DRAFT California's Zero Waste Plan

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Executive Summary

The California Zero Waste Plan, authorized by the 2023 Budget Act (SB 101), is California's circular economy roadmap, identifying innovative solutions to strengthen circular systems while maximizing community, economic, and environmental benefits.

The Problem
Pollution from waste contaminates our air, water, food, and land with billions in health and financial costs.

Ongoing Disparities
Disadvantaged communities with fewer resources suffer from:

- Lower recycling rates
- More illegal dumping and trash pollution

Community-based organizations and California Native American tribes (Tribes) are critical partners to:

- Address ongoing disparities
- Engage community members
- Identify solutions

Waste Disposal Still High
Despite progress expanding compost/recycling and closing incinerators in California, studies show higher disposal of materials with strong reuse and recycling/compost potential.

Benefits of Circularity
Over 40 California local governments already have zero-waste strategies.Circular systems bring healthier, safer, and more prosperous communities.

- Realize $411 billion in annual GDP growth[i]
- Create more than half a million new jobs[ii]
- Avoid $11 billion in health/environmental costs[iii]

The Plan
The Plan is not material-specific and has 15 recommendations in eight areas that prioritize: 1) rethinking design and reducing waste, 2) reusing and repurposing, and 3) recycling.

1. Policy and Regulation
   - Adopt a framework based on the Materials Management Hierarchy (MMH)
   - Review and refine existing policies to align with the MMH
2. Financial Mechanisms
   - Align market signals with circularity
   - Establish sustainable public sector funding
3. Infrastructure for Circularity
   - Reduce challenges for infrastructure development
   - Grow circular businesses and develop systems for material distribution
4. Research and Innovation
   - Support research initiatives and adoption of circular solutions
   - Increase use of circular design principles in products and business models
5. Communication for Cultural and Behavior Change
   - Develop communication and education campaigns based on research
   - Make it easier to find and use zero waste resources and tools
6. Data and Monitoring
   - Expand and standardize data visibility for material types and management
   - Improve and expand data analysis and monitoring
7. Community Engagement and Capacity Building
   - Foster open dialogue with community members
   - Engage and support capacity building for Tribes, rural, and disadvantaged communities
8. Partnerships
   - Lead local, national, and international multi-party collaboration

CalRecycle manages waste but lacks authority over many materials and could serve as California's coordinator for a transition to a circular economy.

CalRecycle's Next Steps
CalRecycle will continue engaging interested parties, working with policymakers, providing technical support, formalizing cross-agency coordination, and partnering with communities. Components of this plan could require expanding CalRecycle's authority. The road to zero waste requires collaboration between state agencies, the private sector, and residents.

Introduction

Our Growing Waste Problem

The increasing convenience of disposable products has driven unprecedented waste.

US per capita consumption of all materials increased almost sixfold—to over 12 tons per person in 2000, nearly doubling again to 23.5 tons by 2020)[iv].

California now sends over six pounds of waste per person, per day to disposal[v] – a total amount equal to the weight of more than seven Golden Gate Bridges daily.

A holistic strategy that reframes California's relationship with materials and products can:

- Reduce the amount of waste disposed of.
- Invest in the economy.
- Improve public health.

Supporting a Healthy Environment for All

Disadvantaged communities face more pollution and harm to public health. The Plan aligns with the multi-state guidance issued by multiple Attorneys Generals, including the Attorney General of California, about the importance of initiatives that address inequities for a healthy environment for all.

Priorities to Make Less and Reuse the Rest

California's Materials Management Hierarchy (MMH) (Figure 1) prioritizes managing materials and products for their highest and best use.

Figure 1: Materials Management Hierarchy

California's Materials Management Hierarchy
The Materials Management Hierarchy outlines actions to reduce waste from most impactful to least desired action.

Rethink to redesign out waste

Reduce to make less waste

Reuse to extend life

Repurpose to give a new life

Recycle to preserve resources

Dispose as a last resort

What is Zero Waste?

Zero Waste is an overall approach to conserving and managing California's resources to protect the environment and health for all by:

- Rethinking design to eliminate waste.
- Reducing what we use.
- Reusing and repurposing what we have.
- Responsibly recycling remaining materials.

What is Circular Economy?

The circular economy can replace today's disposable "take-make-waste" economy by:

- Eliminating waste at the design, sourcing, manufacturing, and distribution stages, and
- **Keeping existing materials and products in use** for as long as possible.

These economic systems would manage materials with their highest and best use (Figure 2), **retaining the value of the materials**.

Zero Waste and Circular Economy Together

The circular economy is how we will create environmental and economically beneficial systems to reach zero waste.

The Materials Management Hierarchy (Figure 1) sets the order of priorities for managing materials with their best and highest use.

Figure 2: Circular Economy

Building a circular economy can fill product and material gaps such as:

- High-value materials with increasing volumes (e.g., food waste, emerging energy transition technologies such as batteries, solar panels)
- Materials with limited value as a resource (e.g., single-use plastics, multi-layer packaging)
- Other materials with service gaps (e.g., non-standard organic waste, urban wood waste, appliances, tires, small electronics such as vaping devices)
- Materials with solution gaps (e.g., disaster debris, recreational vehicle and temporary encampment materials, wind turbines, medical waste, litter and illegal dumping, residuals)

Not all materials and products in California have clear recycling or composting solutions. The Zero Waste Plan offers a path for managing these hard-to-recycle materials through source reduction, while continuing to improve and develop new solutions for recycling.

