Sustainable Recycling Market Development Plan

EIERA

Missouri Sustainable Materials Management Plan

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BURNS McDONNELL

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List of Abbreviations

Abbreviation	Term/Phrase/Name
BESS	Battery Energy Storage System
C&D	Construction & Demolition
DOE	Department of Energy
EIERA	Environmental Improvement & Energy Resources Authority
EPR	Extended-Producer-Responsibility
EV	Electric Vehicle
E-waste	Electronic waste
FY	Fiscal year
CI	Industrial, commercial, and institutional
Li-ion	Lithium-ion
MoDNR	Missouri Department of Natural Resources
MOPSC	Missouri Product Stewardship Council
MMDP	Missouri Market Development Program
MRF	Material Recovery Facility
MSW	Municipal solid waste
SMDP	Sustainable Market Development Plan
SMMP	Sustainable Market Development Plan
SOMMP	Sustainable Materials Management Plan
District	Solid Waste Management District
U.S.	United States
U.S. EPA	United States Environmental Protection Agency

Executive Summary

The Sustainable Recycling Market Development Plan (SRMDP), commissioned by the Missouri Environmental Improvement and Energy Resources Authority (EIERA), aims to strategically guide financial assistance from the Missouri Market Development Program (MMDP) toward expanding and stabilizing recycling markets across the state. Market development in recycling links recovered material supply with stable demand through policy, infrastructure, and economic strategies, boosting collection and processing while encouraging manufacturers to use recycled content and redesign production for sustainability. The SRMDP has five strategic goals as follows.

- Support the development of markets for recovered materials and recycled content products.
- Promote the Market Development Program to targeted markets in the state.
- Promote consistent statewide compliance to support diversion.
- Provide targeted distribution of funding through the Missouri Market Development Program.
- Develop and strengthen policies to promote the diversion of recovered materials.

The SRMDP combined state and national recycling trends with key Missouri stakeholder interviews across diverse recycling sectors to identify barriers, assess supply-demand dynamics, and uncover opportunities for market development. The SRMDP outlines five strategic goals focused on advancing Missouri's recycling economy by developing markets, promoting MMDP awareness, optimizing potential funding distribution enhancing regulatory compliance, and strengthening statewide recycling policies.

Missouri's recycling ecosystem faces critical supply and demand imbalances across nearly every material type. For commodities like wood, glass, batteries, and solar panels, existing processing infrastructure operates below capacity despite strong market potential. Conversely, materials like scrap tires and wind turbine blades often experience excess supply with insufficient local demand, forcing export to out-of-state processors. These inconsistencies hinder recycling market efficiency and highlight the need for statewide interventions that align collection, processing, and end-use capacities.

Missouri's recycling sector faces recurring challenges across material types including high transportation costs, material contamination, limited processing infrastructure, and low public participation, particularly in rural and remote areas with underdeveloped collection systems. The SRMDP recommends strategies to support the development of end markets for recovered materials, promotion of recycling participation and use of recycled feedstocks, increasing the impact of the MMDP, prioritizing infrastructure for materials like glass, batteries, and wood, and supporting regional processing hubs to strengthen markets and reduce logistical costs statewide.

Five strategic themes guide the SRMDP's strategy development: Waste Reduction and Infrastructure, Education and Outreach, Compliance, Incentives, and Policies. Each theme is supported by targeted objectives and ranked strategies based on stakeholder prioritization, feasibility for implementation, and transformative potential. Some high-ranking strategies include incentivizing rubberized asphalt use for scrap tires, retrofitting MRFs to process glass, and developing regional battery processing capabilities to meet rising demand for critical materials recovery.

The SRMDP recommends that the MMDP transition from grants alone to a hybrid model that includes low-interest loans. Additionally, strategic policy tools, including support for local leadership initiatives to

increase landfill diversion and exploring statewide sustainable product stewardship initiatives are proposed to bolster landfill diversion and create steady demand. A summary of the objectives for each goal is as follows.

Goal Theme	SRMDP Objectives
Waste Reduction & Infrastructure	• Increase end market demand. • Attract new processing and end-use mill companies to increase critical mineral production.
Education & Outreach/Technical Guidance	• Promote recycling participation and use of recycled materials feedstocks. • Increase Missouri Market Development Program promotion.
Compliance	• Increase landfill diversion of recoverable materials. • Standardize EIERA Market Development Program compliance.
Incentives	• Develop a market sector concentration strategy. • Evaluate modifying market development incentives.
Policies	• Increase landfill diversion rates. • Increase the use of recycling feedstock.

1.0 Introduction

The MMDP was established in 1990 by the EIERA to promote the development of markets for recovered materials.[1] The EIERA engaged Burns & McDonnell Engineering Company, Inc. to develop this SRMDP to strategically direct financial assistance from the Missouri Market Development Program (MMDP) toward growing recycling markets and sustaining demand for recovered materials in the State of Missouri. In addition to the SRMDP, supporting plans were created to address the programs and resources needed to develop a more sustainable management of materials for the state. The supporting plans are included below.

- Sustainable Materials Management Plan (SMMP)
- Sustainable Organic Materials Management Plan (SOMMP)

1.1 Purpose

The goal of recycling market development is to ensure recyclable materials move efficiently from sellers to buyers through stable, economically viable systems by strengthening both the supply and demand sides of the materials economy. On the supply side, market development supports collection, processing, and the availability of quality recyclable materials. On the demand side, market development encourages manufacturers and end-users to incorporate these materials into new products. By aligning supply “push” with demand “pull”, market development creates a more efficient, resilient system that drives investment, reduces waste, and supports a circular economy.

Figure 1-1 shows the dynamics of the recycling market ecosystem.

[1] Environmental Improvement and Energy Resources Authority. (n.d.). Missouri Market Development Program.

Figure 1-1: Recycling Market Ecosystem

Market development can stimulate local economies, create jobs, reduce landfill use, and promote sustainable resource recovery by strengthening existing recycling markets and fostering new ones. This SRMDP supports these goals by identifying market barriers and helping suppliers, processors, and end-users connect and operate more effectively.

The SRMDP is organized into five sections. Section 1.0 provides the purpose, methodology, and goals of the SRMDP. Section 2.0 provides an overview of the EIERA's MMDP and a financial synopsis of the MMDP's grant dispersion by the Missouri Solid Waste Management District (District). Section 3.0 describes key market trends for recyclable material feedstocks and commodities across the nation and in the state. Each supply and demand sub section in Section 3.0 (Section 3.2 through 3.9) defines the characteristics of the commodity recycling system at the national-level, and examines state-level supply and demand dynamics, and state-specific barriers and opportunities. The key commodities analyzed for the SRMDP are single-stream recycling, scrap tires, solar panels, wind turbine blades, Department of Energy (DOE)-designated critical materials, batteries and electronics (e-waste), glass, and wood. Section 4.0 provides key findings and identifies cross-material and infrastructure barriers and opportunities. Section 5.0 outlines tangible goals, objectives, strategies, and action items for the EIERA's MMDP to implement to achieve SRMDP goals.

The SRMDP provides value to a range of stakeholders within the state, including businesses seeking recycling-related market information and opportunities in the state, as well as governmental and nongovernmental entities developing recycling market strategies.

1.2 Goals

The SRMDP aims to strengthen the state's recycling economy by expanding end markets for materials and increasing the use of recovered materials. Five overarching goals were identified in the SRMDP, which act to

drive investment, reduce waste, and support the mission of the EIERA's MMDP across the state. The five SRMDP goals are presented in Table 1-1.

Table 1-1: SRMDP Goals

Theme	Goal
Waste Reduction & Infrastructure	Support the development of markets for recovered materials and recycled content products.
Education & Outreach/Technical Guidance	Promote the EIERA's MMDP to targeted markets in the state.
Compliance	Promote consistent statewide compliance to support diversion.
Incentives	Provide targeted distribution of funding through the Missouri Market Development Program.
Policies	Develop and strengthen policies to promote the diversion of recovered materials.

Section 5.0 of the SRMDP builds upon the goals and provides associated objectives, strategies, and actions designed to guide the EIERA's MMDP and contributing partners toward successful implementation.

1.3 Stakeholder Engagement

The SRMDP was developed using a structured methodology incorporating 16 stakeholder interviews across Missouri and the broader United States, representing a wide range of recycling sectors, from processors to end-market consumers. This process was supported by research into the characteristics of the state's waste system and broader national market trends to assess supply and demand dynamics, identify barriers, and uncover growth opportunities.

The interviews were strategically distributed across key sectors—including single-stream recycling, scrap tires, solar panels, DOE critical materials, battery and e-waste, glass, wood, and other materials—to capture a comprehensive understanding of market conditions. Attempts to schedule interviews for wind turbine and plastics recycling were unsuccessful. The insights gathered provided a well-rounded view of current challenges and opportunities, informing targeted strategies for market development in the state.

For the District analysis presented in Section 2.2, Districts were designated as large metro, small metro, or rural based on population size and defined using the categories and definitions in Table 1-1. These designations were used to compare each District's characteristics, such as the number of available services, facilities, and common challenges and opportunities. The state was analyzed regarding District designations determined by population. Table 1-2 provides the established definitions used to classify service Districts geographically.

Table 1-2: Solid Waste Management District Designation Definitions

District Designation	Definition
Large Metro	Districts with at least one City that has a population greater than 100,000
Small Metro	Districts with at least one City that has a population between 20,000 and 100,000
Rural	Districts without at least one City with a population greater than 20,000

2.0 Missouri Market Development Program

Through the MMDP, EIERA provides financial incentives, technical assistance, and informational services to businesses, governments, and other organizations. Recycling market development helps to ensure that recycling will expand its role in a sustainable Missouri economy, create jobs, conserve resources, contribute to a quality environment, and reduce reliance on Missouri's landfills for disposal of solid waste. To implement this statewide effort, the EIERA is allocated $800,000 annually from Missouri's Solid Waste Management Fund to fund activities that promote the development and maintenance of markets for recovered materials through the MMDP. The Missouri Department of Natural Resources (MoDNR) allocates a portion of annual solid waste tonnage fee revenues to the Solid Waste Management Fund to fund its statewide solid waste management functions.

