REPORT: SENATE CONCURRENT RESOLUTION NO. 13

2022 Regular Legislative Session

A Study of Strategies to Increase Plastic Recycling in Louisiana

Prepared by the

Louisiana Department of Environmental Quality

March 10, 2023

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Preamble

Senate Concurrent Resolution Number 13 (SCR13) (**Attachment A**), adopted during the 2022 Regular Legislative Session of the Louisiana State Legislature, requested the Secretary of the Louisiana Department of Environmental Quality (LDEQ) study strategies to increase plastics recycling in Louisiana. The resolution directed the Secretary to submit a written report to the Senate Committee on Environmental Quality and the House Committee on Natural Resources and Environment by March 10, 2023.

Members of LDEQ staff engaged with a wide variety of stakeholders including governmental entities, nongovernmental organizations, and other stakeholders, which formed the dialogue team (**Attachment B**). LDEQ met with the dialogue team in a series of five virtual and/or in-person dialogue sessions that took place between November 2022 and January 2023, at LDEQ Headquarters in Baton Rouge, Louisiana. The dialogue team provided input to LDEQ through presentations and open discussions. Copies of any written comments, recordings of the dialogue sessions, and written material presented at the dialogue sessions are available through LDEQ's Electronic Document Management System (EDMS) using Agency Interest Number 200321.

This SCR13 Report reflects LDEQ's findings based on the dialogue team's input and Department research, addresses the directives of SCR13, and provides recommendations for consideration by members of the Louisiana State Legislature.

1. Executive Summary

During Louisiana's 2022 Regular Legislative Session, eight recycling-related instruments were introduced. Two of the eight instruments addressed the recycling of plastics. These instruments included Senate Bill No. 155 (SB155) by Senator Patrick Connick and SCR13 by Senators Eddie J. Lambert and Regina Ashford Barrow. This report describes strategies to increase plastics recycling, and recycling overall, and makes recommendations on increasing overall recycling in Louisiana.

LDEQ invited the dialogue team to a series of dialogue sessions between November 2022 and January 2023, on increasing and improving plastics recycling and overall recycling in Louisiana. LDEQ also explored mechanical (*i.e.*, shredding, pelletizing, *etc.*) and advanced (*i.e.*, chemical structure change) recycling strategies. Any reference to "recycling" in this report, unless otherwise stated, refers to mechanical recycling.

The concerns detailed in SCR13 include the following:

- Economic development and the consumers' changing patterns of consumption and production leading to increases in plastic wastes;
- Inadequate recycling of plastic wastes' contribution to accumulation of plastic litter in the natural environment;
- Public cost of 40 million dollars a year to collect and dispose litter;
- Exploration of innovative strategies to increase mechanical recycling; and
- Progress and opportunities in advanced recycling to recycle the vast supply of currently non-recyclable plastics.

Based on preliminary research, successful recycling programs require solving challenges related to the following:

- Supply of Recyclable Material
    - Consumer behavior;
    - Access to recycling;
    - Collection methods; and
    - Sorting methods.
- Demand for Recyclable Material
    - Recovery capabilities;
    - Economics; and
    - End markets.
- Value-Chain Coordination

LDEQ acknowledges that this SCR13 Report is the first step towards a model of production and consumption, which involves reusing, remanufacturing, and recycling existing materials and products as long as possible, otherwise referred to as a circular economy. [1] Though SCR13 has a

[1] https://www.europarl.europa.eu/news/en/headlines/economy/20151201STO05603/circular-economy-definition-importance-and-benefits

specific focus on plastics recycling, the dialogue sessions confirmed that a holistic approach to recycling is required. As such, this report is an overall evaluation and assessment of strategies to increase recycling as a whole in Louisiana.

2. Introduction

SCR13 urges the Secretary of LDEQ to study strategies to increase plastic recycling in Louisiana. Upon conclusion of the study, this resolution requires the Secretary to document findings and provide recommendations in a written report to the Senate Committee on Environmental Quality and the House Committee on Natural Resources and Environment no later than March 10, 2023.

Additionally, SCR13 allows the Secretary flexibility to determine the framework and process to perform this evaluation. The final instruction in this resolution directed the Secretary to engage and consult with governmental entities, nongovernmental organizations, and other stakeholders. In carrying out the legislature's instructions, LDEQ also researched and gathered information regarding the United States Environmental Protection Agency's (USEPA) and other states' solid waste management plans.

2.1 Public Engagement

To fulfill the public engagement responsibilities, LDEQ scheduled a series of five dialogue sessions, which focused on successful recycling programs and challenges related to supply, demand, and value-chain coordination.

The sessions allowed the dialogue team to share perspectives with LDEQ on the information presented. LDEQ staff moderated each session and set the resolution directives and rules of engagement to facilitate stakeholder feedback on the topics presented.

Dialogue Session #1, held November 1, 2022, presented a general overview of SCR13. Subsequent dialogue sessions addressed the following:

- Dialogue Session #2 (November 15, 2022) addressed consumer behavior and successful approaches to recycling.
- Dialogue Session #3 (December 13, 2022) addressed collection methods, sorting methods, and recovery capabilities.
- Dialogue Session #4 (January 10, 2023) addressed economics, end markets, and cost of recycling versus cost of disposal.
- Dialogue Session #5 (January 17, 2023) addressed value-chain coordination and advanced recycling.

2.2 Scope of the Report

The report reflects LDEQ's findings based on stakeholder input and Department research. It covers topics presented in the dialogue sessions and issues raised by the stakeholders. The report discusses LDEQ's existing statutory authority under the Louisiana Environmental Quality

Act (EQA) and discusses LDEQ's current recycling programs, along with recommendations and strategies to increase recycling as part of an updated *Statewide Solid Waste Management Plan*.

3 USEPA Policy: National Recycling Strategy

The National Recycling Strategy (NRS) focuses 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 domestic MSW recycling system.

The NRS aligns with and supports implementation of the National Recycling Goal to increase the recycling rate to 50% by 2030. The Strategy outlines five strategic objectives to create a more resilient and cost-effective national recycling system:

- Objective A: Improve Markets for Recycling Commodities.
- Objective B: Increase Collection and Improve Materials Management Infrastructure.
- Objective C: Reduce Contamination in the Recycled Materials Stream.
- Objective D: Enhance Policies to Support Recycling.
- Objective E: Standardize Measurement and Increase Data Collection.[2]

3.1 Reframing Recycling and the Case for a Circular Economy Approach

Reliable demand for recycled plastic is critical for recycling to be sustainable. Decades ago, the process of recycling was much simpler. Products were manufactured with fewer materials, thereby making them simpler to sort. The ease of sorting common items like glass, newspaper, and cardboard contributed to the success of municipal collection programs. Today, bigger challenges exist, such as development of new polymers that are incorporated into products and new methods of packaging that cause confusion making it challenging for consumers to understand how to properly recycle. [3]

3.2 Overview of the Circular Economy and Recycling Process

Waste affects people and the environment on many levels. According to the USEPA, greenhouse gas (GHG) emissions from the production of plastics alone are expected to double by 2060.[4] The move to a circular economy could address pollution and human health in these areas and address 70% of global GHG emissions. The transition from a linear economy to a circular

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[2] EPA, "National Recycling Strategy; Part One of a Series on Building a Circular Economy for All," U.S. EPA Office of Resource, Conservation and Recovery, Washington DC, 2021. [Online]. Available: https://www.epa.gov/system/files/documents/2021-11/final-national-recycling-strategy.pdf

[3] EPA, "National Recycling Strategy; Part One of a Series on Building a Circular Economy for All," U.S. EPA Office of Resource, Conservation and Recovery, Washington DC, 2021. [Online]. Available: https://www.epa.gov/system/files/documents/2021-11/final-national-recycling-strategy.pdf

[4] EPA, "Building a Circular Economy For All: Progress Toward Transformative Change," 2022. [Online]. Available: https://www.epa.gov/system/files/documents/2022-09/EPA_Circular_Economy_Progress_Report_Sept_2022.pdf.

economy is becoming a key focus for policymakers around the world. 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 while reducing pollution and harm to human health. [5]

A circular economy, as defined in the *Save Our Seas 2.0 Act*, is a systems-focused approach involving industrial processes and economic activities to enable resources to maintain their highest value for as long as possible and to eliminate waste through design of materials, products, and practices. This is a paradigm shift from the current model where resources are mined, processed, used, and then disposed. A circular economy reduces virgin material use, promotes product redesign to be less resource intensive, and recaptures waste streams used as feedstock to manufacture new materials and products. MSW recycling is the keystone aspect of a circular economy system, and it provides the raw materials to be recovered and remanufactured. Additionally, MSW recycling serves as a mechanism for reducing environmental and social impacts of materials use, keeping valuable resources in productive use rather than in landfills, and creating jobs. The circular economy is based on three principles: eliminating waste and pollution; circulating products and materials; and regenerating nature. [6]

The ***first principle*** of the circular economy is to eliminate waste and pollution and to ensure raw materials are recovered. Many products can be incorporated into the circular economy by being maintained, shared, reused, repaired, refurbished, remanufactured, and recycled. Products can be designed with a focus to minimize or eliminate generated waste.[7]

The ***second principle*** of the circular economy is to market products and materials at their highest value. This means keeping materials in use, as either a product, component, or raw material. Therefore, the value of products and materials are retained, thereby minimizing the amount of waste generated.

Materials are kept in circulation in two ways: the *technical cycle* and the *biological cycle*. In the technical cycle, products are reused, repaired, remanufactured, and recycled. In the biological cycle, biodegradable materials are returned to the earth through composting and anaerobic digestion.

The most effective way to retain the value of products is to maintain and reuse them. Therefore, first steps in the technical cycle focus on keeping products whole to retain the maximum possible value. When the product can no longer be used, its components can be remanufactured and parts that cannot be remanufactured can be broken down into their constituent materials and recycled.

