.R. Part 260). The guides help marketers avoid making environmental marketing claims that are unfair or deceptive under Section 5 of the FTC Act, 15 U.S.C. 45. The FTC has authority to take enforcement action if a marketer makes any deceptive or unfair environmental claims. In any such enforcement action, the Commission cannot rely on its Environmental Marketing Guides, and, therefore, must prove that the challenged act or practice is unfair or deceptive in violation of the FTC Act.

Explicit roles and actions in recycling: The FTC has no specific, statutorily directed role in advancing or promoting recycling. Rather, the FTC's efforts focus on helping consumers by combating deceptive or unfair claims in the marketplace.

Agency name: National Science Foundation (NSF)

Physical location: Alexandria, VA

Agency's mission: Established by the National Science Foundation Act of 1950 (P.L. 81-507), NSF is an independent federal agency charged with the mission "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes." NSF is unique in carrying out its mission by supporting research across all fields of science, technology, engineering and mathematics, as well as all levels of STEM education. NSF investments contribute significantly to the economic and national security interests of the nation and development of a future-focused science and engineering workforce that draws on the talents of all Americans and creates new businesses, new jobs, and more exports.

Context and applicability to recycling: NSF fulfills its mission chiefly by issuing limited-term grants to fund specific research proposals that have been deemed the most promising by a rigorous and objective merit-review system. Innovative and meritorious research proposals related to recycling and alternative materials may be supported through a variety of defined funding opportunities.

Explicit roles and actions in recycling: NSF supports basic research that develops fundamental knowledge and engineering advances pertaining to recycling; polymer chemistry and physics; alternative materials; sustainable and circular processes; the fate and impact of plastic materials lost to the environment; and pollution mitigation, control systems, and remediation. NSF's Engineering Directorate is home to several programs and solicited opportunities that support research in these areas, including programs offered by the Divisions of Chemical, Bioengineering, Environmental and Transport Systems and Civil, Mechanical, and Manufacturing Innovation and the Emerging Frontiers in Research and Innovation program's solicitation on Engineering the Elimination of End-of-Life Plastics (NSF 19-599 and NSF 20-614). Similarly, the Mathematical and Physical Sciences Directorate offers relevant programming through the Divisions of Chemistry and Materials Research. An agency-wide initiative, Critical Aspects of Sustainability (PD 19-9102), also supports recycling-related research. Searchable abstracts of past and current projects can be found using the NSF award search engine.

Examples of partners and stakeholders: NSF funds research and education through grants and cooperative agreements to approximately 2,000 institutions of higher education, K-12 school systems, businesses, informal science organizations and other research organizations throughout the United States. NSF also partners with other federal agencies to fund research of mutual interest.

Agency name: Office of the United States Trade Representative (USTR)

Physical location: Washington, D.C.

Agency's mission: USTR is responsible for developing and coordinating U.S. international trade, commodity and direct investment policy, as well as overseeing negotiations with other countries. USTR seeks to ensure that our international trade and environmental policies are mutually supportive. Our bilateral and international trade agreements and initiatives are valuable tools to protect the environment and level the playing field for the American worker and for U.S. industry abroad, and we are using these agreements and initiatives to tackle pressing environmental challenges.

Context and applicability to recycling: USTR seeks to advance a trade-facilitative approach to supporting resource efficiency. This includes enabling environmentally sound trade and management of plastic waste and scrap so that materials can be recovered, recycled and returned to commerce. USTR engages bilaterally and in international trade agreements, as well as in international forums like the World Trade

Organization and Organization for Economic Cooperation and Development, to advocate for mutually supportive trade and environmental policies.

Explicit roles and actions in recycling: Not applicable.

Examples of partners and stakeholders: Congress, non-governmental, and industry stakeholders.

Agency name: U.S. Agency for International Development (USAID)

Physical location: Washington, D.C.

Agency's mission: USAID is the world's premier international development agency and a catalytic actor driving development results. USAID's work advances U.S. national security and economic prosperity, demonstrates American generosity, and promotes a path to recipient resilience.