The MMDP program offers Missouri businesses financial assistance through MMDP to purchase machinery or equipment needed to manufacture products from recovered material or convert recovered material into a feedstock to be used by others. MMDP Financial assistance selection criteria require that applicants have a financially viable project and have already identified feedstock and end markets. Currently, applicants receive more points if they operate in a minimally funded Missouri District (Regions A, B, C, J, N, Q, T) or recycle construction and demolition waste, food waste, organics, and plastics that create challenges with landfill waste management.

2.1 Program Evaluation

Over the past decade, the MMDP has effectively pursued its resource conservation and job creation goals. Over the fiscal years (FY) 2014 through 2023, the MMDP has distributed a total of 52 awards totaling nearly $7.5 million in funds to support recycling efforts for wood, organics, plastics, paper, tires, glass, mattresses, foam, batteries, electronics, and construction and demolition waste (C&D).

The estimated quantities of tons diverted, jobs created, and corresponding value per job and per ton are provided by grant recipients at the application stage. The information is presented for comparison purposes only, as actual jobs created and tons diverted are not measured. The actual value per job and per ton may be different.

Per applicant estimates, MMDP investment in recycling industries led to the diversion of approximately 277,500 tons of material annually and has generated an estimated 326 new jobs in Missouri. Project data suggest for every $27 invested, one ton of material is diverted annually, while every $23,000 invested creates one job. Among the funded material industries, organics, plastics, and wood received the largest share of awards, as shown in Table 2-1.

Table 2-1: Market Development Program Grant Analysis by Material Type, FY 2014-2023

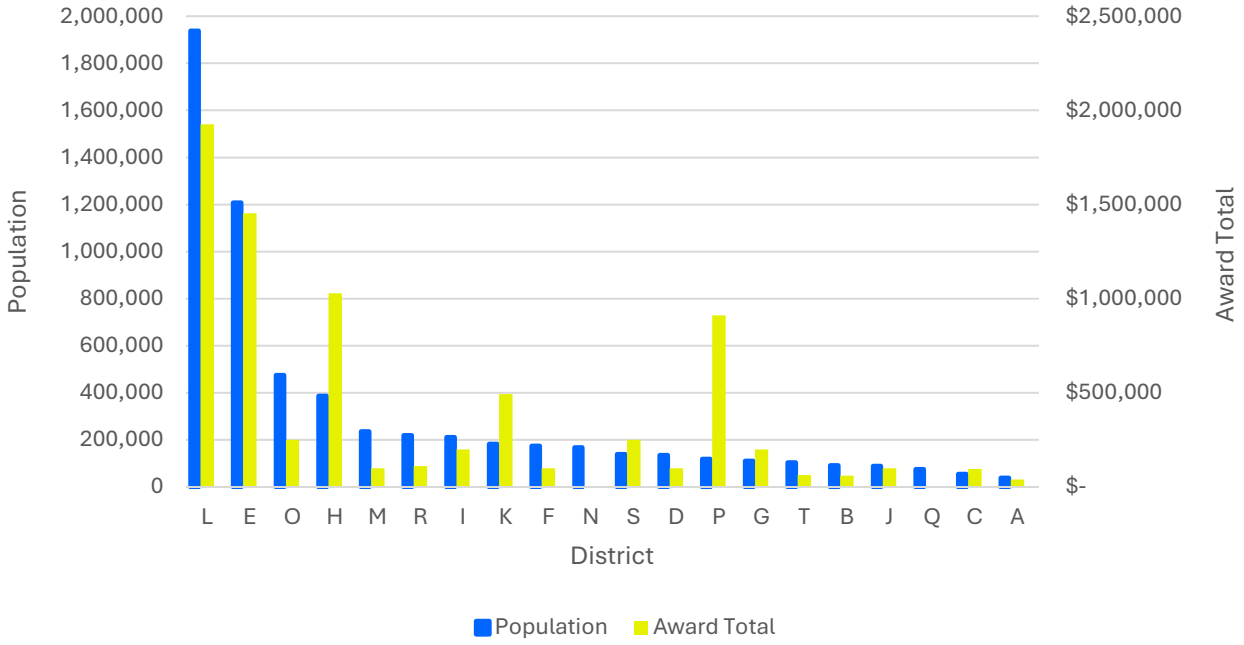
Material Industry	Number of Awards	Award Total	Estimated Tons Diverted Annually	Estimated Jobs Created	Awarded Value per new Estimated Job	Awarded Dollars per Ton Diverted
Organics	13	$2,280,204	111,935	73	$31,236	$20
Plastics	14	$2,082,900	46,696	121	$17,214	$45
Wood	12	$1,302,826	31,246	42	$31,020	$42
Tires	3	$550,000	31,300	15	$36,667	$18
Glass	1	$250,000	1,500	0	$0	$167
Batteries	1	$250,000	3,630	27	$9,259	$69
C&D	1	$240,000	46,800	22	$10,909	$5
Electronics	1	$200,000	2,000	4	$50,000	$100
Foam	3	$139,947	300	12	$11,662	$466
Paper	2	$115,095	416	3	$38,365	$277
Mattresses	1	$73,000	1,677	7	$10,429	$44
TOTAL	**52**	**$7,483,972**	**277,500**	**326**	**$22,957 (Average)**	**$27 (Average)**

2.2 Program Distribution Across Districts Analysis

The state's Districts encompass multiple counties and include cities with differing population levels, recycling infrastructure, and recycling end markets. Each District was created to foster cooperation between cities and counties in managing solid waste properly. Within each District, qualified businesses can apply for financial assistance via the EIERA's MMDP. Figure 2-1 shows a map of the 20 Districts located across the state. Figure 2-2 shows the geographic relationship between the total MMDP funding awarded to businesses within each District and the corresponding population of each District, comparatively. Generally, funding is proportional to the District population. The spike in funding in District P is due to the location of a plastics recycling company that serves communities statewide.

Figure 2-1: Missouri Solid Waste Management Districts Map

Figure 2-2: Market Development Program Grant Analysis by District, FY 2014-2023



3.0 Missouri Recycling Materials Markets

This section presents an assessment of recycling materials supply and demand for each material type included in the SRMDP, including the following.

- A broad description of the recycling systems in the state
- An overview of national and state material flows and markets
- A summary of the supply of recycling materials generated in the state of Missouri
- A summary of the demand for recycling materials generated in the state of Missouri
- A supply and demand comparison
- A summary of barriers and opportunities for the market

Organic materials were not evaluated in this plan. Please see the Missouri Sustainable Organic Materials Management Plan for organic the materials management evaluation. In addition, plastic materials were not evaluated due to the lack of stakeholder response limiting the ability to collect data. However, plastics and packaging materials recycling is captured, in large part, by the evaluation of single-stream recycling materials. The material types evaluated are provided below.

- Single-stream recycling
- Scrap tires
- Solar panels
- Wind turbine blades
- DOE critical materials
- Batteries and e-waste
- Glass
- Wood

3.1 Overview of Missouri Recycling Systems

Below is an overview of the recycling systems in the state by generator and generation location type.

Large Metro Recycling System. Recycling systems are more well-established in large metro Districts. Curbside recycling is widely available for large metro areas, often provided by municipalities or private haulers through contracts or open market arrangements. Households may receive recycling as a default service in conjunction with trash service or opt in for an additional fee. Drop-off sites are plentiful and typically managed by public agencies or nonprofits. Importantly, large metro areas also serve as recycling hubs, hosting most of the state's processing infrastructure through materials recovery facilities (MRFs), making them the cornerstone of statewide recycling operations**.** MRFs utilize labor and machinery to separate recyclables into specific material categories for sale to end-use markets specific to each material type.

Small Metro Recycling System. In the state's small metro Districts, recycling accessibility is more variable. While many communities offer curbside collection, its availability often depends on local contracts and funding arrangements. Households may have curbside recycling service included with trash service, opt-in programs, or none at all. Drop-off options are typically provided by local governments or nonprofit partners. However, some Districts' locations are distant from recycling processing facilities and end markets, meaning

collected recyclables must be shipped elsewhere—often to large metro areas—adding cost and complexity to the system.

Rural Recycling System. Rural recycling systems face the greatest challenges. Access to curbside collection is rare in rural areas, with only a few communities offering the service. Rural drop-off recycling programs are limited and typically reliant on the same municipal and nonprofit partners as urban counterparts, though on a much smaller scale. The absence of recycling processing infrastructure in rural areas results in long transport distances to processing facilities and end markets, increasing cost and hindering sustainability. The low density of recyclables collected, combined with minimal funding and outreach, makes it challenging to build economically viable recycling programs in these regions, leading to underperformance compared to Missouri's more densely populated communities.

Industrial, Commercial, and Institutional Materials Recycling System. In Missouri, industrial, commercial, and institutional (CI) generators typically contract recycling services with private haulers to manage municipal solid waste (MSW) materials generated on-site (e.g., office and cafeteria waste). Recycling can be financially incentivized in locations where disposal is costly, as recycling may be less expensive than trash collection. Where disposal is inexpensive, however, generators often have less financial incentive to recycle and some businesses choose not to do so. Typical recyclable materials collected through the CI sector may be delivered to an MRF that accepts residential materials, to a commercial-only processing facility, or in some cases, directly to an end market.

Construction and Demolition Debris Recycling System. C&D recycling in the state is generally conducted by hiring a hauler directly or by delivering materials directly to a recycling facility. In the state, all landfills, whether sanitary or demolition-waste landfills, must meet the same regulations, consequentially there is less financial incentive to separate C&D waste from MSW. The C&D recycling system is comprised of a few processing facilities – some of which have conveyors and automated sorting while others sort manually.

3.2 Single-Stream Recycling

Single-stream recycling consists of recyclables collected and mixed together instead of source-separated recycling. Common commingled and single-stream materials include cardboard, mixed paper, plastics #1-7, aluminum cans, steel cans, and glass containers. Commingled and single-stream recycling materials streams are common in residential and commercial collection systems. MRFs utilize labor and machinery to separate recyclables into specific material categories for sale to end-use markets specific to each material type.

3.2.1 Characteristics of the Single-Stream Recycling System

Collection. Larger metro areas, such as Kansas City, St. Louis, Springfield, and Columbia, offer residential curbside single-stream recycling collection. Some small metro areas and communities offer drop-off collection centers for residents to deposit single-stream recycling. Commercial entities also collect commingled and single-stream recycling for ease of collection and transportation.