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[5] EPA, "National Recycling Strategy; Part One of a Series on Building a Circular Economy for All," U.S. EPA Office of Resource, Conservation and Recovery, Washington DC, 2021. [Online]. Available: https://www.epa.gov/system/files/documents/2021-11/final-national-recycling-strategy.pdf

[6] EPA, "National Recycling Strategy; Part One of a Series on Building a Circular Economy for All," U.S. EPA Office of Resource, Conservation and Recovery, Washington DC, 2021. [Online]. Available: https://www.epa.gov/system/files/documents/2021-11/final-national-recycling-strategy.pdf

[7] Ellen Macarthur Foundation, "Eliminate waste and pollution," 2022. [Online]. Available: https://ellenmacarthurfoundation.org/eliminate-waste-and-pollution.

Recycling is an important final step, which allows materials to stay in the economy and avoid disposal.

Reused biodegradable materials, like food byproducts and vegetative wastes, can be circulated back into the economy through composting and/or anaerobic digestion. Valuable nutrients, such as nitrogen, phosphorous, potassium, and micronutrients, can be used as fertilizer. Some products, like cotton clothing or wooden furniture, can be circulated through the technical and biological cycles, and can be maintained, reused, repaired, and reclaimed through both cycles.

The ***third principle*** of the circular economy is to regenerate natural systems. This is accomplished by shifting the economy from linear to circular by minimizing the need to extract raw materials and by reducing the amount of pollution and waste generated. Some key issues to moving from a linear to a circular economy include:

- Eliminating single-use plastics;
- Refocusing aspects of distribution and means by which natural resources are harvested and processed; and
- Rethinking which ingredients are used and how products are designed.

Agriculture and food industries and distribution companies may provide choices that are more balanced for their producers and consumers.

Adopting these principles can lead to reversing the loss of biodiversity, taking advantage of ingredients previously wasted, and using ingredients produced in regenerative approaches. Moving away from a linear economy to a circular economy supports natural processes. [8]

4 LDEQ Policy: Louisiana Recycling Strategy

In an effort to develop strategies to increase recycling in Louisiana, it is important to approach this effort in a holistic manner through the development of an updated ***Statewide Solid Waste Management Plan***, which best serves Louisiana and is protective of human health and the environment.

This updated plan would provide the framework for actions to be taken by LDEQ and other stakeholders to maximize recycling and the diversion of materials from landfills, advance sustainable materials management practices, incorporate zero waste principles, and minimize GHG emissions in the state. Additionally, this plan would assist in developing a cohesive system of public and private collection and disposal activities throughout the state with the long-term goal of developing public and private recycling programs. With growth and development comes increased quantity and complexity in solid waste generation with equal emphasis on protection of human health and the environment.

[8] EPA, "National Recycling Strategy; Part One of a Series on Building a Circular Economy for All," U.S. EPA Office of Resource, Conservation and Recovery, Washington DC, 2021. [Online]. Available: https://www.epa.gov/system/files/documents/2021-11/final-national-recycling-strategy.pdf

5 Improve Markets for Recycled Commodities

Plastics are lightweight/durable materials manufactured into a variety of products, which find use in a wide range of applications. As such, production has increased tremendously over the last several decades creating levels whereby use and disposal contribute to various environmental concerns. Recycling is a viable alternative available to reduce environmental impacts. Combined actions of the public, industry, and state and local government to implement strategies to increase recycling make possible the diversion of recyclable material from landfills while creating supplies to sustain end-use markets.

Recovering materials is the initial step, but markets for these materials must exist for recycling to become economically viable. The benefits of increasing the environmentally sound use of recycled materials and markets include the following:

- 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.

The highlighted benefits are overriding factors for promoting recycling programs and developing an environmentally sustainable market. These benefits aid in the creation and promotion of sustainable recycling markets. [9]

5.1 Promote Market Development

An examination of the recycling sectors indicates that one of the areas in need of improvement is the plastics recycling industry. Some concerns about the economics of recycling include the cost of recycling versus cost of disposal, cost of sorting between plastic types, cost of new plastic versus recycled plastic, and costs of contaminated plastics. While it costs to establish and maintain recycling programs, the environmental and economic benefits of recycling outweigh long-term costs. Some of these benefits are the preservation of landfill space, which increases the amount of recovered materials in the manufacturing supply chain, job creation, and incentive investments.

It is important to ensure that markets for recyclables do not further harm the environment or place additional burdens on communities near manufacturing, processing, and recycling facilities. A reliable market demand for recycled plastics and other materials greatly improves recycling effectiveness and economy. Improvements in markets for recyclable materials and recyclable products are needed to facilitate efficient integration of recycled materials for end markets.

[9] EPA, "National Recycling Strategy; Part One of a Series on Building a Circular Economy for All," U.S. EPA Office of Resource, Conservation and Recovery, Washington DC, 2021. [Online]. Available: https://www.epa.gov/system/files/documents/2021-11/final-national-recycling-strategy.pdf

5.2 End Markets: Resilience, Environmental Benefits, and Other Relevant Factors

End markets refer to industries that use recyclable materials to make desirable commercial products. Once materials recovery facilities (MRFs) sort and process recyclable materials received from collection facilities, businesses and other generators, the recyclable material is sold to end markets as commodity. These markets are a crucial element of the process and recycling would not be possible without them. Commodity values are another consideration and they fluctuate daily. In calendar year 2022, some plastic commodity values had a net decrease whereas other plastic commodity values had a net increase.

While end markets vary in ability to consume recycled material, economic viability and stability, the demand for recycled materials benefits the environment. An analysis of end markets and their requirements can inform decision-makers about the value, costs, social impacts, and potential benefits associated with investing in activities to strengthen the state's recycling system. Environmentally sustainable practices are needed to increase manufacturing of recycled material as feedstock and to circulate products and materials at their highest value. This means keeping materials in use, as a product, or, when no longer usable, as components or raw materials.

To complement current recycling efforts, manufacturers are exploring and proposing the implementation of procedures that change the chemical composition of post-use plastic materials through a process known as ***advanced recycling***. Advanced recycling technology allows facilities to accept types of plastic that are not typically recycled and accept lower qualities of plastics or plastics that have been contaminated. The post-use material is altered at a chemical level, limiting contamination, improving the purity of outputs, and generating virgin or new-quality products.

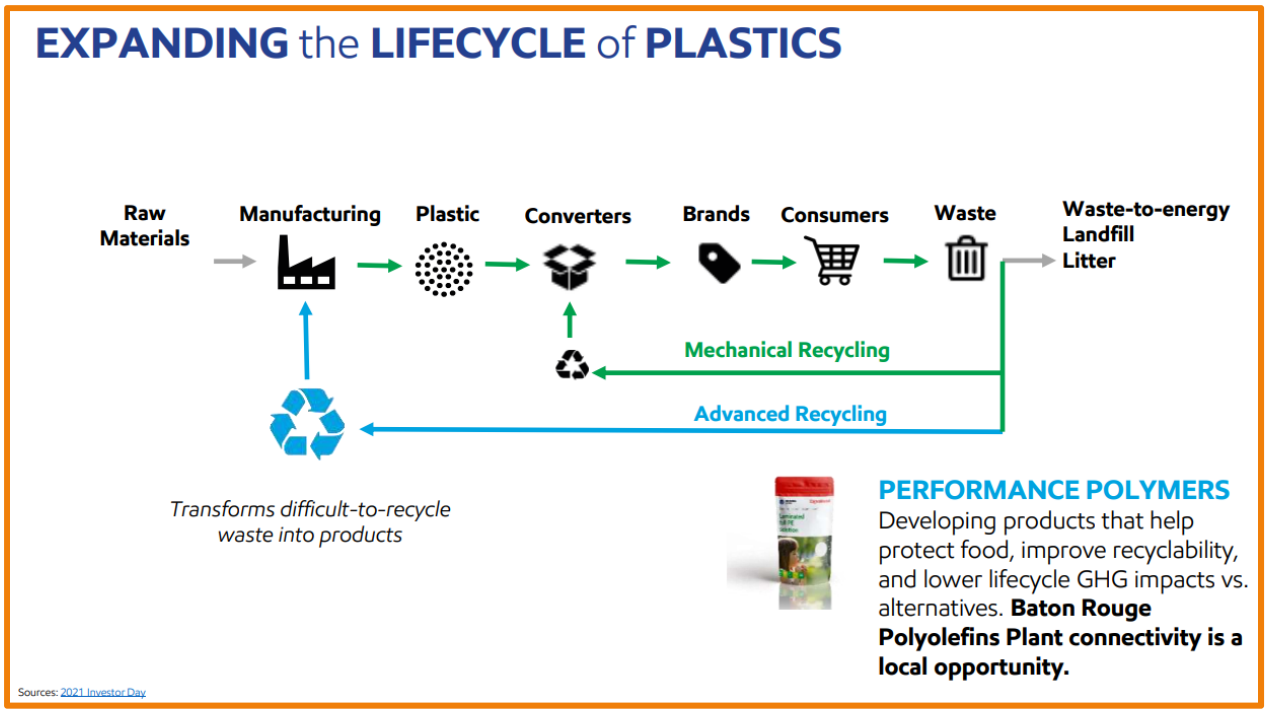

Figure 1. Mechanical Recycling vs. Advanced Recycling

5.3 Advanced Recycling

Traditional recycling is mostly a mechanical process. See **Figure 1**. For metals and glass, the material is broken down into smaller pieces, melted down, and reformed into recycled material. Although some plastics can be mechanically recycled, many plastics cannot be cost effectively recycled in a similar manner to metals and glass. However, through certain chemical reactions, plastics can be recycled. It is by using these chemical processes that advanced recycling can take place. Moreover, advanced recycling can be implemented alongside mechanical recycling. This way, advanced recycling acts as a complement to the existing infrastructure for traditional recycling. At the end of the day, the goal is for all types of plastics to be recycled.