Context and applicability to recycling: Over the past 20 years, two major trends have contributed to an ocean plastic crisis. The first is the rapid growth of plastic production and plastic packaging use across the world, in rich and poor countries alike. The second is increasing incomes and urbanization in low- and middle-income countries in the developing world, leading to more waste generation per person. Plastic waste is increasing at the fastest rate in the developing world, where waste management systems, infrastructure and governments struggle to keep pace and are not primed for private sector investment. As the leading development agency for the U.S. government, USAID is responding to the ocean plastic crisis by helping developing countries, and particularly cities along rivers and in coastal areas, to develop the enabling conditions for the three R's (reduce, reuse, recycle).

Per the 2020 Save our Seas 2.0 Act, USAID is partnering with developing countries to build the foundations for a circular economy by:

- First, incentivizing recycling of plastic waste through policies and partnerships with the private sector, including working closely with vulnerable populations involved in the waste value chain to ensure they are involved and protected.
- Second, strengthening local and national governments' capacity to manage their solid waste and build a circular economy – including through better planning, financial sustainability and enforcement of regulations.
- Third, building on a long history of promoting innovation, investing in right-sized technology and infrastructure, as well as in the development and scaling up of new business models.
- Finally, encouraging behaviors that reduce, reuse, and recycle plastic waste.

Explicit roles and actions in recycling: USAID has several ongoing programs and initiatives that seek to address ocean plastic pollution internationally and improve solid waste management systems:

- USAID's Clean Cities, Blue Ocean (CCBO) is the agency's flagship program on ocean plastic pollution. The five-year, global program (2019 to 2024) is working in rapidly urbanizing focal countries across Asia and Latin America and the Caribbean to target the sources of ocean plastic pollution. CCBO works to improve solid waste management systems in areas that are at the heart of the global plastic pollution crisis, build capacity and commitment for the three R's, and promote sustainable social and behavioral change. In support of these objectives, CCBO partners with local and multinational corporations to effectively leverage private sector expertise, investment and supply chains.
- USAID's five-year (2016 to 2021) Municipal Waste Recycling Program (MWRP) reduces land-based sources of ocean plastic waste in four of the top five contributing countries – Indonesia, Philippines, Sri Lanka, and Vietnam. Through MWRP, USAID has provided 30 grants and technical assistance to a variety of local actors, such as NGOs and recycling entrepreneurs, for innovative, local and sustainable solutions to improve solid waste management and waste recycling efforts in and around targeted cities. As a result, people across the four countries are benefiting from cleaner and healthier cities with improved waste management services. Having recognized their effectiveness, local governments plan to extend and replicate these approaches.
- In June 2019, USAID launched an agreement leveraging more than $100 million in a private-sector investment strategy managed by Circulate Capital and funded by multinational companies, including PepsiCo, Procter & Gamble, Dow, Danone, Unilever and Coca-Cola. USAID provides a $35 million, 50 percent loan-portfolio guarantee through the U.S. International Development Finance Corporation (DFC), which is used to incentivize private capital investment in the recycling value chain in South and Southeast Asia. At least 50 percent of the total facility must be used for loans in four countries that align with USAID's MWRP (Indonesia, Philippines, Vietnam and Sri Lanka).
- Subject to availability of funding, USAID plans to expand its work through field-based programs in key countries of Asia, Latin America and the Caribbean, and Africa. To prepare for these new programs addressing ocean plastic pollution, USAID is currently training staff members on governance, finance, technologies and policies to support solid waste management and the circular economy.

You can find more information on all of USAID's ocean plastic pollution and solid waste management programming at https://urban-links.org/issue/ocean-plastic-pollution.

Examples of partners and stakeholders: USAID works internationally with a diverse group of stakeholders across the solid waste management system, including local and national governments, NGOs, academia, donor organizations, and members of the private sector.