Processing. There are approximately five small- to medium-sized MRFs in the state. Currently, no MRFs accept glass containers in their material streams and do not have the equipment necessary to accept and process glass containers. However, Republic Services is constructing a new MRF in Bridgeton that will accept glass bottles and jars. Additionally, other commercial recycling processing facilities accept commingled and source-separated recycling from commercial sources.

End Markets. Once MRFs and recycling facilities sort the materials into specific types, they are marketed to end-use mills for those specific types. Most sorted materials go to end markets in surrounding states, such as Arkansas, Oklahoma, and Louisiana. Depending on market conditions, plastics are more commonly shipped to states further away or exported to other countries.

3.2.2 Single-Stream Recycling Supply and Demand

The state's supply of single-stream recyclables comprises approximately 60 percent residential and 40 percent commercial sources. A relative lack of single-stream recycling supply exists when considering facility operating capacity. The lack of supply is driven by overall recycling rates that are lower than the potential to capture and recycle the materials. MRF representatives reported that the facilities were running under potential operating capacity. However, the MRF representatives reported selling materials to end-use markets without too much difficulty, even if pricing was not ideal depending on commodity market conditions. Once sorted, most single-stream recycling commodities are shipped to other states for end-use mill consumption.

For drop-off single-stream collection facilities, MRF representatives reported that demand for the materials is less than supply due to the operational challenges of aggregating materials for cost-effective shipping to MRF processing facilities or end-use mills. In addition, drop-off facilities face challenges with regard to funding and staffing challenges.

Supply and demand for specific material types varies based on the material. The cardboard and mixed paper supply is less than the likely demand. Plastics supply and demand dynamics vary based on external market factors, primarily the cost of oil. Generally, the demand for plastics recyclables is less than the supply. #1 PET and #2 HDPE markets are in relative equilibrium. The demand for mixed plastics #3-7 continues to be weak and challenging for facilities to market to end-use mills. The market for #1 PET materials is stronger. However, MRFs are not currently outfitted to capture that specific material separately. Metals supply is less than demand, with facilities seeking additional metal container supply. With no facilities accepting glass containers in the commingled and single-stream materials mix, limited glass container supply and demand exists. One facility representative noted that adding glass containers to curbside single-stream programs could increase supply but require facility retrofits and added cost. Interviewees reported an oversupply of wood pallets from commercial sources relative to demand.

3.2.3 Single-Stream Recycling Barriers and Opportunities

Facility representatives reported the following as significant barriers to expanding single-stream recycling.

- Difficulty securing a sufficient or consistent quantity of recycled materials or feedstock
- Contamination in the single-stream recycling supply increases processing costs
- High cost of obtaining recycled materials compared to landfill tipping fees
- High transportation costs and/or distance to aggregate recycling to end-use markets

Facility representatives recommended the following actions to reduce single-stream recycling barriers.

- Public education aimed at reducing contamination in recyclables and incentives to boost recycling participation
- Minimum recycled content mandates to boost demand for the use of recyclable materials
- Logistics assistance for aggregating supply in rural areas to improve transportation efficiency

3.3 Scrap Tires

Scrap tire recycling involves transforming discarded tires into reusable materials through a series of steps, often involving sorting, shredding, wire removal, and baling. The primary material is rubber, which is often shredded into smaller pieces to create rubber mulch or crumb rubber. Within the rubber are steel wires, which are extracted and sold separately as scrap metal. Additionally, tires contain fibers, made from polyester or nylon, which are also separated and processed. Products from scrap tire recycling are used in applications ranging from playground surfaces to energy generation.

3.3.1 Characteristics of the Scrap Tire Recycling System

Collection. Scrap tires are collected through various methods, including drop-off centers run by local governments, and retailer take-back programs where consumers can return old tires for a fee when purchasing new ones. Additionally, municipalities occasionally hold tire amnesty days for free tire drop-offs. Businesses generating large quantities of scrap tires, such as transportation companies, auto repair shops, and tire dealerships, often have regular collection agreements with tire recycling companies. Missouri Code of State Regulations has an established 50-cent scrap tire fee which is applied to the retail sale of every new tire in the state. This fee contributes to funding a variety of MoDNR scrap tire management activities, such as inspection and enforcement as well as grants. Per state regulations, tires cannot be disposed of in landfills without being quartered or further broken down into smaller pieces. Licensed haulers also collect scrap tires from various sources and transport them to recycling facilities. While these methods help manage the large volume of scrap tires generated annually, illegal dumping of scrap tires remains a persistent problem in Missouri. MoDNR conducts enforcement to combat illegal dumping and manages grant programs to incentivize scrap tire recycling end-use markets.

Processing. Following collection, scrap tires may be refurbished via a retreading process for continued use or stamped, punched, or shredded into new products such as floor mats, gaskets, and other rubber goods. An alternative to reuse or recycling is pyrolysis, which involves heating tires in the absence of oxygen to break them down into oil, gas, and char, which can be used as raw materials for other products. Processed scrap tires in the state are commonly sold to consumers for landscaping as rubber mulch, pellets, and crumb rubber for playground surfaces and asphalt. Additionally, tire processing companies commonly produce tire-derived fuel, which supplements wood, coal, or other combustible materials in power plants and kilns. Lastly, scrap tires may be recycled into rubberized asphalt for application in road building.

End Markets. Cement kilns are the largest users of scrap tires as fuel in Missouri. Nationally, other fuel-related end markets split equally between pulp and paper mills and electric utility boilers. The second largest use of scrap tires is for crumb rubber applications. Mulch, synthetic turf infill, sports and playground surfaces, and thin shavings of rubber (i.e. buffings) from tire retreader operations consume nearly half of the ground rubber produced annually across the nation. Molded and extruded products are the next largest application, used in civil engineering applications, such as lightweight aggregate for drainage purposes.

As the push for sustainable infrastructure grows, rubber-modified asphalt is becoming increasingly popular nationwide, increasing the demand and end markets for recycled scrap tires. For example, states like California, Arizona, and Texas have implemented policies promoting rubberized asphalt use. Other state government programs incentivize companies to use recycled scrap tires in their manufacturing processes. These programs offer grants, funding, and tax incentives to bolster recycling infrastructure, stimulate market development, and encourage innovative uses of recycled tire materials.

3.3.2 Scrap Tires Recycling Supply and Demand

In Missouri, the supply of scrap tires outpaces demand. The state generates approximately 6 million tires per year, with inbound supply generated from up to 250 miles away, spanning the entire state. Overall, the supply of recyclable scrap tires in the state is mainly commercial, approximately 90 percent, with some residential at approximately 10 percent. In 1990, Senate Bill 530 established a scrap tire fee to fund MoDNR scrap tire oversight and management activities. MoDNR's tire program influences the supply of scrap tires for recycling in the state by discouraging illegal disposal and incentivizing end-use markets.

Demand for scrap tires in the state is less than the supply of tires provided by commercial, industrial, and residential industries. Scrap tires for recycling are shipped to multiple states for processing, including Texas and Michigan. Additionally, several companies in the state are involved in processing and recycling scrap tires. Some of these companies process over 72 million pounds of scrap tires per year and are operating slightly over capacity. Due to the excess supply over demand, existing scrap tire processing facilities have the potential to expand to meet the surplus if end market demand increases. In Missouri, the cost of landfilling scrap tires is generally lower than the cost of recycling the tires due to landfill tipping fees and handling fees. This influences the supply and demand dynamics for scrap tires.

3.3.3 Scrap Tires Recycling Barriers and Opportunities

Facility representatives reported the following as significant barriers to expanding scrap tire recycling.

- High cost of obtaining recycled materials (or low tip fee if paid to accept materials)
- Lack of capital for equipment or facility upgrade/expansion
- Insufficient processing capacity for recyclable materials or space constraints
- High transportation cost and/or distance to aggregate or receive incoming recycled materials/feedstock, and transport end products

Facility representatives recommended the following actions to reduce scrap tire recycling barriers.

- Minimum recycled content mandates to boost demand for the use of recyclable materials
- Policies that mandate recycling collection service provision to improve public access to recycling
- Financial assistance for recycling facility update/expansion/equipment, in addition to that already provided via District grants

3.4 Solar Panels

Solar panel recycling in the U.S. is increasing due to expanding solar panel array installation, which may result in damaged, defective, and end-of-life solar panels. Solar panels are recycled for their mixed materials, including glass, metals, and plastics. Up to 90 percent of a solar panel's mass is glass; the remainder are metals and plastics, including silver, aluminum, copper wire, and plastic junction boxes. Panels also contain critical materials like aluminum, tin, tellurium, and antimony, which are often imported due to limited U.S. mining.

3.4.1 Characteristics of the Solar Panel Recycling System

Collection. End-of-life solar panel collection occurs in the residential, commercial, and utility-scale industries. In the residential sector, residents typically lack access to solar panel recycling facilities. In some states, residential and commercial collection is mandated. However, collection is not mandated in Missouri, and entities may decide to landfill the materials rather than seek out a recycle facility. Utility-scale solar

panel recycling is more common due to economies of scale, increasing the economic viability of recycling and potential business mandates to recycle. Solar panel installation services and national companies with recycling and decommissioning capabilities collect panels ready to be recycled. Some end-of-life solar panels contain enough metals, like lead, to meet the definition of hazardous waste under the Resource Conservation and Recovery Act. Handling and disposal of hazardous components is regulated under the Resource Conservation and Recovery Act, impacting transportation costs, material handling procedures, and disposal and recycling options.

Processing. Solar panel recycling involves several steps. First, the solar panels are tested for potential reuse. Then, the aluminum frame, electric wiring, and junction box are removed, followed by the separation and disposal or recycling of glass. The glass is typically shredded to reduce the volume of the material in preparation for transportation to end-use mills. However, solar panel glass is economically challenging to recycle due to its heavy weight, low economic value, and low end-use demand impacted by chemicals in the glass components. The chemicals in the glass make the glass incompatible with other glass recycling processes. Other components, such as copper wire, plastic, and silicon cells, are extracted using high temperatures to loosen adhesives. Toxic metals like lead and cadmium are managed to prevent environmental contamination. Recovered metal materials are processed for recycling. High recycling costs stem from the complexity of the process and the presence of hazardous metals, which increase disposal costs due to regulatory requirements.

Despite having over 20 facilities nationwide, large-scale recycling in the U.S. is limited and inconsistent. The U.S. EPA is developing a proposed rule to add solar panels to universal waste regulations to ease transportation and recycling burdens.