Advanced recycling encompasses a variety of technological processes. These include pyrolysis, gasification, depolymerization, catalytic cracking, reforming, hydrogenation, solvolysis, or other similar technologies. These reactions often take place in conditions of increased temperature and pressure or in the presence of catalysts.[10] [11]

A wide variety of plastic materials can be utilized in advanced recycling, including, but not limited to:

- Polyvinyl chloride (PVC);
- Low-density polyethylene (LDPE);
- Polypropylene (PP); and
- Polystyrene (PS).

The acceptable material can vary in levels of contamination and require minimal or no

Portland, Oregon

- Portland offers resource conservation and recycling education programs for children in elementary school through high school.
- Through educational guides, community events, and internships, children in Portland learn about the importance of recycling and how to recycle materials like plastics from a young age, encouraging a lifelong commitment to recycling.
- Portland also offers low-cost curbside recycling through a public-private partnership.
- The state of Oregon also incentivizes residents to recycle plastic bottles by offering collection refunds that can be linked to college savings accounts.

Boise, Idaho

- Boise has collaborated with the plastic bag and household goods manufacturer, Hefty, to encourage residents to separate materials and recycle more.
- The program provides residents with specific bags to collect plastics that are not accepted in curbside recycling, such as plastic bags, food coverings, and wrappers.
- The plastics are then converted into energy and fuel through advanced recycling facilities.

[10] H. A.-V. H. A. A. R. D. B. X. B. C. H. B. G. T. Li, "Expanding plastics recycling technologies: chemical aspects, technology status and challenges," *Green Chemistry,* vol. 24, no. 23, pp. 8899-9002, 2021.
[11] U.S. GAO, "Science & Tech Spotlight: Advanced Plastic Recycling.," [Online]. Available: https://www.gao.gov/products/gao-21-105317. [Accessed 6 December 2022].

preprocessing. [12] [13] [14] Additionally, the versatility of advanced recycling increases the value of the current mechanical recycling infrastructure, including collection and sorting, by creating a constant supply of post-use plastics to fuel the demands of advanced recycling.

In 2019, the American Chemistry Council (ACC) predicted that advanced recycling could produce 40,000 jobs and $9.9 billion in economic output across the US. In practice, advanced recycling created 1,230 jobs and generated $1.8 billion in investment for the state of Georgia in 2020. In addition to employment opportunities in collection of recyclable materials and operations of advanced recycling facilities, the emergent nature of advanced recycling technologies guarantee employment opportunities in research and development of new or improved recycling methods. In addition to ExxonMobil, American Styrenics LLC (AmSty) is currently exploring advanced recycling opportunities in Louisiana. [15] [16] [17]

Phoenix, Arizona

- Phoenix has a comprehensive program to improve the city's recycling capabilities; they have invested significant funds in educational programs, waste recovery facilities, and public-private partnerships encouraging sustainable waste management and effective recycling methods.
- Additionally, Phoenix offers a soft plastics recycling program in grocery stores throughout the city that provides an easily accessible way for residents to recycle plastics that can be transformed into new bags, lumber, and furniture.

ExxonMobil operates one of the world's largest advanced recycling facilities in Baytown, Texas. This facility is capable of processing over 40,000 metric tons of plastic waste per year. ExxonMobil uses a proprietary process to create virgin-quality plastic feedstock from a wide range of plastic waste.

AmSty, the largest producer of polystyrene in the Americas, is considering adding advanced recycling capabilities to their manufacturing plant in St. James, Louisiana. [18] This operation would reduce post-use polystyrene products to virgin-equivalent styrene monomers. These monomers

[12] American Chemistry Council, "The Potential Economic Impact of Advanced Recycling and Recovery Facilities in the United States.," [Online]. Available: https://www.americanchemistry.com/better-policy-regulation/plastics/advanced-recycling/resources/the-potential-economic-impact-of-advanced-recycling-and-recovery-facilities-in-the-united-states. [Accessed 6 December 2022].
[13] Greenbiz, "Is advanced recycling the answer to plastic waste?," [Online]. Available: https://www.greenbiz.com/article/advanced-recycling-answer-plastic-waste. [Accessed 6 December 2022].
[14] Select Georgia, "Industry Highlight: Advanced recycling industry takes hold of Georgia.," [Online]. Available: https://www.selectgeorgia.com/news-and-updates/advanced-recycling/. [Accessed 6 December 2022].
[15] American Chemistry Council, "The Potential Economic Impact of Advanced Recycling and Recovery Facilities in the United States.," [Online]. Available: https://www.americanchemistry.com/better-policy-regulation/plastics/advanced-recycling/resources/the-potential-economic-impact-of-advanced-recycling-and-recovery-facilities-in-the-united-states. [Accessed 6 December 2022].
[16] Greenbiz, "Is advanced recycling the answer to plastic waste?," [Online]. Available: https://www.greenbiz.com/article/advanced-recycling-answer-plastic-waste. [Accessed 6 December 2022].
[17] Select Georgia, "Industry Highlight: Advanced recycling industry takes hold of Georgia.," [Online]. Available: https://www.selectgeorgia.com/news-and-updates/advanced-recycling/. [Accessed 6 December 2022].
[18] AmSty - AmSty and Agilyx Announce Collaboration to build Advanced Recycling Facility

can be used to manufacture new polystyrene products. The feasibility of AmSty's advanced recycling technology has been demonstrated at the Tigard, Oregon, facility, which began operations in 2019. The construction of advanced recycling facilities by corporations like ExxonMobil and AmSty has the potential to bring hundreds of jobs to Louisiana while diverting thousands of tons of plastic material from the waste stream.

ExxonMobil Advanced Recycling Initiative

ExxonMobil plans to build advanced recycling facilities at many of its other manufacturing sites around the world, which would give it the capacity to process up to one billion pounds of plastic waste annually by year-end 2026. Currently, the company is assessing the development of an advanced recycling facility at its Baton Rouge Plant in Louisiana. See **Attachment C**.

In 2021, the Louisiana Legislature amended R.S. 30:2153(2) through (5) and enacted R.S. 30:2153(1)(b)(v), (8) through (15) and R.S. 30:2157 to address advanced recycling in the state. This legislation defined several aspects of advanced recycling, provided for advanced recycling processes, facilities, and products, and delegated powers and duties to the Secretary of the LDEQ. Additionally, the legislation provided important exceptions, which exempt advanced recycling activities from regulation as solid waste. However, advanced recycling activities must adhere to several criteria to qualify for the exemption, including management that is comparable to analogous products and prevents releases to the environment, as well as storage that does not exceed reasonable timeframes. Additionally, post-use polymers must provide a useful contribution to the production of a valuable product or intermediate; the derived product must contain contaminants at levels comparable to those produced by traditional recycling processes. Finally, advanced recycling facilities and post-use polymer storage facilities must provide written notification to LDEQ prior to operation.[19]

There are currently six advanced recycling facilities in the US, which are located in Oregon, Ohio, North Carolina, Tennessee, and Texas. See **Table 1**.

Table 1. Advanced Recycling Facilities

City	State	Company
Tigard	Oregon	Agilyx
Akron	Ohio	Alterra Energy
Garner	North Carolina	Premirr Plastics
Kingsport	Tennessee	Eastman Chemical Company
Baytown	Texas	Exxon
Dallas	Texas	Dow

[19] Louisiana State Legislature, "Act No. 460, Senate Bill No. 97," 2021. [Online]. Available: https://legis.la.gov/legis//ViewDocument.aspx?d=1236234.

Twenty states, listed in **Table 2**, have passed legislation addressing advanced recycling.

Table 2. State Laws for Advanced Recycling

State	Law	Title
Arizona	S.B.1156, 2021	Solid waste; Advanced recycling facilities
Arkansas	HB 1944, 2021	An Act To Facilitate The Conversion Of Plastics And 9 Other Recovered Materials Through Advanced Recycling Processes; And For Other Purposes.
Florida	HB 335, 2017	Resource Recovery and Management
Georgia	HB 785, 2018	Solid waste management; certain definitions; modify and enact
Illinois	HB 2491, 2019	EPA-Uncontaminated Plastics
Iowa	S534, 2019	A bill for an act relating to the use of gasification and pyrolysis facilities for the conversion of certain recoverable waste materials.
Kentucky	B.R.192 / HB 45, 2022	AN ACT relating to resource recovery.
Louisiana	S.B.97, 2021	SOLID WASTE: Provides for advanced recycling facilities and processes for the conversion of certain recovered materials.
Mississippi	H.B. 1135, 2022	Advanced plastic recycling; define terms relating to.
Missouri	H.B. 2485, 2022	Enacts provisions relating to environmental regulation
New Hampshire	SB 367, 2022	Relative to the Regulatory Status of Advanced Recycling and Manufacturing Facilities.
Ohio	HB 166, 2019	Creates FY 2020-2021 operating budget
Oklahoma	S.B.448, 2021	Solid waste management; adding definitions; modifying definitions. Effective date.
Pennsylvania	HB 1808, 2020	Solid Waste Management Act - Definitions and Editorial Changes
South Carolina	S.B.0525, 2021	Solid Waste Policy and Management Act
Tennessee	S923, 2019	AN ACT to amend Tennessee Code Annotated, Title 68, Chapter 211, relative to solid waste.
Texas	SB 1656, 2019	Relating to the conversion of plastics and other recoverable materials through pyrolysis or gasification.
Virginia	S.B. 1164, 2021	Advanced recycling, *etc.*; definitions.
West Virginia	SB 4084, 2022	Relating to advanced recycling
Wisconsin	A789, 2018	Relating to: exempting certain facilities from solid waste facility regulations.

5.3.1 The Benefits of Advanced Recycling

Beyond economic benefits (*i.e.*, job creation), advanced recycling can provide a number of environmental benefits. Advanced recycling helps achieve a circular economy by expanding the range of plastic that can be recycled and improves sustainability by diverting thousands of tons of plastics from landfills. Additionally, energy derived from recycled material in the form of fuels and process heat can reduce reliance on traditional energy sources like fossil fuels. The reduction of fossil fuel use is necessary to avoid climate change impacts. In addition to these important environmental benefits, advanced recycling helps meet consumer demands to see more sustainable products by offering a sustainable alternative to disposal for materials that cannot be recycled through mechanical means.