Agency name: U.S. Department of Commerce

Physical locations: Washington, D.C., Silver Spring and Gaithersburg, MD, and multiple U.S. and overseas offices

Agency's mission: The mission of the Department of Commerce is to create the conditions for economic growth and opportunity. The Department of Commerce promotes job creation and economic growth by ensuring fair trade, providing the data necessary to support commerce and constitutional democracy, and fostering innovation by setting standards and conducting foundational research and development. Through our bureaus and 46,608 employees (as of January 31, 2018) located in all 50 states, every U.S. territory, and more than 86 countries, we provide U.S.-based companies and entrepreneurs with invaluable tools through programs such as the Decennial Census, the National Weather Service, NOAA Fisheries, and the Foreign Commercial Service. Among many other functions, the Department oversees ocean and coastal navigation, helps negotiate bilateral trade agreements, and enforces laws that ensure a level playing field for American businesses and workers.

Context and applicability to recycling: Department of Commerce officials regularly consult with private-sector stakeholders and non-governmental organizations, and they work with state, local and foreign governments to support U.S. firms, including solid waste management and recycling firms, both domestically and abroad. Through its various bureaus, the Department works to foster innovation and the international competitiveness of U.S. solid waste management and recycling firms, as well as that of the companies using recycled materials.

Department of Commerce's explicit roles and actions in recycling by bureau:

Agency Name: International Trade Administration (ITA)

Agency's mission: The mission of ITA is to create prosperity by strengthening the international competitiveness of U.S. industry, promoting trade and investment, and ensuring fair trade and compliance with trade laws and agreements. ITA assists U.S. recycling firms in finding new and expanding existing export markets for their equipment and materials. ITA's team of environmental technologies industry and trade specialists, located in the United States and overseas, is dedicated to enhancing the global competitiveness of U.S. industry, expanding market access, and increasing exports. The *Environmental Technologies Top Markets Report* highlights overseas markets where the U.S. government is best able to

leverage finite resources to generate export opportunities for U.S. environmental technologies, goods, services and products, including for the recycling sector. Such market analysis also serves to inform ITA's trade promotion work, including under the auspices of ITA's Environmental Technologies Global Team. ITA employs the Global Team to share information on global policy issues impacting the industry and international markets and to work with U.S. companies to promote trade in recycling equipment and recycled materials. ITA is assisted in these efforts by the Environmental Technologies Trade Advisory Committee (ETTAC), which advises the Environmental Trade Working Group of the Trade Promotion Coordinating Committee, through the Secretary of Commerce, on the development and administration of programs to expand U.S. exports of environmental technologies, goods, services and products.

Partners and stakeholders: The Department works with the full range of stakeholders on matters relating to recycling, including standards and certification organizations, professional and trade associations, non-profit and global organizations, and government entities at the state, local and federal level, as well as individual solid waste management, recycling and materials firms.

NIST
National Institute of Standards and Technology
U.S. Department of Commerce

Agency Name: National Institute of Standards and Technology (NIST)

Agency's mission: The mission of NIST is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life. NIST is developing a circular economy program with subprograms enabling materials design to improve recyclability (e.g., through use of machine learning technologies established as part of the Materials Genome Initiative); supporting development of critical infrastructure for circularity; and supporting improved performance and efficiency of recycling instrumentation and equipment. NIST is establishing work to support the data infrastructure necessary for a national approach to circularity including recycling by development of documentary standards with international standards bodies and tools to support the entire supply chain (for example, through our Office of Data and Informatics, Manufacturing Extension Partnership Program, Applied Economics Office, and research programs). NIST supports its other agency partners through measurement tools, data and standards to better understand and reliably quantify environmental impacts of mismanaged waste and the linear economy (for example, in partnership with Hawaii Pacific University and the Center for Marine Debris Research).

Agency Name: National Oceanic and Atmospheric Administration (NOAA)

Agency's Mission: Science, service and stewardship.

1. To understand and predict changes in climate, weather, oceans and coasts.
2. To share that knowledge and information with others.
3. To conserve and manage coastal and marine ecosystems and resources.

While NOAA does not have explicit mandates or regulations related to recycling, NOAA's Marine Debris Program is the U.S. federal government lead for addressing marine debris (through the Marine Debris Act, or Save Our Seas Act). Marine debris results from solid waste that is not properly disposed of, managed, or recycled and is deposited or washed into waterways or coastal areas. The Marine Debris Program works at the national, state and local levels to prevent marine debris from entering the environment (including through increasing recycling), remove priority debris from coastal areas, study and understand the scope and scale of marine debris in the U.S., and understand the impacts of marine debris on the environment.