End Markets. Most end markets for end-of-life or damaged solar panels are located in surrounding states, with major processing and recycling facilities in Nevada, Ohio, and Texas. However, there are a few solar panel processing and recycling facilities in the state, one in Louisiana, Missouri and one outside of St. Louis, Missouri, that recycle the panels and then export the recovered materials outside of the U.S. for end-use. The market share of refined materials recovered from solar panels varies depending on the type of end-use material. In general, solar panel glass is challenging to recycle with little end market demand due to the chemical components in the glass components.

3.4.2 Solar Panels Recycling Supply and Demand

The state's solar panel recycling supply is driven by its growing solar power capacity, with significant contributions from residential, commercial, and utility-scale projects. Voluntary recycling in the state is promoted and supported by rebate programs driven by utility companies. As mentioned in Section 3.4.1, at least two companies in the state are processing and recycling solar panels. However, these companies are operating under capacity and need more supply of solar panels.

On the demand side, solar panel recycling in the state is an emerging market, with demand primarily originating from outside the state. A significant barrier facing the demand for solar panels is the high recycling costs compared to landfill disposal. High recycling costs are driven by the complexity of the recycling process, transportation costs, and the fact that some panels contain hazardous waste. On the other hand, the recovered metals are readily recycled. Solar panel glass recycling is challenging due to limited end markets for this type of glass and the potential for associated hazardous materials. Interviewees reported research and development efforts focused on improving the viability of solar panel glass recycling.

3.4.3 Solar Panels Recycling Barriers and Opportunities

Facility representatives reported the following as significant barriers to expanding solar panel recycling.

- High cost of obtaining recycled materials (purchasing the end-of-life panels from users and transportation costs) compared to the costs of landfilling
- Technological issues (e.g., processing equipment that can extract silicon more efficiently)
- High transportation costs and/or distance to aggregate recycling to end-use markets

Facility representatives recommended the following actions to reduce solar panel recycling barriers.

- Public education aimed at reducing contamination in recyclables and incentives to boost recycling participation
- Promotion programs aimed at increasing the purchase of products made with recycled content
- Policies that mandate recycling collection service provision to improve public access to recycling

3.5 Wind Turbine Blades

The wind turbine blade recycling market in the U.S. is expanding as more aging wind turbines are decommissioned. These blades, composed mainly of fiberglass and plastic resin, offer recycling potential, with about 90 percent of a wind turbine's total mass being potentially recyclable. Recycling companies have devised methods to repurpose and separate the fiber-reinforced composites in these blades, recovering their constituent materials to produce new products like cement. Despite the industry's growth, many wind turbine blades still end up in landfills due to insufficient recycling infrastructure, limited end-use markets, and the high costs associated with transportation.

3.5.1 Characteristics of the Wind Turbine Blades Recycling System

Collection. When wind turbine blades are removed, they must be cut into smaller pieces for easier transportation to recycling facilities. The large size and mass of the blades provides transportation and logistical barriers once the blades are decommissioned. Additionally, the cost of transporting the blades to recycling facilities can be prohibitive due to the distance between wind farms and recycling centers.

Processing. The wind turbine recycling process involves two primary methods: mechanical and chemical. Mechanical recycling includes shredding the blades and using the materials primarily as aggregate to produce cement products. Chemical recycling involves pyrolysis, which breaks down composite materials to recover glass fibers and converts the resin into energy, and solvolysis, which dissolves the resin to separate and reuse the glass fibers.

End Markets. The end markets for recycled wind turbine blade materials in the U.S. include a range of buyers. For example, cement manufacturers recycle wind turbine blades into raw materials for cement production as an aggregate additive. Advanced material companies transform the fiberglass from decommissioned blades into high-purity glass fibers for composite applications. Additionally, companies repurpose blade materials into products like recyclable flooring and silicon carbide. These buyers are driving the growth of the wind turbine blade recycling market by finding new and sustainable uses for the materials. Generally, recycling wind turbine blades is more cost-effective than sending them to a landfill. This is because landfills commonly require blades to be ground into small pieces, an expensive and energy-intensive process, and landfill fees can be high due to the large volume and weight of the blades.

3.5.2 Wind Turbine Blades Recycling Supply and Demand

Most wind turbine blades are transported from existing wind farms in the state's northwest corner to the state's only processing facility in Louisiana, Missouri. Processing capacity for retired blades is currently lower than the supply of wind turbine blades. Utilities and power producers are planning future wind farm development throughout the state. As additional wind farms are constructed and turbine blades age, supply for recycling will grow and the demand for localized recycling solutions will increase. Due to the high cost and logistics associated with transporting the massive blades for recycling, localized recycled solutions may increase recycling viability. The state's existing wind turbine blade processing facility is currently operating under capacity. Therefore, demand for recycled wind turbine blades outpace supply. Currently, recyclable blades are primarily sourced from out of state from utility companies.

3.5.3 Wind Turbine Blades Recycling Barriers and Opportunities

The following are significant barriers to the expansion of wind turbine blade recycling.

- Difficulty securing a sufficient or consistent quantity of recycled materials or feedstock
- High transportation cost and/or distance to aggregate or receive incoming recycled materials/feedstock, and transport end products
- Lack of capital for equipment or facility upgrade/expansion

Facility representatives recommended the following actions to reduce wind turbine blade recycling barriers.

- Assistance in aggregating supply in rural areas to improve transportation efficiency
- Promotion programs aimed at increasing the purchase of products made with recycled content
- Contracting best practices guidance to local governments supplying recyclable materials
- Financial assistance for recycling facility update/expansion/equipment
- Increase demand for recycled content materials/products

3.6 Batteries and Electronics

There are many battery types and several ways they can be classified. Batteries are commonly categorized as follows: lead acid, alkaline, portable, EV, and battery energy storage systems (BESS). Additionally, electronics, or e-waste, include all discarded items with an electrical cord or powered by batteries. Batteries and e-waste contain valuable metals, re-usable critical materials and minerals such as nickel, lithium, manganese, and graphite, and hazardous materials, like lead and mercury, that need to be responsibly managed at the end of their useful life to protect humans and the environment. Black mass, plastics, glass, and other metals, such as aluminum and copper, are common end-products produced from recycling batteries and electronics.

In the U.S., the batteries and electronics recycling industries face several significant challenges, including material contamination, which complicates the recycling process. Additionally, the physical difficulties of separating small batteries from electronics housing and shredding smaller electronics pose substantial obstacles. Furthermore, collecting and transporting these items adds another layer of complexity to the recycling efforts.

3.6.1 Characteristics of the Batteries and Electronics Recycling System

Collection. The MoDNR recommends taking all used batteries to facilities for disposal and recycling rather than placing them in household waste containers. Portable batteries are collected for recycling in the state at Household Hazardous Waste collection facilities and during public collection events hosted by cities, counties, and Districts. Some battery recycling companies in Missouri provide mail-in services for non-hazardous used batteries. In addition, businesses and the national non-profit Call2Recycle facilitate commercial drop-off locations. These collection sites include Lowe's, Home Depot, Interstate All Battery Centers, electronics stores, and battery retailers. For the disposal and recycling of EV Li-Ion and BESS batteries, MoDNR recommends consumers refer to the manufacturer's instructions or the automobile dealer for management and end-of-life options.

The state prohibits the disposal of lead-acid batteries in landfills. In Missouri, lead-acid battery recycling is led by wholesalers and retailers, who are required to accept used batteries in exchange for new batteries. Notably, the state is home to one of the world's largest single-site lead-acid battery recycling facilities, located in Boss, Missouri.

Large appliances are recycled through scrap metal dealers due to their steel and valuable metal content. These items can be collected by retailers for a fee, municipal or private haulers for an added fee, or dropped off at municipal sites. Electronics and television recycling by retailers has become less common due to a decline in the availability and accessibility of these recycling services in recent years in the U.S. While electronics are not banned from landfill disposal in the state, many municipalities and counties now offer collection sites or events, often at their own expense, for consumer electronics, small appliances, and other items.

Processing. Once at a processing facility, EV batteries and other battery types are sorted by type, discharged if needed, then dismantled, shredded, and separated into different materials. These processes are followed by shredding and sorting the materials to separate out the copper, aluminum, steel casings, and plastic fluff. The resultant product after sorting and shredding is black mass. Further refining by chemical processes is then required to isolate specific battery-grade minerals from the black mass.

To recycle e-waste, the electronics are sorted, removing the batteries and memory drives. Some facilities factory reset or disassemble electronics and ship components for reuse or recycling, while others use shredders to break materials into smaller pieces for sorting. Magnets separate ferrous metals, and non-ferrous metals are removed mechanically, leaving mostly plastic that may be recycled depending on the type of plastic and quantities generated.

End Markets. The national battery recycling market is projected to grow rapidly over the next decade, with an annual growth rate of approximately 12 percent between 2024 to 2025, alone. This growth is driven by a focus on sustainable practices, government incentives for recycling, rising demand for energy storage solutions, and efforts to develop circular economies. Additional key factors contributing to this growth include the rising demand for Li-ion battery technologies, the need for battery minerals, supportive federal policies, and initiatives to reduce landfill contamination and safely dispose of hazardous materials.

The recovered lead from recycled lead-acid batteries is often reused in new batteries and the sulfuric acid is neutralized and converted into sodium sulfate for use in laundry detergents, glass, and textiles, while the plastic casing can be processed into new plastic products. Alkaline batteries are commonly processed into

zinc and ammonium sulphate fertilizers for the agricultural industry. Additionally, after lead-acid batteries are recycled, the lead is used to manufacture new batteries.

E-waste is one of the fastest-growing solid waste streams globally. The large e-waste recycling market aims to recover valuable materials like metals and plastics from discarded electronics. The leading e-waste recycling standards include Responsible Recycling Standard for Electronics Recyclers and e-Stewards Standard for Responsible Recycling and Reuse of Electronic Equipment certifications. Affiliation help e-waste recyclers demonstrate compliance with local and federal recycling regulations and provide accreditation of labor and environmental standards to recycling facilities across the globe. Currently, there are 13 R2-certified recycling facilities in the state. However, the e-waste recycling market faces significant barriers, primarily related to collection issues and the need for better consumer education and outreach.