Houston, Texas

- Houston collaborates with plastic industry leaders such as ExxonMobil, LyondellBasell, Cyclyx, and FCC Environmental Service to advance Houston's recycling systems and sorting methods.
- The collaboration resulted in a $100 million investment in a new plastic scrap sorting and processing facility in Houston.
- The new Houston Recycling Collaboration and recent industry investment will improve the city's plastic recycling goals.

5.3.2 Incentives for Advanced Recycling

State governments can incentivize advanced recycling through several types of legislation. Louisiana is among 20 states that have passed legislation addressing advanced recycling, thereby facilitating the operation of six advanced recycling facilities in the US. One legislative incentive for advanced recycling is the exemption of these facilities from solid waste regulation. Extended Producer Responsibility (EPR) bills can provide another legislative incentive. Including advanced recycling in the definition of acceptable forms of recycling in EPR bills creates a market for advanced recycling facilities. A final legislative incentive for advanced recycling includes the direct financial assistance of tax breaks and government bonds, which ease the financial strain of new facility construction.[20]

Seattle, Washington

- Seattle provides a digital app to its residents that helps them learn about recycling pick-up days and acceptable materials.
- The city also provides significantly larger recycling bins compared to trash bins as a tool to promote residential recycling.
- The city aims to achieve a 72% recycling rate by 2025.

[20] Global Alliance of Incinerator Alternatives. (2022). Tracking Trends in Advance/Chemical "Recycling". Berkeley.

5.4 Strategies to Increase the Demand for Recycled Material through Research, Development of Technologies, and Expanding Market Opportunities

The demand for recycled materials in Louisiana is adversely impacted by the lack of recycling education and outreach, access, and increased percentages of contamination. These issues plague the industry and inhibit recycling initiatives from reaching the public eye and from becoming effective programs.

Other end-market barriers include:

- Supply chain;
- 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.

Research and utilization of existing legislation and development of new legislation can promote new market opportunities by finding novel ways to use secondary materials as feedstock and technology to address difficult-to-recycle materials. The *2020 Save Our Seas 2.0 Act* is the most comprehensive legislation ever passed to address the issue of plastic waste. This legislation mandates USEPA to collaborate with key partners to identify:

- Innovative uses for plastic waste;
- Recommendations for overcoming barriers to recycling;
- Incentives to create new end-use markets for recycled plastics; and
- Opportunities to minimize new plastic waste.

In addition to increasing access, increasing education and outreach, and decreasing contamination, expanding recycling market opportunities is also a key factor to increasing recycling rates and demand for recycled material.

In an effort to increase demand for recycled material, studies are ongoing by USEPA and several states to find the economic benefits that arise from recycling. In 2001, USEPA established the ***National Recycling Economic Information (REI) Project and Report***.[21] The *REI Report* includes economic activities for nine sectors of recycling:

- Ferrous metals;
- Non-ferrous metals;
- Glass;
- Paper;
- Plastics;

[21] Environmental Protection Agency, "Recycling Economic Information (REI) Report," 16 June 2022. [Online]. Available: https://www.epa.gov/smm/recycling-economic-information-rei-report#findings.

- Rubber;
- Construction and Demolition Debris (C&D Debris);
- Electronics; and
- Organics.

The latest report featured in 2020 includes updated information about the number of recycling jobs, wages, and tax revenue.

In 2012, recycling and reuse activities in the US accounted for 681,000 jobs, $37.8 billion in wages, and $5.5 billion in tax revenues.[22] This equates to 1.17 jobs for every 1,000 tons of materials recycled. **Figure 2** illustrates how each recycling sector contributes to total employment, wages, and tax revenues.

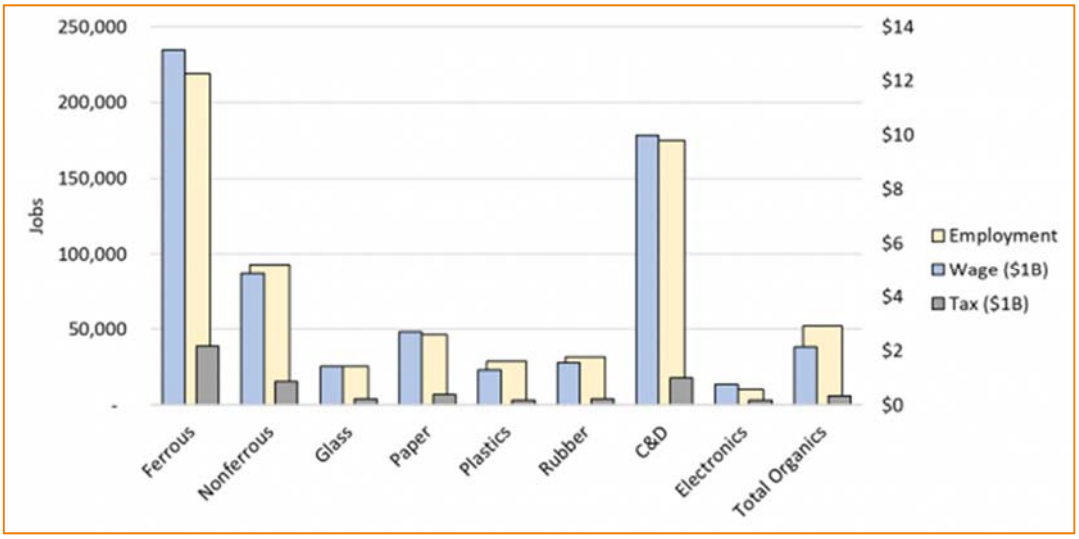

Figure 2. Jobs, Wages, and Tax Revenues Due to Recycling

6 Increase Collection, Processing and Improve Materials Management Infrastructure

The first tenet to a circular economy is to divert and collect recyclable materials from disposal. The supply of recycled materials, including plastics, depends on two factors: consumer behavior and the infrastructure to allow ease of access to recycling. Collection is the keystone to recycling; without collection, none of the other recovery processes reduces the amount of waste disposed.

[22] Environmental Protection Agency. (2022, June 16). *Recycling Economic Information (REI) report.* EPA. Retrieved January 13, 2023, from https://www.epa.gov/smm/recycling-economic-information-rei-report#findings.

Research shows consumers use the majority of products made with recycled materials.[23] Consumer behavior plays an important role in the supply of recycled materials and is often affected by factors such as product design and visual indicators or shape distortion. A less distorted package shape has a higher chance of being recycled and reserved by the consumer than tempered and imperfect material.[24] Raising consumer awareness of proper recycling has a larger impact on the supply of recyclable materials.

6.1 Understanding Available Recycling Infrastructure

Evaluating access to recycling is the first step in reaching any target-recycling goal. Communities should be analyzed to see if recycling is available to them, what collection points exist and potential organizations that can be partnered with or leveraged to provide access. Collection points can include curbside pickup, drop-off centers, and/or MRFs.

In addition to the type of recycling available, the type of communities and residential homes should be considered. Some urban, single-family homes have access to curbside pickups, but heavily occupied communities with multifamily housing would benefit more from residential drop-off locations.

Some rural communities in Louisiana have access to garbage collection; others do not. Rural communities that do not have garbage collection may also lack waste and/or recycling collection centers, further limiting access. This limited access is another reason why recyclables are disposed instead of recovered.

Recyclable materials frequently vary by program. Customized education is needed so that residents understand how to participate. The problem is partly due to miseducation and the lack of standardization at the collection point. These differences reinforce the need for customized educational tools that accommodate the specific needs of each community. During discussion sessions, some stakeholders noted higher contamination rates with universal recycling versus opt-in only. However, some research indicates that universal recycling resulted in higher collection rates versus opt-in only. As such, any recycling program should be evaluated and tailored to the specific challenges and needs of individual communities.

The Recycling Partnership (TRP) will publish a report in Spring 2023 on the state of recycling in Louisiana. This report will summarize public residential recycling access in Louisiana and regional process and end-market infrastructure in the Gulf Coast. This report will better define the recycling landscape in Louisiana and help tailor and customize targeted outreach programs to increase recycling.

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[23] Plastics Recycling Update, "Data Corner: Tracking the growing variety of products made with PCR," 2022. [Online]. Available: https://resource-recycling.com/plastics/2021/03/22/data-corner-tracking-the-growing-variety-of-products-made-with-pcr /. [Accessed 2022].

[24] Sustainable Packaging Coalition, "Psychology of Recycling: Driving Consumer Recycling Behavior," 2017. [Online]. Available: https://sustainablepackaging.org/psychology-recycling-driving-consumer-recycling-behavior/. [Accessed 2022].

6.2 Increasing Recycling Education and Outreach.

Literature reviews indicate that strong education and outreach campaigns improve recycling rates. Education and outreach through social media, TV and radio ads, and print media raise public participation rates in household recycling.[25] Youth environmental education is a major component of recycling education. Early environmental education promotes a culture of cleanliness and inspires kids to become more engaged.

Education Initiatives

Louisiana ACT 72

- Signed Spring 2016.
- Required schools to teach students about litter and its consequences on the environment.

Keep Louisiana Beautiful (KLB)

- Works with the state's Task Force on Statewide Litter Abatement and Beautification.
- Promotes community litter-reduction activities and environmental education programs tailored to Louisiana youth.

KLB's Environmental Education Program

- Delivered environmental education information and materials with focus on environmental stewardship to 24,440 students and educators in 2021.
- Provides opportunities for students to engage in hands-on activities and lesson plans on real-life environmental challenges in the state.
- Recruited seven university affiliates, requiring some to conduct campus waste audits.
- Expanded the environmental education program to include Boy and Girl Scout Leaders, librarians, school summer programs, special events and activities, and after-school programs.

Community Education and Outreach

Tangipahoa Parish/Independence, LA: Tangipahoa Parish implemented a litter education program that incorporated lessons on recycling. The program targets 4th-grade students at selected schools in the parish. The liaison for the program collaborated with Keep Louisiana Beautiful to form ***Keep Tangipahoa Beautiful***.