The NOAA Marine Debris Program is dedicated to reducing and preventing the impacts of marine debris by conducting education and outreach and supporting practical solutions to marine debris problems. NOAA accomplishes this by increasing participation in education and outreach opportunities, developing outreach products that raise awareness of marine debris, and reducing waste and increasing recycling in internal operations. NOAA's Marine Debris Program also provides grant funding to support projects across the country that use outreach and education as a way to help change behavior and result in more sustainable practices to reduce the volume of waste produced, increase recycling, or ensure more effective waste management practices.

Agency name: U.S. Department of Energy (DOE)

Physical location: Washington, D.C.

Agency's mission: The mission of the DOE is to ensure America's security and prosperity by addressing its energy, environmental and nuclear challenges through transformative science and technology solutions.

Context and applicability to recycling: Transitioning from a linear to a circular economy provides significant energy and emissions savings and is a key focus area for the DOE. DOE is primarily a science- and technology-funding organization, competing awards for transformative science and research, development, and demonstration of

energy-related technologies. In addition, DOE sponsors 17 National Labs, which have delivered tremendous scientific and technological progress to address the nation's greatest needs. Regarding recycling, the priority is to develop efficient and economic pathways, as well as the scientific foundations, to recycle (or upcycle to high value products) energy-intensive materials, such as metals and plastics, as well as developing materials that enable renewable energy, such as polymer matrix composites for vehicles and wind blades and critical materials used for wind turbines and batteries.

Explicit roles and actions in recycling: DOE has made several strategic investments to develop technology for improved recycling systems. These efforts span from fundamental research to technology development to industry partnerships. Examples include:

- IACMI – The Composites Institute, a Manufacturing USA Institute, was established in 2015 to develop lower-cost, higher-speed and more efficient manufacturing and recycling processes for advanced polymer matrix composite materials.
- The REMADE Institute, a Manufacturing USA Institute, was established in 2017 to address recycling challenges across the supply chain for metals, fibers, plastics and e-waste.
- The BOTTLE Consortium is a National Lab-led consortium focused on developing chemical and biological pathways to upcycle plastics and designing novel plastics that are recyclable by design.
- Energy Frontier Research Centers bring together creative, multi-disciplinary scientific teams to tackle the toughest scientific challenges preventing advances in energy technologies. Two centers were selected in 2020 to address challenges associated with plastic waste:
    - Center for Plastic Innovation.
    - Institute for Cooperative Upcycling of Plastics.
- Better Plants is a program that partners with industry to reduce their energy and emissions impacts. As part of this broader program, the Waste Reduction Pilot was recently launched to share best practices for reducing waste, including through recycling.
- The ReCell Center is a national collaboration of industry, academia and national laboratories working together to advance recycling technologies along the entire battery life cycle for current and future battery chemistries.

Examples of partners and stakeholders: DOE funds research, development and deployment through cooperative agreements and grants. Awardees include universities, National Labs, NGOs, and small, medium and large businesses.

Agency name: U.S. Department of State

Physical location: Washington, D.C.

Agency's Mission: The mission of the Department of State is to represent America's foreign policy abroad and advance the interests and security of the American people.

Context and Applicability to Recycling: The Department of State has two offices that lead in recycling initiatives and support related efforts in international fora: the Office of Management Strategy and Solutions (M/SS) and the Office of Environmental Quality (ENV) in the Bureau of Oceans and International Environmental and Scientific Affairs (OES). Several missions abroad and domestic operations implement recycling initiatives with support from M/SS and OES/ENV.

Explicit Roles and Action in Recycling:

Management and Operations: With 22,000 facilities, 15,000 vehicles, and 75,000 personnel in more than 190 countries, the U.S. Department of State has a large global footprint to leverage to highlight recycling. Domestically, the Department works to reduce waste production and improve recycling, typically reaching 49 percent or greater waste diversion in its portfolio. The Department diverted 40 percent of nearly 3.5 million metric tons of construction and demolition waste in fiscal year (FY) 2018.