3.6.2 Batteries and Electronics Recycling Supply and Demand

In the state, the supply of batteries for recycling is increasing with the growth of EV ownership and the construction of multiple BESS facilities. State facilities that recycle end-of-life Li-ion batteries primarily recycle scrap materials from the automotive manufacturing industry and need more supply. For example, Missouri battery recyclers could consider expanding their capacity to decommission and recycle BESS. In comparison, alkaline battery recycling facilities in Missouri are operating at capacity, with plans to grow, but face funding issues for equipment to support their expansion at a commercial scale. Demand for end-of-life batteries is high, with established lead-acid battery recycling and a growing interest in recycling other types of batteries, like Li-ion and alkaline. Multiple companies in Missouri are known for their large-scale lead battery recycling operations, and other facilities specialize in Li-ion battery recycling and accept a variety of batteries in the Kansas City metro area, including but not limited to Interco Recycling and MRC Electronics Recycling.

E-waste recycling companies operate at 50 percent capacity, facing challenges in supply collection due to consumer habits and the small size of e-waste. Consumers often store used e-waste in their homes rather than transporting these products to recyclers. Increasing awareness and accessibility for e-waste recycling could help address this issue and boost the supply of recyclable materials. In addition to education and outreach needs, the small physical size of e-waste creates challenges in handling e-waste for recycling because specialized equipment is needed to deal with smaller materials for recycling. There is significant demand for e-waste, with companies in the St. Louis and Kansas City areas and beyond seeking more materials for recycling and processing.

3.6.3 Batteries and Electronics Recycling Barriers and Opportunities

Facility representatives reported the following as significant barriers to expanding batteries and electronics recycling.

- Difficulty securing a sufficient or consistent quantity of recycled materials or feedstock
- Existing government regulations and/or enforcement activities
- Lack of capital for equipment or facility upgrade/expansion
- High transportation costs and/or distance to aggregate recycling to end-use markets

Facility representatives recommended the following actions to reduce batteries and electronics recycling barriers.

- Promotion programs aimed at increasing the purchase of products made with recycled content

- Minimum recycled content mandates to boost demand for the use of recycled materials
- Financial assistance for recycling facility update/expansion/equipment

3.7 Department of Energy (DOE) Critical Materials

Critical minerals and materials recycling in the U.S. is gaining momentum due to increasing demand for sustainable practices, international trade challenges and national security concerns. The DOE's critical materials list includes essential minerals and materials such as rare earth elements, lithium, cobalt, nickel, and platinum group metals, which are vital for energy technologies, manufacturing, and national security applications.

Many types of technologies contain critical materials and minerals that can be recycled. These technologies include electric vehicle (EV) lithium-ion (Li-ion) batteries, portable electronics, magnets in defense and medical technologies, and renewable energy technologies.

3.7.1 Characteristics of the DOE Critical Materials Recycling System

Collection. Recycling collection practices for products containing critical materials are driven by federal initiatives and industry efforts. Regulatory agencies, such as the U.S. EPA, also play a significant role in developing best practices and guidelines for collecting batteries and other technologies nationwide. The S\state's e-waste and battery recycling industries and national-scale battery recycling non-profits drive collection practices. Many companies looking to recycle batteries for critical materials prefer state-wide implementation of Extended Producer Responsibility (EPR) regulations. EPR regulations require producers to be responsible for the entire lifecycle of their products, including recycling, which would incentivize manufacturers to design products with easier recyclability and would improve collection efforts.

Processing. Processing and recycling batteries, primarily Li-ion, results in the product referred to as black mass, a lumped or flaked black material comprised of high concentrations of minerals along with impurities. Further refining with chemical processes into battery-grade chemical components is required to recover specific battery-grade minerals from black mass. Li-ion battery recycling poses a unique and serious safety challenge due to the well-documented potential for fire and explosion within recycling plants.

A company in Fredericktown, Missouri, is currently raising funding to expand its Li-ion battery recycling operation and process existing lead mine tailings to produce cobalt, nickel and copper.

End Markets. In the U.S., the end markets for recycled black mass are rapidly expanding due to increased electrification and decarbonization efforts. The automotive sector is a significant market driver. with growing adoption of EVs and hybrid EVs generating a substantial volume of end-of-life batteries. Additionally, the consumer electronics industry is another driver for recycled black mass demand, as these materials are used to produce new devices. The energy storage sector also benefits from recycled black mass, which is used to create a more sustainable power grid.

Despite the growing domestic demand, a significant portion of U.S. black mass is exported to Southeast Asia and South Korea markets due to higher profitability and limited refining capacity in the U.S. To increase domestic processing, federal incentives, such as U.S. DOE grant and loan programs, help de-risk the critical material recycling industry and promote investment into these companies. For example, the DOE's Battery and Critical Mineral Recycling Program funds various entities, including universities, national laboratories, and private companies, to develop innovative recycling methods.

3.7.2 DOE Critical Materials Recycling Supply and Demand

The end-of-life technology supply in Missouri's critical materials recycling market is dominated primarily by battery and e-waste recycling industries. Most of the demand for black mass and other heavy metal processed products is located outside Missouri, in states that have established battery manufacturing facilities near critical materials processing facilities, like Arizona and Ohio. The Missouri University of Science & Technology's Critical Minerals and Materials for Advanced Energy Tech Hub recently received $28.5 million in federal funding to develop innovative recycling and processing methods for critical minerals. University-led projects and programs like this will help drive demand and educational efforts across the state for critical materials recycling.

Most battery and precursor materials manufacturing companies are located outside of the U.S. However, more companies are choosing to locate in the U.S. due to the various federal government funding and tax incentives available. Even though global critical material processing and recycling are primarily located overseas, U.S. demand for these processed materials is high and the industry is growing.

3.7.3 DOE Critical Materials Recycling Barriers and Opportunities

Facility representatives reported the following as significant barriers to expanding critical materials recycling.

- Existing government regulations and/or enforcement activities
- High transportation costs and/or distance to aggregate recycling to end-use markets
- Lack of capital for equipment or facility upgrade/expansion
- Difficulty securing a sufficient or consistent quantity of recycled materials or feedstock

Facility representatives recommended the following actions to reduce DOE critical materials recycling barriers.

- Financial assistance for recycling facility update/expansion/equipment and operating expenses
- Minimum recycled content mandates to boost demand for the use of recycled materials
- Increase the recovery of recycling generated in the state
- Safety risks associated with transporting and recycling lithium-ion batteries

3.8 Glass

Glass can be endlessly recycled by crushing, blending, and melting it with sand and other materials. Various types of glass can be recycled, such as container glass, which includes bottles, jars, and other post-consumer containers from residential and commercial sources. Due to the heavy weight and related transportation costs, glass recycling markets are typically local, with collection and processing solutions varying by region. Nationally, about 80 percent of recovered glass containers are remelted to create new glass containers. This is primarily because manufacturing glass from recycled cullet is cheaper and more energy-efficient than using raw materials, like sand, soda ash, and limestone, to manufacture new glass products.

The main challenges facing glass recycling in the U.S. are non-glass contamination and undersized materials due to single-stream processing system design and a lack of public awareness about where to recycle glass.

3.8.1 Characteristics of the Glass Recycling System

Collection. Recyclable glass is collected curbside, at drop-off centers, commercial sites, and deposit sites at grocery stores or food/beverage facilities. After collection, recycled glass is sent to processing facilities near major population centers. These facilities use optical sorting equipment to remove contamination and produce color and size-separated glass products. The primary source of recycled glass in the state is collected from drop-off location systems. MRFs in the state do not currently accept glass, which limits the supply of glass for recycling and processing facilities in Missouri.

Processing. After collection, recycled glass is transported to recycling facilities where metal, paper, ceramics, stones, and other contaminants are cleaned with pick lines, vibratory screens, air knives, and magnets. Then, the glass is sorted by color and type with optical sorters. The sorted glass is crushed into small pieces known as cullet, which is then further cleaned to remove any impurities. Cullet is then melted in high-temperature furnaces and molded into new glass products, such as bottles and jars. Multiple glass recycling companies are in the state. For example, companies operating in St. Louis and Kansas City recycle glass into new glass containers and fiberglass. Their presence boosts the supply and demand of recyclable glass in the state.

End Markets. Recovered glass from recycling has diverse applications, including glass containers, fiberglass manufacturing, industrial glass beads for highway and petroleum industry use, abrasives for sandblasting, aggregates, fillers in products like paint and flooring, and specialty items like tiles and countertops. When markets are unavailable, glass can be used in road base, concrete and asphalt manufacturing, and as an alternative daily cover at landfills.

3.8.2 Glass Recycling Supply and Demand

In Missouri, the supply of recyclable glass is primarily sourced from drop-off locations, with commercial sources like bars and restaurants contributing about 10 percent. Industrial supply comes from glass manufacturing and medical industries. Glass processing facilities in the state are generally operating at full capacity. However, they plan to expand operations and are open to more supply, pending enhanced collection efforts. At present, certain glass recycling companies in the state report approximately 20 percent participation across metro areas, with private sector collection containers located in many cities, including St. Louis, Kansas City, and Jefferson City. Downstream demand for recycled glass is high in the state due to the concentration of fiberglass manufacturing in Missouri and in Kansas. For example, multiple companies located in Kansas City manufacture fiberglass for vehicles, reinforced panels, and other applications. In addition, companies that recycle glass for a variety of commercial, industrial, and residential applications exist outside of Kansas City, which creates regional demand for recycled glass.

3.8.3 Glass Recycling Barriers and Opportunities

Facility representatives reported the following as significant barriers to the expansion of glass recycling.

- Difficulty securing a sufficient or consistent quantity of recycled materials or feedstock
- High cost of obtaining recycled materials
- High transportation costs and/or distance to aggregate recycling to end-use markets

Facility representatives recommended the following actions to reduce glass recycling barriers.

- Public education aimed at reducing contamination in recyclables and promotional campaigns and/or incentives to boost recycling participation
- Policies that mandate recycling collection service provision to improve public access to recycling
- Assistance in aggregating supply in rural areas to improve transportation efficiency

3.9 Wood

Wood recycling in the U.S. is primarily driven by environmental concerns and the need for sustainable waste management. Sources of wood in MSW include furniture, durable goods like cabinets, and wood packaging and construction materials such as lumber, crates, and pallets. The process involves collecting wood waste from construction sites, demolition projects, and manufacturing processes, followed by sorting, shredding, and grinding. Recycled wood is repurposed into products like mulch, biomass for energy production, compost, and new wood products such as particleboard.