Lafayette, LA: Lafayette's curbside recycling education campaign was conducted in 2020-21. The city's recycling program received a grant from ***The Recycling Partnership*** that covered costs associated with cart stickers, tags, billboards, advertising, transport drivers, and temporary labor to conduct the recycling audit program.

[25] Oregon Department of Environmental Quality, "Multi-Tenant Recycling Literature," Portland, 2018.

Community Education and Outreach

The Green Project in New Orleans: ***The Green Project Organization*** in New Orleans provides free, hands-on environmental education to K-12 schools. The program engages students in thoughtful dialogue and critical problem-solving plans relevant to their daily lives and their city.

Baton Rouge, LA: East Baton Rouge City-Parish's Recycling Office developed several lesson plans to help educators teach students about recycling. They also offer supporting materials focused on recycling, including activities, videos, student certificates, and handouts for students.

6.3 Incorporating Underserved Communities in Accessing Recycling Services

In February 2023, LDEQ applied for USEPA's Recycling Education and Outreach (REO) Grant funding. If awarded, a portion of the grant will focus on Environmental Justice (EJ) and Justice40 requirements by targeting disadvantaged, rural, and low-income communities by promoting education to support recycling and waste reduction activities. EJSCREEN and Climate & Economic Justice Screening Tool (CEJST) are USEPA tools, which can be used to locate disadvantaged and underserved communities. These tools may also be used to identify communities that may not have access to recycling programs and to ensure these communities are engaged in education and outreach and in developing recycling programs.

6.4 Collection Methods

Recyclable materials generated by consumers or business are collected by private haulers and governmental entities. The haulers collect the material through curbside collection, transfer stations, on-site collection, drop-off centers, take-back locations, stewardship programs, and scrap yards. Most recycling programs in other states and Louisiana use single-stream recycling collection in curbside programs, where all recyclables are placed in the same bin. The convenience and simplicity of this method have increased participation and tonnage of collected recyclables while providing a reduction in cost due to automated trucks with single compartments.

6.5 Optimize Processing Efficiencies at Materials Recovery Facilities and Processing Facilities

Once single-stream recyclables are collected and transported, the materials arrive at a processing facility or a MRF. At the processing facility, the recyclables are sorted, cleansed of physical contaminants, reduced in size, and prepared for transport to a milling facility or directly to a manufacturing facility. The following equipment and methods are typical for sorting at processing facilities and MRFs:

- Manual Picking;
- Trommel Screens;
- Old Corrugated Cardboard (OCC) Screening;

- Optical Sorting Machines;
- Sink-Float Separators;
- Eddy Currents;
- Ballistic Separators; and
- Magnet Separators.[26]

Though recycling has many challenges, there are unique challenges for plastics at MRFs. Glass, ferrous and non-ferrous metals, and papers all have low-technology requirements for sorting. Recycling plastics can require intense hand sorting along with optical recognition equipment for sorting to be economical.

Recycling loads that arrive with high levels of contamination may be rejected by the MRF. Contamination consists of high levels of non-recyclables that are not easily separated (*e.g.,* food waste). Some MRFs charge a fee for high levels of contamination or reject the entire load.

It is important that residual wastes are removed and the recyclable material is as clean as possible, as it can affect the quality and value of the final product. After all necessary sorting is complete, recyclables are then baled and sold to end-market buyers. Alternatively, plastics can be sent to advanced recycling facilities for chemical processing.

6.6 Strategies to Increase Collection of Recyclable Materials

To develop effective strategies to increase collection rates, it is important to understand the associated challenges. The primary issue is lack of residential access to recycling. Ensuring recycling is kept simple is the best way to help achieve consistency. Through a more standardized system, programs may increase collection volumes, which also increases the types of recyclables collected and processed for post-consumer recycled content.

Some strategies to combat lack of standardization include:

- Using one container for recyclables and one container for waste throughout facilities;
- Using consistent recycling containers with restrictive openings and clear-color coordination;
- Using clear and concise labeling and signage options; and
- Using simple, easy-to-read signs at eye level that incorporate both graphics and a short list of unacceptable recyclable items.

[26] British Plastics Federation (BPF), "How is Plastic Recycled? A Step by Step Guide to Recycling," 2023. [Online]. Available: https://www.bpf.co.uk/plastipedia/sustainability/how-is-plastic-recycled-a-step-by-step-guide-to-recycling.aspx. [Accessed 2023].

Curbing Contamination in Curbside Recycling

According to the ***2020 State of Curbside Recycling Report***, some communities have taken action against contamination issues by:

- Tagging carts (putting "oops tags" on carts that tell residents what unacceptable materials were found in the carts);
- Rejecting contaminated carts (not picking them up and leaving them on the curb);
- Sending direct mailers or bill inserts to residents on acceptable and unacceptable materials; and
- Using general advertising to promote what recyclables are acceptable and unacceptable.

Curbside programs can address inbound contamination if they have staffing (*i.e.,* recycling coordinators) and outreach resources to support those efforts.

Some recycling programs have moved towards opt-in curbside collection in denser urban areas, such as Baton Rouge and Lafayette, and conveniently located drop-off sites in more rural areas. The most effective recycling method in urban areas is curbside recycling, along with a recycling option at the point of disposal in parks, by sidewalks, or at transit stops. In addition, placing a recycling bin next to a trash bin encourages recycling in general. Some challenges to public-space recycling include lack of education, inconsistent signage, and contamination.

Moncus Park, Lafayette, Louisiana

Another method proven to decrease contamination is the use of smart recycling trucks. These trucks are equipped with sensors, cameras, and other technology that allow them to receive and gather information as they travel. Smart recycling trucks can be used to identify and document overloaded containers and contamination. When contamination occurs, customers are notified by invoice, letter, email, text, or phone. Communities can use this data to develop programs to increase diversion and improve recycling participation.[27]

[27] Waste Management, "WM Smarttruck Frequently Asked Questions," 2022. [Online]. Available: https://www.lodi.gov/DocumentCenter/View/2145/WM-SmartTruck-FAQ-PDF.

Lafayette Consolidated Government - Recycling Audit Program

Lafayette Consolidated Government (LCG) conducted a contamination audit and tagging campaign as part of its curbside recycling program.

- LCG compiled a recycling audit file that tracks the score of passing and failing resident addresses for use in future follow-up audits.
- Recycle bins of repeated failed residential audits were removed and replaced with a garbage cart.
- LCG also collected video footage of the recycle audit and conducted a digital media campaign to further engage and educate citizens about curbside recycling services.

6.7 Other Strategies

While increasing recycling awareness is important, it is just as important to change consumer behavior and for consumers to choose products and packing materials that are recyclable. Studies show methods that drive the consumer's intention to action are the most compelling way to reinforce recycling.[28] [29] These methods include standardizing labeling, expanding recycling education, and developing and implementing incentives and penalties.

Additional collection efforts will increase capacity. One suggested example consisted of collecting material twice a week, instead of once a week, thereby potentially doubling the recyclables collected per week.

Another strategy to increase the supply of plastics is to increase the number of recycling bins and collection centers and provide online training before bin delivery. Rural communities benefit by adding collection centers at commonly visited local places, such as gas stations, grocery stores, feed stores, co-ops, churches, city halls, restaurants, *etc*.

7 Reduce Contamination in Recycled Materials Streams

Reducing contamination improves the quality of the recycling stream. Contamination can occur throughout the recycling process, particularly at the curbside, and negatively affect a MRF's equipment, process, and product. Along with increasing access, participation, and education, reducing contamination produces a higher quality of recovered material, which increases the overall supply of recovered materials and strengthens markets for recovered materials.

[28] Oregon Department of Environmental Quality, "Multi-Tenant Recycling Literature," Portland, 2018. https://www.oregon.gov/deq/FilterDocs/recMultiTenLitRev.pdf

[29] EPA, Social Marketing: Messaging for Behavior Change https://www.epa.gov/system/files/documents/2022-11/EPA%20Social%20Marketing%20Training-%2010.25.22%20FINAL.pdf

7.1 Challenges in Consumer Behavior

Through multiple dialogue sessions with stakeholders and based on the latest NRS Report,[30] LDEQ identified numerous challenges in the area of consumer behavior in Louisiana, including confusion about what materials are recyclable and the differences in recycling programs offered by individual parishes. This confusion often causes some recyclable materials to end up in the trash or some trash in recycle bins. LDEQ identified the following main challenges facing consumer behavior:

- Public Awareness and Education;
- Inconsistent Messaging; and
- Lack of Information on Contamination.

7.1.1 Public Awareness and Education

Based on research and feedback from dialogue sessions, there is limited awareness about parish and municipal recycling programs. Effective and comprehensive awareness and education about these programs can prevent valuable materials from being disposed and instead allow recovery for future use. Communities are often confused about what materials are recyclable. Most do not know about the presence of any drop-off collection locations.

Similarly, there is limited public awareness about the social and economic benefits of recycling. To drive the consumer's intention to action, public and private stakeholders should go beyond providing information about recycling only. Awareness and education alone do not lead to behavior change. Many environmental campaigns fail, because they ignore "the rich mixture of cultural practices, social interactions, and human feelings that influence the behavior of individuals." [31] [32] [33] Therefore, it is vital to incorporate research and evidence-based, social-marketing strategies to improve consumer behavior towards recycling efforts.

7.1.2 Inconsistent Messaging

Consistent messages are crucial to recycling and reducing contamination by making sure the public understands the consequences of contamination.