Overseas, many areas lack municipal waste management infrastructure but U.S. embassies and consulates work to develop creative solutions to reduce, reuse and recycle and to maximize efficiency. Examples of these waste management efforts include waste reduction and recycling campaigns, auditing local waste management infrastructure, upgrading onsite waste management capabilities, and composting.

The Department supports ongoing sustainability efforts through its annual Greening Diplomacy Initiative Awards and other programs. More information on the Department's sustainability efforts are available at state.gov/eco-diplomacy and in the annual *Sustainability Report and Implementation Plan*.

Policy Development: The Office of Environmental Quality (ENV) develops and coordinates U.S. policy on international waste management issues, including international efforts relating to plastic pollution, land-based sources of marine debris, electronic waste and hazardous wastes. ENV leads U.S. participation in relevant multilateral agreements and forums, such as the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, and addresses related issues, including recycling, through close collaboration with the U.S. interagency and outreach efforts.

ENV has led campaigns to educate posts and Department staff on plastic pollution and waste management through a webinar series and recycling challenge, as well as facilitating communication with U.S. companies on international commercial, trade and investment conditions in this sector. ENV also coordinates a monthly U.S. government interagency call on plastic waste and scrap to provide updates and support collaboration and information exchanges on relevant issues, including recycling initiatives both domestically and abroad. Additionally, ENV regularly conducts stakeholder outreach to U.S. industry and environmental NGOs to exchange information relevant to developing U.S. policies and negotiating positions in international fora. Finally, ENV uses economic support funds to support projects abroad on improving solid waste management and encouraging innovation along the entire value chain.

Agency name: U.S. General Services Administration (GSA)

Physical location: Washington, D.C.

Agency's mission: GSA's mission is to deliver value and savings in real estate, acquisition, technology and other mission-support services across government. Through GSA's Public Buildings Service (PBS), Federal Acquisition Service (FAS), and various staff offices, GSA provides workspaces to more than 1 million federal civilian workers, oversees the preservation of more than 480 historic buildings, and facilitates the federal government's purchase of high-quality, low-cost goods and services from reliable commercial vendors.

Context and applicability to recycling: GSA promotes recycling through various programs, standards and tools, as well as through the Federal Management Regulation (FMR) and associated FMR Bulletins on personal property management. GSA's GSAXcess® website facilitates reuse of excess and surplus federal personal property like furniture, motor vehicles, computers and other equipment by transferring it to other federal agencies or State Agencies for Surplus Property for subsequent donation to eligible non-federal entities. In FY 2019 and FY 2020 through mid-April, GSAXcess enabled the reuse of over $1.8 billion worth of such items from dozens of agencies, keeping these items out of the solid waste stream while stretching federal and state taxpayer dollars. GSA's Facilities Standards for the Public Buildings Service (P100) establishes sustainable performance criteria for the diversion of construction and demolition waste from landfills through reuse, recycling and donation. PBS's national specifications for contracted facilities operations services establish requirements for recycling municipal solid waste generated at GSA-managed facilities.

Explicit roles and actions in recycling: GSA provides education and tools to support recycling and the procurement of products made with recovered materials through the Sustainable Facilities Tool, or SFTool.gov. GSA's GSAXcess® program facilitates reuse of excess and surplus federal personal property. GSA's National Capital Region (NCR) offers federal agencies in the Washington, D.C. metro area the opportunity to participate in GSA NCR's recycling sales program, whereby participating federal agencies and recycling contractors share revenue generated through the recycling of municipal solid waste generated in federal buildings.

Examples of partners and stakeholders: In GSA-managed and leased buildings, GSA relies on federal tenant agencies to participate in recycling programs and on facilities operations and construction contractors, as well as lessors, to offer recycling services to the federal government. GSA's personal property disposal works with several stakeholders, including public agencies and eligible nonprofit organizations, to assist them with the donation or sale of surplus federal personal property.

U.S. EPA Office of Resource Conservation and Recovery

EPA 530-R-21-003
November 2021