Wood waste recycling receives support through various government-run programs focused on managing construction and demolition waste and renewable energy policies that incentivize biomass energy production.

3.9.1 Characteristics of the Wood Recycling System

Collection. Wood waste is primarily composed of pallets from manufacturing facilities and construction and demolition waste from building sites. Collection of wood waste mixed with other construction and demolition materials often involves separating wood waste from other materials like plastics and paper at the generation source or at specialized facilities. Wood pallets are a significant source of wood waste and are stacked by size and type at manufacturing facilities to be loaded onto trailers.

Processing. Once collected, wood waste is typically processed by chipping, shredding, or grinding to create mulch, animal bedding, or feedstock for bioenergy production. Processing commonly utilizes magnets to remove nails or metals from recyclable wood. Some construction and demolition recycling processing facilities use conveyors, screening equipment, robotic pickers, and optical sorters to sort wood and other waste streams into categories prior to chipping, shredding, or grinding wood waste. Pallets may be reused and refurbished, as necessary, for sale to pallet users. If pallets are beyond repair, they are processed similarly to construction and demolition wood processing.

End Markets. Multiple markets drive the need for recycling wood. The biomass energy sector is a significant market that utilizes wood waste to produce renewable energy. Some of these companies are renewable energy providers, high-energy-content pellet manufacturers, and power plant companies. The agriculture sector utilizes recycled wood for animal bedding and soil conditioners. The manufacturing sector also plays a key role by utilizing recycled wood products to produce wood panels and furniture. Most commonly, wood waste is chipped, shredded, or ground for resale as mulch.

3.9.2 Wood Recycling Supply and Demand

In Missouri, the wood supply for recycling is a geographically balanced mix, sourced from Kansas and Missouri, primarily originating from new construction sites. Challenges such as the distance to the demand market pose significant barriers to increasing the supply of wood waste to recycling companies. Additionally, it is cheaper for companies to send wood waste to landfills than to recycle wood.

The most prominent end market for recycled wood is companies that use wood as biofuels or biomass. For example, at least one regional company utilizes locally sourced recycled wood as biomass for energy. The University of Missouri also uses wood for biomass for campus energy needs, creating additional local market demand for wood. Wood waste generated from construction activities is not as desirable as a mulch product from brush waste.

In general, processing demand for wood waste currently outpaces supply, with construction and demolition recycling processing facilities in the state operating at about 50 percent capacity. On the other hand, end market demand is less than the current supply for recycled wood. The primary market for construction and demolition wood waste is as a feedstock for biomass facilities. However, transportation costs to biomass facilities and price competition with other energy sources does not create sufficient end market demand for recycled wood waste materials. For pallet wood waste, there is an oversupply of pallets, but the demand for reused pallets is soft due to comparatively inexpensive cost of new pallets.

3.9.3 Wood Recycling Barriers and Opportunities

Facility representatives reported the following as significant barriers to the expansion of wood recycling.

- Low demand or prices for outgoing materials/products
- High transportation costs and/or distance to aggregate recycling to end-use markets
- Lack of capital for equipment or facility upgrade/expansion
- Difficulty securing a sufficient or consistent quantity of recycled materials or feedstock

Facility representatives recommended the following actions to reduce wood recycling barriers.

- Financial assistance for recycling facility update/expansion/equipment
- Assistance in finding buyers of processed materials and/or finding suppliers of recyclable materials
- Minimum recycled content mandates to boost demand for the use of recyclable materials (i.e., contractors required to perform diversion on-site)

4.0 Key Findings and Summary

4.1 Summary of Missouri Supply Relative to Missouri Demand

In a balanced economic system, supply and demand are in equilibrium. Towards this end, recycling market development strategies aim to build healthy market conditions for recyclable materials which entails having the following conditions.

- **Supply**. Sufficient quantity and quality of recyclable materials supplied to meet demand, available at a price that buyers are willing to pay and sellers are willing to accept
- **Processing**. Sufficient capacity for processing recyclable materials into usable recycled material feedstock
- **Manufacturing**. Manufacturing capacity is adequate to absorb the processed material and produce recycled content products
- **End-Use Markets**. Final product demand is adequate to absorb the recycled-content products at a price acceptable to the manufacturer

An action in any of these four components (supply, processing, manufacturing, final product end-use) that expands healthy recyclable materials markets can be considered recycling market development.

Supply and demand can vary depending on the economic sector being consider (e.g., point of waste generation, recycling processing facility, and end market). Recalling Figure 1-1, supply can originate from the point of waste generation as a feedstock for recycling processing facilities. Additionally, supply can originate from recycling processing facilities to end-use mills. Similarly, demand derives from both recycling processing facilities and end markets. For example, scrap tires simultaneously has more and less supply than demand. The supply of processed scrap tires is greater than the end market demand for the material. At the same time, scrap tire processing facilities have the ability to expand processing capacity but there is not sufficient end market demand for the product despite a larger supply of scrap tires that can be processed. With multiple economic sectors involved with overlapping supply and demand dynamics, opportunities to increase recycling activities require solutions at the point of waste generation, recycling processing infrastructure, and end markets.

4.2 Cross-Material Barriers and Opportunities

Several of the barriers and opportunities for materials listed above exist for multiple material types. It is helpful to identify cross-material barriers, as actions to address them can improve marketability/markets for multiple materials as opposed to just a single material type. The main cross-material barriers are identified below.

- **Contamination**. Particularly with single-stream recycling, glass, and batteries and e-waste, contamination of materials collected for recycling can degrade materials, resulting in reduced revenue. Contamination can result from a variety of reasons, including a lack of public awareness of what can be accepted in various programs and where to dispose of materials.
    - **Opportunities to improve the quality/decrease the level of contamination of incoming materials or feedstock.** Increasing awareness and conducting outreach to generators, including how materials are processed at recycling processing facilities, can help increase

awareness and decrease contamination. Additionally, developing public education aimed at reducing contamination in recycling streams and associated promotional campaigns can improve recycling operations. Providing financial incentives to recycling processing facilities for sorting equipment upgrades may be beneficial in cutting down contamination levels.

- **Lack of participation where programs are accessible.** Many Missouri residents have access to recycling but do not participate, or do not participate fully (i.e., only recycle a portion of what can be recycled). For example, many residents primarily located in metro areas have access to glass recycling drop-off locations. However, they are unaware of the locations or what type(s) of glass are recyclable.
    - **Opportunities to address the lack of participation.** Lack of participation can be addressed through increasing public awareness by providing and facilitating recycling educational campaigns. Additionally, local ordinances and policies can be implemented that incentivize recycling behavior. Increased drop-off locations geared towards residents for materials like single-stream recycling in locations without curbside programs, scrap tires, solar panels, glass, wood, and batteries and electronics, would also increase supply and participation.
- **Difficulty securing adequate quantity/quality on a regular basis.** Multiple types of recycling and processing facilities face difficulties in securing an adequate and sustainable supply of materials on a regular basis. For example, recycling and processing facilities often compete with landfills for materials, as it is commonly cheaper to landfill materials than to collect and recycle them.
    - **Opportunities to secure adequate materials on a regular basis**. Difficulty in securing an adequate supply of materials may be addressed by employing landfill bans on certain material types, like the State's landfill ban on lead-acid batteries, and adopting or expanding promotional programs aimed at increasing the purchase of products made with recycled content to increase demand. Moreover, adoption of EPR laws requiring producers to manage the end-of-life disposal or recycling of their products would enable producers to take responsibility for the entire lifecycle of their products and would increase public awareness and incentivize participation.
- **Lack of processing infrastructure and capital for new high-cost processing equipment.** For example, facilities in the state that process alkaline batteries into fertilizer products receive enough supply of end-of-life batteries but need capital to expand processing capabilities and purchase more equipment to meet demand. In addition, many types of materials are collected in the state but shipped out of the state for processing and recycling due to a lack of processing facilities in the state. This is particularly true for facilities processing black mass into DOE critical materials, as most processing facilities for Li-ion batteries are located outside of the state.
    - **Opportunities to address the lack of processing infrastructure and high costs of processing equipment**. It is commonly cheaper and easier to develop new facilities at locations with pre-existing access to energy and transportation infrastructure. Therefore, state, District, and municipal initiatives that incentivize brownfield revitalization and retrofitting into processing facilities can address the lack of processing infrastructure located in that respective state. Expanding existing programs, like the EIERA's MMDP, to include low-interest loans would increase the program's ability to incentivize market development, offering assistance to more companies interested in investing in recycling infrastructure.
- **High transportation costs and/or distance to aggregate recycling to end markets.** Transporting materials to and from recycling facilities is costly due to various factors, including permitting and transporting hazardous waste like Li-ion batteries, long-distance transportation to end markets, and aggregating supply from rural areas. For instance, over 50 percent of Li-ion battery recycling costs

originate from transportation alone. Wind turbine blade recycling faces high costs due to the size and weight of the blades, while glass recycling in the state struggles with collection and transportation costs associated with collecting glass outside of metro areas due to transportation distances to processing facilities.

- **Opportunities to address the high transportation costs and/or the distance to aggregate recycling to end markets.** Implementing programs and policies that improve the quality of the recyclable materials and decrease material contamination would help address transportation costs. This would help make transporting the materials more cost-effective. Logistical assistance in aggregating the supply of materials in rural areas would also improve transportation efficiency.

Table 4-2 provides a summary of these key cross-material barriers and opportunities for recyclables, plus additional barriers that are less significant in nature.