Another challenge associated with different local recycling capabilities is inconsistent recycling messaging across the state. Discussions compiled from the dialogue sessions have also emphasized the importance of creating a unified statewide recycling program to improve the

[30] EPA, "National Recycling Strategy; Part One of a Series on Building a Circular Economy for All," U.S. EPA Office of Resource, Conservation and Recovery, Washington DC, 2021. [Online]. Available: https://www.epa.gov/system/files/documents/2021-11/final-national-recycling-strategy.pdf
[31] Oregon Department of Environmental Quality, "Multi-Tenant Recycling Literature," Portland, 2018.
[32] M. Costanzo, D. Archer, E. Aronson, & T. Pettigrew, "Energy Conservation Behavior: The Difficult Path from Information to Action," *American Psychologist,* 1986.
[33] D. McKenzie-Mohr, "New Ways to Promote Proenvironmental Behavior: Promoting Sustainable Behavior: An Introduction to Community-Based Social Marketing," *Journal of Social Issues,* 2000.

consistency of labels, signage, symbols, and messaging for recycling products, recycle bins, and trash bins. Even the color of recycling bins should be more consistent throughout the state.

Consistent labels, signage, symbols, and messaging for recyclable products, recycling bins and trash bins could reduce consumer confusion. Likewise, clarifying existing labels that are confusing should make recycling easier. Labels should not be misleading and inaccurate.[34]

7.1.3 Lack of Information on Contamination

Contamination of recyclable products occurs when products are labeled as recyclable but are not supported by the infrastructure and/or secondary markets in a specific location or when garbage and non-recyclable materials such as food, yard waste, and textiles are placed in the recycling carts. Contamination decreases the quality of recycled materials. An increase in contaminated recyclables leads to the following problems:

- Complete contamination rendering the entire load unacceptable for recycling;
- Slowdowns in recycling machinery and increases in operating costs;
- Damage to the recycling machinery;
- Fires; and
- Valuable materials escaping the economy.

Thus, it is important to increase awareness regarding the extent and impacts of contamination on recycling through education and outreach to help improve knowledge and subsequently lower contamination in the recycling stream.

7.2 Ensure Resources are Available for Education and Outreach Initiatives

Effective public education and outreach programs focusing on issues associated with contamination will increase the quality of recyclable materials.

Many research studies suggest the use of social marketing to drive behavioral change. Education and outreach programs should inform residents of the environmental, social, and economic benefits of recycling and acceptable materials, recycling schedules, access to services, *etc*. Consistency is a key factor in implementing these strategies, which aids to reinforce recycling messages over time.

[34] EPA, "National Recycling Strategy; Part One of a Series on Building a Circular Economy for All," U.S. EPA Office of Resource, Conservation and Recovery, Washington DC, 2021. [Online]. Available: https://www.epa.gov/system/files/documents/2021-11/final-national-recycling-strategy.pdf

Multiple studies confirm that successful recycling programs utilize most of the following resources: [35]

- Education materials;
- Advertisements;
- Infographics about recycling, social, and economic benefits;
- Public events; and
- Recycling audit programs.

The strategies stated in this section align with the NRS.[36]

Education and outreach activities require resources to ensure sustainable and effective outcomes. In-kind resources, funding, and other types of support should be leveraged and/or created.

It is important to elevate the importance of recycling and develop new educational materials and campaigns, which are advanced by all stakeholders to increase the impact of the messaging.

8 Other Recycling Opportunities

These opportunities include, but are not limited to, recycling universal waste (electronics and batteries) and used oil.

8.1 Household Hazardous Waste Collection Days

Local municipalities establish Household Hazardous Waste (HHW) Collection Days to provide residents opportunities to drop-off HHW and universal waste. Local governmental entities contract with universal waste handlers and destination facilities to ensure collected universal waste is properly reclaimed and/or recycled.

8.2 Universal Waste and Used Oil

Universal waste and used oil have established recycling programs and the materials have a known commodity value, either on secondary markets or as raw components. Retailers of these materials act as collection facilities and take expired, broken, or spent components at no cost to the consumer. Universal wastes are sent to destination or collection facilities. They are broken down to individual parts (working electronics) and sold on second-hand markets or broken down into base components and sold or manufactured into new products (batteries). Used oil is sent to processors, re-refiners, or marketers.

Because of fires and safety concerns at MRFs caused by lithium-ion batteries, special emphasis should be placed on lithium-ion battery recycling.

[35] Oregon Department of Environmental Quality, "Multi-Tenant Recycling Literature," Portland, 2018.
[36] EPA, "National Recycling Strategy; Part One of a Series on Building a Circular Economy for All," U.S. EPA Office of Resource, Conservation and Recovery, Washington DC, 2021. [Online]. Available: https://www.epa.gov/system/files/documents/2021-11/final-national-recycling-strategy.pdf

9 Enhance Policies and Programs for Recycling

Different policies and programs can be effective in increasing circularity and aim to increase coordination, availability, and accessibility of information on recycling at the state and local levels. Anticipated benefits of enhancing policies to support circularity include better-informed, effective, and efficient policies that lead to increased recycling. [37]

The Legislature, through La. R.S. 30: Chapter 18, enacted statutes to address recycling. LDEQ promulgated the Recycling Waste and Reduction Rules (LAC 33:VII.Chapter 103), which address the development of the following:

- Solid waste reduction and recycling management provisions;
- State recycling industry;
- Local recycling programs by political subdivisions; and
- Effective public education programs concerning recycling.

9.1 Value-Chain Framework

The goal to improve Louisiana's value-chain framework is to transform Louisiana's current linear recycling system into a circular system. In a circular system, very little waste ends up in a landfill, but rather is reused or recycled to reduce environmental pollution and GHG emissions. To accomplish a more circular recycling framework, the modifications described below are needed to update Louisiana's current value-chain framework.

9.1.1 Increase the Number of Material Recovery Facilities throughout Louisiana

In order for a circular recycling system to work, sufficient numbers of MRFs should be strategically located to facilitate sorting and collection of recyclables.

Additional studies should be conducted to assess the need for additional MRFs in Louisiana, which are strategically located to be economically feasible for local entities.

9.1.2 Identify End Users

To close out the circular recycling system, a list of end users should be identified and further developed.

9.2 Incentives and Legislation

Although the public may be aware of hazards that plastics pose to the environment, knowledge sometimes is not sufficient to encourage change. However, incentives, especially financial incentives, can be a great force to encourage behavioral change. The key is to make the incentive align with the desired goal, which in this case would be to persuade households and consumers to

[37] EPA, "National Recycling Strategy; Part One of a Series on Building a Circular Economy for All," U.S. EPA Office of Resource, Conservation and Recovery, Washington DC, 2021. [Online]. Available: https://www.epa.gov/system/files/documents/2021-11/final-national-recycling-strategy.pdf

reduce, reuse, and recycle. Incentives can include rewards and monetary charges (such as deposit refund schemes).

9.2.1 Modernize Existing Recycling Regulations and Statutes

The current regulatory framework should be updated to address:

- Minimum recycling standards;
- Standardized recycling requirements;
- Standardized reporting requirements to provide accurate and relevant data; and
- Updated local plans and reporting requirements for parishes and municipalities.

9.2.2 Recycling Incentive Scheme

Most states rely heavily on recycling advertising campaigns to create social norms to promote recycling rather than financial incentives for individuals and businesses. Incentivized programs include rewards and penalties. Rewards to encourage recycling can be in the form of payments or coupons to individuals, communities, or businesses or by reducing waste collection fees for residents. [38]

Other incentivized programs include requiring a fee for single-use plastic bags or plastic bottles. Eight states (California, Connecticut, Delaware, Hawaii, Maine, New York, Oregon, and Vermont) ban single-use plastic bags. [39] [40] [41] Most of these states started with a bag fee in preparation for the ban.

10 Reducing Food and Organic Waste through Composting and Digestion

Wasted food and organic material are major environmental, social, and economic challenges. Recycling food and organic waste can help reduce methane emissions from landfills and aid in resource recovery. [42] The management of decomposition to reduce food and organic waste can be accomplished by using two common processing methods - composting and digestion.

10.1 Composting

Composting, a controlled, aerobic process that converts organic materials through natural decomposition, is nature's way of recycling. By transforming food and organic waste into compost, waste streams can evolve into beneficial amendments, which promote cleaner environments and reduce the volume of waste disposed in landfills.[43] Biological organisms, which

[38] https://plasticsmartcities.org/products/recycling-incentive-scheme
[39] https://www.ncsl.org/environment-and-natural-resources/state-plastic-bag-legislation#:~:text=Bans%20and%20Fees,banned%20single%2Duse%20plastic%20bags
[40] https://www.hubert.com/resources/article/plastic-ban-questions
[41] https://www.instituteforenergyresearch.org/uncategorized/eight-states-ban-plastic-bags-but-more-prohibit-local-bans/
[42] "Food Waste" - https://www.epa.gov/land-research/food-waste-research
[43] "Composting at Home" - https://www.epa.gov/recycle/composting-home#whatcom

transform the materials through chemical reactions, facilitate the process of composting, similar to digestion.

10.1.1 University of Louisiana at Lafayette Initiative

The University of Louisiana at Lafayette (ULL) provided an opportunity to merge sustainable operational goals to offer education with a desire to solve real world problems through collaboration utilizing the Zero Waste Program.[44]

Zero Waste Initiative

ULL collaborated with seven university initiatives to engage students in sustainability research to reduce waste on campuses, communities, and waterways as a part of their ***2018-2021 Sustainability Strategy Plan***. One of the objectives of the plan was to implement a Zero Waste Program. The primary goal is to reduce waste material (less than 10%) created during games/campus events through recycling and composting.

Program Implementation on Campus

- Provide composting and recycling bins on campus
  - Green Bins = Recycling (plastics, aluminum, paper, and cardboard)
  - Blue Bins = Composting (organic waste)

Game Events

- PSA for Games and Events
- Volunteers act as "Zero Waste" Goalies
  - Stationed at "Zero Waste" Zones to assist fans
  - "Zero Waste" Zones spread throughout the campus

10.1.2 Louisiana Department of Agriculture and Forestry (LDAF) Initiative

LDEQ and LDAF established a working partnership to promote Best Management Practices (BMPs) for beneficially using organic solid waste materials. The BMP Program allows for less LDEQ regulatory oversight of organic solid waste materials determined to pose minimal risk to human health and the environment if managed in an environmentally sound manner.

BMPs are intended to guide the collection, storage, and handling of organic solid waste materials such as, but not limited to, yard trash, vegetative debris, race track stable bedding, and agricultural and forestry production residues destined for soil enrichment or other approved beneficial uses. BMP Plans defining appropriate locations, site preparation, and operation standards that minimize risk of impact upon human health and the environment must be approved by LDAF before beneficial activities may commence.

[44] https://sustainability.louisiana.edu/

Examples of organic solid waste materials that may be managed under approved BMP Plans include, but are not limited to:

- Woodwaste;
- Vegetative debris;
- Sugar mill bagasse and bagasse ash, bagasse, and filter press mud from sugar mills;
- Chicken litter;
- Poultry carcasses;
- Rice hulls;
- Ash residue from burning organic solid waste materials;
- Shells from crawfish and shellfish processing;
- Cotton gin trash;
- Livestock and poultry litter, bedding, and composted livestock and poultry carcasses; and
- Waste and wastewater from livestock, poultry, and fisheries packaging and processing.

LDAF's BMP Program typically averages 30-40 new BMPs and BMP modifications and revisions each year. This number of new and modified BMPs is drastically higher in the aftermath of floods and hurricanes. By number and volume, BMPs are approximately 70% vegetative debris, whether from individuals, companies, municipalities, arborists, or storm-generated vegetative debris. In the past decade, LDAF has seen an increase in BMPs or requests for guidelines from distillers and craft brewers, seafood processors, and aquaculture operations.

10.1.3 Lafayette Consolidated Government Initiative

LCG developed a composting facility where green waste such as tree branches, grass, and shrub trimmings are converted into a nutrient-rich soil additive. Residents pay $6.00 per cubic yard when dumping yard waste in the composting facility. The composting program has kept Lafayette's disposal rates stable, improved waste diversion from landfills, and provided citizens with free composting material for personal use.[45]

10.2 Digestion

Digestion can be aerobic or anaerobic; however, it is often utilized as an anaerobic process to reap the benefits of producing and capturing methane-rich biogas. Anaerobic digestion is a process through which bacteria break down organic matter–such as animal manure, wastewater biosolids, and food/organic waste–in the absence of oxygen.[46] By adopting this method of waste decomposition, many benefits can be implemented within local communities across the state.

[45] https://www.lafayettela.gov/public-works/curbside-services/composting
[46] "The Benefits of Anaerobic Digestion" - https://www.epa.gov/agstar/benefits-anaerobic-digestion

10.3 Benefits of Composting and Anaerobic Digestion

Composting involves minimal efforts, equipment, and expenses. The composted product can help build healthier soil, prevent soil erosion, conserve water, and reduce dependence on store-bought fertilizers and pesticides. [47]

Anaerobic digestion produces two valuable outputs: biogas and digestate. Biogas can be sold and injected into the natural gas distribution system; compressed and used as vehicle fuel; or processed further to generate alternative transportation fuel, energy products, or other advanced bio-chemicals and bio-products.

Digestate is the residual material left after the digestion process. Beneficial applications of digestate include animal bedding, nutrient-rich fertilizer, foundation material for bio-based products, organic-rich compost, and soil amendments.[48]

These processes allow the generation and employment of many benefits, which have the potential to enhance the value of recycling organic material.[49]

10.4 Strategies to Increase Composting and Digestion

Strategies to promote food waste reduction and composting include the following:

- Conduct education workshops on organic waste composting in schools and community-led programs;
- Distribute educational and outreach materials and zero-waste toolkits to businesses to inform them about the economic and environmental benefits of material reuse, waste reduction, and composting;
- Encourage pick-up and delivery of food waste from food service vendors for composting;
- Develop private-public partnership to facilitate turning food scraps into organic fertilizer; and
- Establish grant programs to support organic composting initiatives in universities and schools.

11 Funding and Sustainability

The sustainability of a *Statewide Solid Waste Management Plan*, which includes a recycling program, requires continued commitment by all stakeholders to eliminate waste, recycle, and reuse. In so doing, the state should undertake certain policy, legal, budget, and regulatory reforms.

Funding could be in the form of tax credits, loans, subsidies, or through cooperative agreements and grants. Public and private funding should be easily accessible and priority given to

[47] "Composting at Home" - https://www.epa.gov/recycle/composting-home#whatcom
[48] "How Does Anaerobic Digestion Work" - https://www.epa.gov/agstar/how-does-anaerobic-digestion-work
[49] "Aerobic Composting and Anaerobic Digestion" - https://www.biocycle.net/aerobic-composting-and-anaerobic-digestion/

under-resourced communities. Public-private partnerships should support a circular economy and meet sustainability commitments. [50]

11.1 Federal Grants for Limited Funding

The 2020 Bipartisan Infrastructure Law provides USEPA with funding to administer the Solid Waste Infrastructure for Recycling (SWIFR) [51] Grant Program and the REO Grant Program.[52]

The scope of the SWIFR includes the following:

- Develop or update plans to advance post-consumer materials management;
- Develop, strengthen, and/or implement comprehensive data collection efforts that demonstrate progress towards the National Recycling Goal and Food Loss and Waste Reduction Goal; and
- Support the state-led implementation of plans.

The scope of REO includes the following:

- Inform the public about residential or community recycling programs;
- Provide information about the recycled materials that are accepted as part of a residential or community recycling program that provides for the separate collection of residential solid waste from recycled material; or
- Increase collection rates and decrease contamination in residential and community recycling programs.

LDEQ has applied for grant funding under SWIFR (maximum grant allocation – $1.5 Million) and REO (maximum grant allocation – $2 Million). LDEQ expects approximate notification of any awards during summer 2023.

12 Standardize Measurement and Data Collection

Developing and enacting recycling programs provide an avenue for both public and private collection and recovery of materials. Reporting and data collection are required and needed to further refine programs, identify and address areas that are underserved, understand effective markets, and monitor performance of enacted programs.

[50] EPA, "National Recycling Strategy; Part One of a Series on Building a Circular Economy for All," U.S. EPA Office of Resource, Conservation and Recovery, Washington DC, 2021. [Online]. Available: https://www.epa.gov/system/files/documents/2021-11/final-national-recycling-strategy.pdf

[51] EPA, "Solid Waste Infrastructure for Recycling Grants for States and Territories," 2023. [Online]. Available: https://www.epa.gov/infrastructure/solid-waste-infrastructure-recycling-grants-states-and-territories.

[52] EPA, "Consumer Recycling Education and Outreach Grant Program," 2023. [Online]. Available: https://www.epa.gov/rcra/consumer-recycling-education-and-outreach-grant-program.

Different definitions and measurement practices create challenges in setting goals and tracking progress. To make informed decisions about recycling programs, standardized measurement and data collection methods provide the following:

- Accurate data collection of recycling activities in Louisiana, including annual reports;
- Available and marketable recyclable materials;
- Effective education outreach campaigns;
- Comparison of data across jurisdictions to track progress and make adjustments to meet recycling goals; and
- Data gaps based on previous year reports.

12.1 Develop and Implement Standardized Data Collection, Measures, Targets, and Performance Indicators

Standardized data collection and performance indicators are needed to measure the effectiveness of any recycling program. This effort would improve statewide data availability, support tracking, and measure progress.

Standardized measurement tools produce reports to help analyze collected data and allow communities, employees, and haulers to share best practices and pinpoint areas to improve educational messaging. If utilized, these reports would:

- Measure the effectiveness of education and outreach programs, including standardized measurements for recycling rates and decreases in contamination;
- Generate analytical reports to assess program performance;
- Engage communities by identifying opportunities to provide direction; and
- Create a tracking and reporting plan.

12.2 Increase Data Availability and Transparency

Data regarding the amount of recycled material generated, types of material, and location of materials often are not readily available.

Improving the availability, transparency, and format of data regarding recycled materials would help state and local governmental entities, industry, and other stakeholders make more informed market-development decisions.

13 Recommendations

This SCR13 Report identifies actions toward a comprehensive, holistic effort to successfully expand recycling and promote a circular economy. Future recycling in Louisiana will require multiple approaches and various stakeholders to establish new recycling programs, expand and improve existing programs, and provide long-term sustainability and resiliency. Stakeholders include, but are not limited to, producers of recyclable materials and final products; consumers and generators; waste management companies; local, state, and federal regulators; industry and trade associations; and other environmental agencies and advocates.

Strategies to increase recycling involve education and outreach, incentives, funding, legislation, regulations, and other program policies to overcome complexities and challenges. Education and consumer awareness have proven to be the best methods to increase access to and participation in recycling, decrease contamination, and decrease the flow of recyclables to landfills. Incentives and penalties are also used to promote recycling and waste reduction.

Based on research, the goals and objectives of the NRS, and dialogue with stakeholders, LDEQ recommends the legislature consider establishment of a *Recycling Stakeholder Task Force* to investigate and advance the following strategies to increase recycling in Louisiana:

Legislation, Regulation, and Policies

- Research and utilize existing legislation and develop new recommended legislation as appropriate to incentivize new market opportunities by finding novel ways to use secondary materials as feedstock and technologies to address difficult-to-recycle materials for traditional and advanced recycling.
- Develop financial incentives that align with the desired goal to encourage households and consumers to reduce, reuse, and recycle.
- Research and develop new funding opportunities through grants, partnerships, and legislative initiatives.
- Update *Statewide Solid Waste Management Plan* to maximize recycling and diversion of materials from landfills, advance sustainable materials management practices, incorporate zero waste principles, and minimize GHG emissions.
- Review and modernize current regulatory framework to address:
    - Minimum recycling standards;
    - Standardized recycling requirements;
    - Standardized reporting requirements to provide accurate and relevant data; and
    - Updated local plans and reporting requirements for parishes and municipalities.
- Develop policies and programs that effectively increase circularity of the economy.