Table 4-1: Key Cross-Material Barriers and Opportunities by Material Type

Barrier	Material Type								Opportunity to Address
	Batteries & Electronics	Solar Panels	Single-Stream Recycling	DOE Critical Materials	Glass	Scrap Tires	Wind Turbine Blades	Wood	
Contamination	X		X		X			X	• Conduct outreach to generators
Lack of participation			X		X			X	• Educational campaigns • Local ordinances • Increase retail drop off via EPR
Inconvenient/limited access to recycling opportunities		X				X		X	• Increase retail drop off via EPR
Difficulty securing adequate quantity/quality on a consistent basis	X	X		X				X	• Local ordinances • Increase retail drop off via EPR
Lack of/gap in processing infrastructure	X			X				X	• Expand MMDP to include low-interest loans
Competition with low-cost alternatives to recycling		X				X		X	• Local ordinances • Increase retail drop off via EPR

Barrier	Material Type								Opportunity to Address
	Batteries & Electronics	Solar Panels	Single-Stream Recycling	DOE Critical Materials	Glass	Scrap Tires	Wind Turbine Blades	Wood	
Lack of resources for additional processing equipment	X							X	• Expand the MMDP to include low-interest loans
High cost of sorting/processing	X	X	X	X	X	X		X	• Expand the MMDP to include low-interest loans
Low price for outgoing materials/products	X							X	• Recycling preferred procurement policies
Costly to transport relative to value	X	X		X	X	X	X	X	• Improve quality/decrease contamination to reduce transportation cost
Reluctance of end markets to pay for processed materials		X			X	X			• Recycling preferred procurement policies
Difficulty in securing, training, and retaining the workforce			X						• Job placement program

4.3 Infrastructure Gaps and Needs

This section identifies and describes the types of facility capacity and related infrastructure needed to sustain existing and potentially increase recyclable material volumes. The project team assessed the need for new facility capacity and other related infrastructure based on the information and analysis presented in Sections 1.0 through 4.2 and prior knowledge and experience. Needs were categorized in one of three levels (i.e., low, moderate, or high) for each recyclable material at each recycling stage. Infrastructure sufficiency levels (i.e., strong, moderate, and weak) were also assigned to each recyclable material based on whether the infrastructure at all stages is strong enough to sustain and increase recyclable volumes.

In assessing infrastructure needs for each material category at each recycling stage, the following criteria were used.

- **High:** High need for additional infrastructure.
- **Moderate:** Moderate need for additional infrastructure.

- **Low:** Low need for additional infrastructure.

To assess overall infrastructure sufficiency for each material category, all recycling stages were considered and values were generally assigned, as identified below.

- **Weak:** Infrastructure is insufficient to sustain or expand statewide recycling levels.
- **Moderate:** Infrastructure needs could limit statewide expansion, or there are key needs that should be addressed even if existing infrastructure could support some expansion. Examples include gaps in key geographic regions, material sub-grades, or the performance of existing equipment.
- **Strong:** Infrastructure is sufficient for statewide expansion.

Table 4-3 illustrates these alternative findings, followed by additional details.

Table 4-2: Infrastructure Assessment Findings by Material Type

Material	Infrastructure Needs Key			Existing Infrastructure Key	
	High:	●		Strong:	●
	Medium:	◑		Moderate:	◑
	Low:	○		Weak:	○
	Level of Infrastructure Need			Overall Sufficiency of Existing Infrastructure	
	Collection	Processing	End-Use		
Batteries & E-Waste	◑	◑	◑	◑	
Solar Panels	●	●	●	○	
Single-stream Recycling	◑	◑	◑	◑	
DOE Critical Materials	○	◑	●	◑	
Glass	●	○	○	◑	
Scrap Tires	●	◑	●	◑	
Wind Turbine Blades[1]	◑	○	●	◑	
Wood	○	◑	●	◑	

Wind turbine blade processors declined to participate in interviews. Consequently, the wind turbine blades recycling infrastructure assessment is based on internal research.

4.3.2 Collection and Transportation Infrastructure Needs

Expanding recycling in the state requires collection and transportation infrastructure. While these needs can sometimes be addressed by more effectively utilizing existing infrastructure, in some cases, investments in new infrastructure, such as land, buildings, trucks, and/or equipment, may be necessary.

Recycling Collection Service and Transportation Infrastructure Needs in Rural, Remote Geographic Regions

The infrastructure assessment identified two broad needs specific to remote, rural regions of the state, primarily outside of metro areas. The first is the need for expanded collection systems to increase recycling access in rural and "recycling desert" areas where significant populations are underserved. This assessment is true of all material types. The second is the need for more cost-effective transportation options to move recyclables from remote, rural regions to processing and end-use facilities that are, by and large, located in urban centers.

Materials Affected by Lack of Collection Infrastructure

There are some material types for which a lack of collection infrastructure is a key expansion barrier. They include the following materials.

- **Single-Stream Recycling.** Expansion of single-family, multi-family, and commercial single-stream recycling collection service is important to increase the supply of these materials, supporting the development of single-stream recycling processing facilities and end markets.
- **Solar Panels.** This material is typically only collected by solar panel installation companies.
- **Batteries and E-Waste.** Batteries and e-waste are primarily collected at government-facilitated drop-off locations, which are primarily located in metro areas. Additional collection outlets, stations, and associated battery and e-waste collection infrastructure are needed for Li-ion and alkaline batteries. Implementing EPR laws or partnering with collection companies and commercial industries may increase the collection of these materials.
- **Glass.** Glass is primarily sourced from drop-off locations. Glass processing facilities are generally operating at full capacity but plan to expand operations and need more supply and pick-up locations.
- **Scrap Tires.** Scrap tires are obtained from a range of sources including residential and commercial entities, and commercial industries. Many end up in landfills or are dumped illegally. Better collection infrastructure and collection enforcement mechanisms are needed to ensure collection for recycling.

4.3.3 Processing and End-Use Needs

There are principal processing and end-use manufacturing facility-related needs associated with expanding Missouri recycling.

Enhance MRF Processing Capabilities and Performance

New equipment investments are required to help MRFs sustain current recycling and potentially expand recycling volumes. Ideally, such enhancements, whether satisfied through infrastructure investments or other operational adjustments, will improve MRF economic resiliency while also strengthening and expanding Missouri recycling. This could be done by expanding and retrofitting MRFs to collect and process glass if feasible.

Establish a Regional Battery Processing Facility

After the fire-related closure of the Li-ion battery recycling facility in Fredericktown in 2024, Missouri offers potential for businesses and investors to build Li-ion battery processing capacity in the state. The Missouri

University of Science & Technology's current may prompt development in this sector that creates demand for processing capacity in the state.

Additionally, as the supply of spent EV and BESS batteries grows and as processing technologies are developed in the coming years, sector growth could provide processing capacity that draws recycled batteries from Missouri and neighboring states. While the immediate barriers to this outcome involve funding, research & development and other non-infrastructure barriers, the strategy would ultimately require development of Missouri-based battery recycling processing and end-use capacity.

Expand Tire-Derived Product End-use

The MDNR's scrap tire oversight and management activities help ensure that newly generated scrap tires are collected and managed responsibly. Missouri has an excess supply of scrap tires, creating ample capacity for production of crumb rubber and other tire-derived material feedstocks. Scrap tires are currently shipped out of the state or to a few processing facilities in Missouri. Due to the excess supply of tires, Missouri-based companies have the potential to expand to use the surplus if the end-market demand increases. If other potential higher-value uses for tire-derived materials develop in the state, then updating existing processing to meet supply could occur. Incentivizing companies that use rubber-modified asphalt would facilitate this end-market creation.

Expand Wood-Derived Product End-Use

The demand for wood waste currently outpaces supply. The most prominent end market for recycled wood is companies that use recycled wood waste as biofuel or biomass. Promoting companies that use biomass for fuel could create additional local market demand for wood.

5.0 Goals, Objectives, and Strategies

The primary aim of recycling market development is to maximize the amount of recyclable materials that move through markets from sellers to buyers via economically viable and stable programs. The role of the EIERA's MMDP is to identify and address barriers and inefficiencies in the marketplace and improve markets by encouraging recyclable materials suppliers, manufacturers, processors, and end-users to be more effective players in the marketplace.

Previous sections of the SRMDP analyzed the status of Missouri recycling markets and identified challenges and opportunities for recycling market development. Using these findings, five overarching themes were developed to categorize the resultant objectives, goals, and strategies. The themes were identified based on the associated stakeholders and intent of the related goals, objectives, and strategies summarized in Sections 5.1 through 5.5. The themes for the SRMDP are listed below.

- Waste Reduction and Infrastructure
- Education and Outreach / Technical Guidance
- Compliance
- Incentives
- Policies

The approach to developing tangible goals, objectives, and strategies associated with each theme is two-pronged in nature. The first prong is a set of general, cross-material strategies that expand the EIERA's MMDP's capacity to promote recycling market development, described in Section 4.2. Various contributing partners can use cross-material strategies to capitalize on market development opportunities, benefiting a wide range of materials. The second prong is a set of material-specific strategies that seek to capitalize on opportunities benefiting individual priority materials.

Goals, objectives, and strategies were evaluated through stakeholder engagement activities as described in Section 1.3 and ultimately developed and recommended by the EIERA and MoDNR. All strategies are assigned a priority ranked as high, medium, or low as defined in Table 5-1.

Table 5-1: Strategic Ranking Criteria

Ranking	Estimated Timeframe for Implementation
High	1-3 years
Medium	3-5 years
Low	5-10 years

The following sections are built upon the previous sections and provide tangible goals, objectives, strategies and action items associated with each goal for recommendation to the EIERA's MMDP.

5.1 Waste Reduction and Infrastructure

The primary goal of the Waste Reduction and Infrastructure theme is to support the development of markets for recovered materials and products with recycled content. Three targeted objectives, each with strategies and actions designed to guide the EIERA's MMDP and contributing partners toward successful implementation, support this goal.

The objectives, strategies, and associated actions are detailed below.