Expanded Access

- Expand existing recycling programs.
- Develop policies and programs to increase residential access to recycling.
- Evaluate leveraging and partnering opportunities to develop and increase access to curbside pickup (*i.e.*, weekly, cart-based curbside recycling collection), drop-off centers, and MRFs.
- Evaluate access to recycling and develop updated, targeted recycling goals.

Increase Demand and End-Use

- Work with other state agencies and public and private partners to research and develop MRFs and end-use markets.
- Develop a comprehensive organic waste and food waste reduction program.

Education and Outreach

- Develop a comprehensive public awareness, education, and outreach program.
- Expand coordination, availability, and accessibility of information on recycling at the state and local levels.
- Develop and implement a data collection and reporting system to further refine programs, identify and address areas that are underserved, understand effective markets, and monitor performance of enacted programs.
- Initiate future collaborative dialogue sessions in an effort to modernize recycling programs and markets.

Attachment A: SCR13 (Enrolled)

2022 Regular Session **ENROLLED**

SENATE CONCURRENT RESOLUTION NO. 13

BY SENATORS LAMBERT AND BARROW

A CONCURRENT RESOLUTION

To urge and request the Department of Environmental Quality to study and make recommendations for strategies to increase the recycling of plastic.

WHEREAS, economic development and people's changing patterns of consumption and production have led to a drastic increase in plastic wastes in Louisiana as it has across the globe; and

WHEREAS, the lack of adequate recycling of plastic waste harms the environment and poses threat to human health, and therefore, there is great desire to reduce plastic wastes; and

WHEREAS, a large portion of litter is composed of plastic that negatively effects our environment, our communities, and our economy; and

WHEREAS, this litter directly impacts the environment through habitat destruction in marine and aquatic ecosystems, largely through storm water runoff, and to pet and wildlife injury and death due to litter entanglement, toxicity, and ingestion; and

WHEREAS, according to a study commissioned by Keep Louisiana Beautiful, the direct economic impact of paying to have litter collected and disposed of costs local and state government forty million dollars per year; and

WHEREAS, this forty-million-dollar-per-year price tag is in addition to other direct costs incurred for enforcing litter laws and developing programs and advertisements encouraging and educating citizens on the dangers of litter and the indirect economic impacts including real estate devaluation, loss of new industry and business, and loss of tourism and ecotourism; and

WHEREAS, by consulting with other governmental and nongovernmental entities and the business community, the department can explore innovative strategies and those that have proven successful in other jurisdictions to increase recycling plastic; and

WHEREAS, a flourishing plastic recycling effort would further make the construction and operation of advanced recycling facilities, provided for in Act No. 460 of the 2021 R.S.,

economically feasible by supplying constant material for processing back into basic components to manufacture into new products and thereby reduce litter on our otherwise scenic roadways and waterways; and

WHEREAS, the advanced recycling and recycling facilities would have the additional benefit of creating additional jobs and economic opportunities for our citizens and businesses.

THEREFORE, BE IT RESOLVED that the Legislature of Louisiana does hereby urge and request the Department of Environmental Quality, in consultation with any governmental entity, nongovernmental organization, or stakeholder the department finds useful or necessary, to study strategies to increase the recycling of plastic and to report recommendations to the Senate Committee on Environmental Quality and the House Committee on Natural Resources and Environment by March 10, 2023.

BE IT FURTHER RESOLVED that a copy of this Resolution be transmitted to the secretary of the Department of Environmental Quality.

_____
PRESIDENT OF THE SENATE

_____
SPEAKER OF THE HOUSE OF REPRESENTATIVES

Attachment B: Dialogue Team Participants

Abby Whitmire – Coca-Cola United
Amanda Olson – Waste Management
Andres Harris – Baton Rouge Materials Recycling Facility Republic Services
Bess Foret – Lafayette Consolidated Governments
Brian Landry – Louisiana Chemical Association
Charlotte Pitt – The Recycling Partnership
Clay Richardson – City of New Orleans
Craig Wittig – The Recycling Partnership
Diane Baum – Baum Industries
Donald Hans – Waste Management
Douglas Melancon – Exxon Chemical Corporation
Gregory Guidroz – Louisiana Consolidated Government
Guy Cormier – Louisiana Police Jury Association
Jeremy Jones – NELA Recycles
John Gallagher – Louisiana Municipal Association
Keli Williams – Louisiana Beverage Association and Louisiana Recycling Coalition
Kelia Bingham – Acadiana Planning Commission
Lisa Johnson – Bossier Chamber of Commerce
Lisa Mahoney – Louisiana Recycling Coalition and Louisiana State University
Lisa Richardson – Keep Ouachita Beautiful
Luis Franceschi – Republic Services
Marissa Ambrosi – The Recycling Partnership
Martin Young – Caddo Parish Solid Waste Department
Mike Marchand – Keep Ascension Beautiful
Richard LeBouef – St. Landry Parish Solid Waste Disposal District
Richard Speer – City of Baton Rouge/East Baton Rouge Parish
Shannon Crawford – Waste Management
Susan Russell – Keep Louisiana Beautiful
Trey Godfrey – Baton Rouge Area Chamber
Will Sagar – Southeast Recycling Development Council
Wyvette Pryor-Cousin – Calcasieu Parish Police Jury

Attachment C: ExxonMobil and Advanced Recycling

Transforming plastic waste through advanced recycling

Plastics are essential to a range of products that enable modern life – from protective medical equipment and food preservation wrap to kitchen appliances and car parts. Yet, some plastics are hard to recycle and end up as waste in landfill, incineration or the environment.

ExxonMobil has developed Exxtend™ technology for advanced recycling to enable more of the plastics we rely on every day to be recycled.

Why does advanced recycling matter?
Today, it is estimated that only 9% of plastics are recycled globally, according to the Organization for Economic Co-operation and Development (OECD). Advanced recycling, also called chemical recycling, breaks down hard-to-recycle plastics into raw materials that can be used to make new everyday products. Deploying advanced recycling technologies will expand the range of plastic materials that can be recycled and allow more certified-circular plastics to make their way into food and medical applications with strict regulations, helping to meet growing customer demand.

How does ExxonMobil's Exxtend™ technology for advanced recycling work?
Once sorted and shredded, plastic waste is fed into a conversion unit at ExxonMobil's refinery, mixed with other hydrocarbon liquids, and then broken down into molecular building blocks through the use of heat in the absence of oxygen. This process is based on pyrolysis technology. These resulting molecules are then combined with other feed streams throughout our facility to be made into a variety of critical products.

Because it is impossible to track the molecules that originated from the plastic waste, ExxonMobil uses an accounting methodology called mass balance, similar to the approaches used by the renewable electricity and sustainable farming industries. Following a set of rules established by an internationally-recognized third-party certification system called ISCC PLUS, we sell certified-circular plastics based on the amount of plastic waste we process. These certified-circular plastics have the same quality and performance as our existing products, enabling companies to use them in a range of applications, from high-performance food packaging to personal hygiene products

Processing plastic waste with ExxonMobil's technology also has greenhouse gas emissions advantages compared to using conventional, crude-based feedstocks. Based on a study conducted by Sphera of ExxonMobil's advanced recycling technology in Baytown, processing plastic waste through our technology results in 19% to 49% lower GHG emissions relative to processing the equivalent amount of fossil-based raw materials

What items can be recycled using ExxonMobil's advanced recycling technology that are currently a challenge to recycle via mechanical recycling?
Our advanced recycling technology has the ability to process a range of plastics generally not recycled today, such as: bubble wrap, chip bags, dry cleaner bags, industrial shrink wrap, motor oil bottles, plastic bags, and PEX plastic pipes.

Another example is artificial grass. In California, ExxonMobil is working with TenCate Grass and Cyclyx to recycle artificial turf used in football fields and other venues – a material that previously has gone to landfill.

What is the status of ExxonMobil's operations and plans for advanced recycling?
In December 2022, ExxonMobil started up a large-scale facility in Baytown, Texas – one of North America's largest advanced plastic waste recycling facilities. The facility has capacity to process up to 40,000 metric

tons (80 million pounds) of plastic waste per year. As of startup, the company had already processed more than 6,700 metric tons (nearly 15 million pounds) of plastic waste through pilot operations at the site.

Through these advanced recycling operations in Baytown, ExxonMobil is making sales of ISCC PLUS certified-circular plastics in the U.S., Canada, Mexico, Europe and Asia Pacific, helping to meet customers' goals around the world for circularity. This includes sales to Berry Global, Amcor and Scientex for use in food-safe plastic packaging.

Leveraging existing assets and the technology proven in Baytown, ExxonMobil plans to increase annual advanced recycling capacity to 500,000 metric tons, approximately 1 billion pounds, by year-end 2026 across multiple sites globally, including assessment of our North American sites in Baton Rouge, Beaumont, Joliet, and Sarnia.

What is ExxonMobil doing to improve the collection and sorting of plastic waste?
In January 2021, ExxonMobil formed the joint venture Cyclyx International, together with Agilyx, to develop innovative solutions for collecting, sorting and pre-processing large volumes of plastic waste. The company is investing in Cyclyx's first-of-its-kind plastic waste processing facility in the Houston area, which, upon startup in 2024, will increase access to feedstock for both mechanical and advanced recyclers.

In January 2022, ExxonMobil alongside the City of Houston, Cyclyx, LyondellBasell and FCC Environmental Services formed the Houston Recycling Collaboration, a group whose focus is to significantly increase the community's plastic recycling rate. In December, the Houston Recycling Collaboration launched its first project, expanding collection to nearly all plastics at a recycling drop-off center in Kingwood, Texas. In February, the collaboration announced a project with the Houston Independent School District, collecting plastics at twenty pilot schools, with intention to expand this model at the more than 200 schools across the district.

We're also piloting takeback programs with customers, including a collaboration with Sealed Air and Ahold Delhaize to collect plastic waste from grocery stores and then leverage advanced recycling to process it and attribute it via mass balance accounting to new food-grade packaging used again in the grocery store

To learn more, visit exxonmobil.com/advancedrecycling. To see the technology in action, see this Houston news story.