GOAL 1 *Support the development of markets for recovered materials and recycled content products.*

Objective 1

Increase end market demand

Strategy 1

Coordinate with the Department of Transportation and transportations stakeholders to consider developing specifications for rubberized asphalt from scrap tires

Priority	*Material Types*	*Contributing Partners*	*District Designations*
Medium	• Scrap Tires	• EIERA • Missouri Department of Transportation	• Statewide

Key Action Items

- Consider developing performance-based specifications for rubberized asphalt
- Gather example policies regarding minimum recycled tire content from other states
- Launch pilot projects and monitor outcomes in the scrap tire recycling industry

Strategy 2

Support MRFs retrofitting to accept glass in single-stream recycling

Priority	*Material Types*	*Contributing Partners*	*District Designations*
Low	• Glass	• EIERA • Districts • Local Governments	• Large Metro

Key Action Items

- Support capital equipment upgrades for glass recovery from single-stream recycling
- Support MRFs to conduct facility-specific engineering assessments and return-on-investment analyses
- Tie support to partnerships with glass beneficiation plants, manufacturers, or local governments that can absorb the recovered materials

Strategy 3

Incentivize waste-to-energy facility development in Missouri for scrap tires

Priority	*Material Types*	*Contributing Partners*	*District Designations*
Medium	• Scrap Tires	• EIERA	• Statewide

Key Action Items

- Provide support for conversion technologies
- Support feasibility studies and market development plans to support early-stage waste-to-energy facility development in the State

Strategy 4

Support research and development on solar panel recycling methodologies

Priority	*Material Types*	*Contributing Partners*	*District Designations*
Low	• Solar Panels	• EIERA	• Statewide

Key Action Items

- Research expected solar panel recycling needs based on existing infrastructure in the state
- Support the extraction of critical minerals from this waste stream

Strategy 5

Support the research and development on wind turbine blades recycling methodologies

Priority	*Material Types*	*Contributing Partners*	*District Designations*
Low	• Wind Turbine Blades	• EIERA	• Statewide

Key Action Items

- Research expected wind turbine blade recycling needs in the state based on existing infrastructure
- Support the extraction of critical minerals from this waste stream

Objective 2

Attract new processing and end-use mill companies to increase critical mineral production

Strategy 1

Support the development of critical materials processing facilities

Priority	*Material Types*	*Contributing Partners*	*District Designations*
High	• Critical Materials	• EIERA • MoDNR • Districts • Local Governments • Department of Economic Development • Missouri Partnership	• Statewide

Key Action Items

- Identify key critical materials/minerals processing stakeholders (private and academic) in Missouri (including the University of Missouri System)
- Host listening sessions/meetings with identified stakeholders to identify specific needs to overcome system development barriers
- Conduct a federal funding landscape review to identify potential funding sources to supplement EIERA or MoDNR financial incentives to offset costs for stakeholders
- Work with economic developers (Missouri Partnership, Missouri Department of Economic Development and local economic development organizations) to promote recycler siting in Missouri

5.2 Education and Outreach/Technical Guidance

The primary goal of the Education and Outreach and Technical Guidance theme is to promote the EIERA's MMDP to targeted markets in the state. This goal is supported by two targeted objectives, each with strategies designed to guide the MMDP and contributing partners toward successful implementation.

The objectives, strategies, and associated actions are detailed below.

GOAL 1 *Promote the Market Development Program to targeted markets in the state.*

Objective 1

Promote recycling participation and use of recycled materials feedstocks

Strategy 1

Develop a unified statewide recycling brand to promote consistent messaging on diversion topics throughout the state (See Sustainable Materials Management Plan)

Priority	*Material Types*	*Contributing Partners*	*District Designations*
High	• All Recovered Material Types	• MoDNR • EIERA • Districts • Local Governments	• Statewide

Key Action Items

- Establish a committee to develop a logo, slogan, website, and print materials and content for consistent messaging statewide to be utilized as desired by Districts and local governments; Under the recycling brand, develop campaign content for recycling, tires, and organics
- Launch a multi-platform public awareness campaign of the created content
- Partner with schools, municipalities, Districts, and local influencers to amplify campaign reach and reinforce recycling behaviors
- Bolster existing recycling initiatives

Strategy 2

Develop contamination reduction guidance to reduce transportation and processing costs

Priority	*Material Types*	*Contributing Partners*	*District Designations*
High	• All Recovered Material Types	• MoDNR • EIERA • Districts • Local Governments	• Statewide

Key Action Items

- Publish contamination reduction guidance and distribute a standardized set of best practices for haulers, MRFs, municipalities, and residents
- Offer technical assistance and standardized signage templates (i.e., provide free bin labels, training materials, etc., to schools, businesses, and local governments)

Strategy 3

Leverage national brands seeking sustainable materials management solutions

Priority	*Material Types*	*Contributing Partners*	*District Designations*
Low	• All Recovered Material Types	• EIERA • Missouri Product Stewardship Council	• Statewide

Key Action Items

- Establish a green supply chain program at the state level (i.e., provide recognition for brands that support sustainable materials management practices or create a formal program inviting national brands with sustainability goals to collaborate on local initiatives

Objective 2

Increase Missouri Market Development Program promotion

Strategy 1

Create and facilitate recycling roundtables and coalitions

Priority	*Material Types*	*Contributing Partners*	*District Designations*
High	• All Recovered Material Types	• EIERA	• Statewide

Key Action Items

- Identify and prioritize commodity types or issue-focus areas that roundtables and coalitions will focus efforts on
- Host semi-annual meetings with guided conversations to learn about issues facing Missouri businesses
- Develop targeted plan for MMDP involvement using findings from roundtable/coalitions discussions

Strategy 2

Develop an outreach campaign specifically targeted at waste generators to raise awareness and encourage participation

Priority	*Material Types*	*Contributing Partners*	*District Designations*
High	• All Recovered Material Types	• MoDNR • EIERA • Districts • Local Governments	• Statewide

Key Action Items

- Add a cross-link to MMDP to the MoDNR website, highlighting MMDP financial incentives and success stories
- Develop fact sheets on recyclable material end-markets per commodity type and note available incentives
- Partner with economic development offices to co-host webinars or lunch-and-learn events for local waste generators and prospective recyclers

5.3 Compliance

The primary goal of the Compliance theme is to promote consistent statewide compliance to support diversion and enforce standardized program compliance with recipients. Two targeted objectives, each with strategies designed to guide the EIERA's MMDP and contributing partners toward successful implementation, support this goal.

The objectives, strategies, and associated actions are detailed below.

GOAL 1 *Promote consistent statewide compliance to support diversion*

Objective 1

Increase landfill diversion of recoverable materials

Strategy 1

Develop model municipal guidance addressing commercial and residential recycling

Priority	*Material Types*	*Contributing Partners*	*District Designations*
Low	• Single-stream	• EIERA • Districts • Local Governments • MoDNR	• Statewide

Key Action Items

- Draft standardized model ordinances and templates that municipalities can adopt or adapt to establish commercial recycling requirements (i.e., templates can outline material types, collection expectations, tenant/landlord responsibilities, and reporting requirements)

Objective 2

Standardize EIERA Market Development Program compliance

Strategy 1

Set grant deadlines for process transparency and effectiveness

Priority	*Material Types*	*Contributing Partners*	*District Designations*
High	• All Recovered Material Types	• EIERA	• Statewide

Key Action Items

- Publish a yearly grant cycle calendar that is easily identifiable online
- Establish and publish transparent guidance and eligibility guidelines

5.4 Incentives

The primary goal of the Incentives theme is to provide targeted funding distribution through the EIERA's MMDP. This goal is supported by two targeted objectives, each with strategies designed to guide the MMDP and contributing partners toward successful implementation.

The objectives, strategies, and associated actions are detailed below.

GOAL 1 *Provide targeted distribution of funding through the Missouri Market Development Program*

Objective 1

Develop a market sector concentration strategy

Strategy 1

Develop a target materials prioritization strategy to concentrate funding efforts

Priority	*Material Types*	*Contributing Partners*	*District Designations*
High	• All Recovered Material Types	• EIERA	• Statewide

Key Action Items

- Utilize SRMDP findings to create a list of material markets to concentrate grant funding for the short, medium, and long-term
- Refine the list and assign priority levels to all markets

Strategy 2

Support the hub-and-spoke model for rural collection infrastructure to reduce transportation costs

Priority	*Material Types*	*Contributing Partners*	*District Designations*
Medium	• All Recovered Material Types	• EIERA • Districts	• Statewide

Key Action Items

- Coordinate with Districts to support creation of centrally located "hub" facilities where rural "spoke" communities can consolidate recyclable materials
- Develop best management practices on creating regional transfer stations or aggregation points in Districts

Objective 2

Evaluate modifying market development incentives

Strategy 1

Evaluate including low-interest loans in the MMDP to extend the impact of funding and target higher-impact projects

Priority	*Material Types*	*Contributing Partners*	*District Designations*
High	• All Recovered Material Types	• EIERA	• Statewide

Key Action Items

- Conduct a statewide study to assess what types of projects are being proposed in Missouri but remain unfunded due to capital constraints
- Evaluate different loan models (e.g., revolving loan fund, public-private partnerships) and simulate repayment terms, interest rates, and default risk under different scenarios to identify the best practices
- Pilot a hybrid loan program to test this financing approach for demonstration projects
- Use outcomes from the pilot to assess repayment performance, applicant satisfaction, and administrative viability before expanding across the state

5.5 Policies

The primary goal of the Policies theme is to develop and strengthen policies to promote the diversion of recovered materials. This goal is supported by two targeted objectives, each with strategies designed to guide the EIERA's MMDP and contributing partners toward successful implementation.

The objectives, strategies, and associated actions are detailed below.

GOAL 1 *Develop and strengthen policies to promote the diversion of recovered materials*

Objective 1

Increase landfill diversion rates

Strategy 1

Increase business and industry recycling

Priority	*Material Types*	*Contributing Partners*	*District Designations*
High	• All Recovered Material Types	• EIERA • Districts	• Statewide

Key Action Items

- Conduct needs assessment to identify underserved areas lacking access to collection and processing infrastructure
- Offer technical assistance to help businesses identify outlets for waste materials
- Offer financial incentives to offset startup costs for new recovered material markets

Strategy 2

Analyze landfill bans of target materials in other states

Priority	*Material Types*	*Contributing Partners*	*District Designations*
Low	• All Recovered Material Types	• EIERA • Missouri Product Stewardship Council	• Statewide

Key Action Items

- Research landfills bans and their effectiveness in other states

Objective 2

Increase the use of recycling feedstock

Strategy 1

Promote existing recycling preferred procurement policies

Priority	*Material Types*	*Contributing Partners*	*District Designations*
High	• All Recovered Material Types	• EIERA	• Statewide

Key Action Items

- Develop and distribute educational materials (one-pagers, best practices guidance, PowerPoint presentation, etc.) targeted to state procurement staff to educate them regarding existing mandatory recycled content procurement standards for commonly purchased goods
- Create a supplier registry and product database
- Provide procurement preference training to state staff

Strategy 2

Explore industry interest in state legislative initatives that promote sustainable material use and stewardship

Priority	*Material Types*	*Contributing Partners*	*District Designations*
Medium	• All Recovered Material Types	• MOPSC • EIERA • MoDNR	• Statewide

Key Action Items

- Evaluate stakeholder and industry interest in legislation enacting Product Stewardship, EPR or landfill ban policy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