A Zero Waste Plan for California: Vision, Impacts, and Measuring Success

The Zero Waste Plan, authorized by the 2023 Budget Act (SB 101), is to address all state materials – including those currently outside CalRecycle's authority and materials not currently considered part of a waste stream.

Zero Waste Plan Vision

The Plan will use the terms "materials management" and/or "circular materials management" instead of "waste management" to highlight the importance of highest and best use of materials and products before managing them as "waste."

Unlike prior plans and reports, this Plan does not focus on specific materials or policies or adjust previously set targets. Instead, it makes recommendations on how to move California towards zero waste.

This pivot from California's waste management approach can help surpass existing targets, including source reducing, recycling, or composting at least 75 percent of solid waste. The Plan provides recommendations to build the systems for managing California's materials in each stage of their lifecycle from design and manufacturing to distribution and disposal, retaining their value to California's economy.

Achieving zero waste requires coordinated action across state agencies, local governments, businesses, and communities.

The Plan is designed for flexible implementation to allow adjustments to data, challenges, and innovations. Some Plan recommendations may require action by lawmakers. CalRecycle will lead implementation of actions that can be accomplished in the short term and collaborate on actions that require longer-term strategies.

Economic Value

A full circular transition for California can add **$411 billion in annual GDP, create 531,000 new jobs**[vi]**, and save Californians an estimated $11 billion** in avoided annual health and environmental costs[vii] by 2050. This estimate reflects the economic benefits of shifting industries toward circular business models that prioritize resource efficiency, material reuse, and waste reduction.

Reaching Broader Goals

The circular economy can help reach California's environmental and community goals.

Climate goals, for example, often focus on the energy transition. However, California will reach and potentially exceed its net zero climate emissions goal with zero waste solutions because 45 percent of climate-heating emissions come from how we make products[viii].

Investing in California's Transition

Solutions will require financial and resource investments across the state. Plan recommendations build on existing investments to lower the funding needs.

With expanded resources and authority, CalRecycle could serve as the central coordinator for the circular transformation.

Measuring Success

CalRecycle is committed to tracking progress. Performance indicators evaluate the entire impact of the Plan. For some indicators, methodologies already exist. For others, additional resources may be needed. The exact indicators may also change based on the program. **Eight Key Performance Indicators (KPI)** measure progress across the three areas:

- Our Environment
- Our People
- Our Economy

The proposed KPIs measure progress against the true objectives and impacts of zero waste.

- **Environment KPIs**: source reduction as a key indicator of recycling and composting progress but also measure inputs recycled back into new products, to demonstrate a complete understanding of California's progress on true recycling and composting beyond collection and sorting.
- **People KPIs:** the health benefits of zero waste and track public adoption.
- **Economy KPIs:** the investment impact to our business and public sector leaders.

Cross-Cutting Key Performance Indicators (KPI)

Our Environment

Meaningfully contribute to achieving California's climate and environmental goals.

Source Reduction

Measurable decrease in the amount of waste generated by preventing material usage at its origin through redesign, reuse, repair, or other mechanism to reduce generation.

Recycling Rate

Percentage of waste materials collected and successfully processed into new material inputs for production, reflecting the efficiency and effectiveness of recycling systems.

Environmental Impact

Measured decrease in greenhouse gas emissions associated with waste-related activities, including methane and CO_2 emissions.

Our People

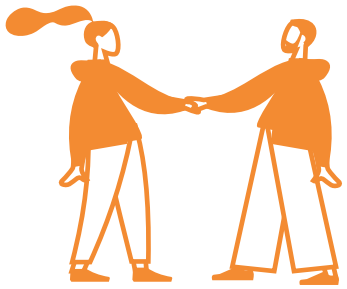
Californians know how and are able to easily participate in key zero waste behaviors.

Adoption

Rate at which zero waste practices and circular economy principles are actively integrated into individual behaviors, community initiatives, and business operations.

Avoided Health Impacts

Reduction in negative health outcomes and associated costs due to improved waste management practices and decreased pollution.



Our Economy

California's economic growth is spurred by zero waste.

Economic Impact

Number of new jobs generated by zero waste and circular economy activities and businesses.

Statewide Investment

Total amount of public and private funding allocated toward circular economy initiatives and Zero Waste infrastructure across California.

Circular Transition

Value of material inputs consumed as compared to GDP by industry; indicating decoupling of resources

Zero Waste Plan Overview and Connections to Baseline Report

The Link Between the July 1 Baseline Report and the Zero Waste Plan

Consistent with SB 101 (Budget Act of 2023), the Baseline Report published in July 2024 evaluated the effectiveness of **existing programs and identified six changes to improve these programs.**

Programmatic and Departmentwide Improvements Needed, from Baseline Report:

- Reaches and surpasses existing waste and emission reduction mandates and goals
- Identifies and addresses gaps and overlaps to make current waste management systems more sustainable, effective, and cohesive
- Improves understanding of the full lifecycle of materials management (including each stage of the material lifecycle from beginning to end) to reduce loss and discourage disposal within a closed loop economy
- Combats environmental health and justice issues associated with the lifecycle of material production, consumption, and waste generation
- Maximizes environmental, social, and economic benefits of a circular economy
- Stimulates growth of our state's circular economy through activities such as:
  - Redesigning products for easy reuse or recycling
  - Implementing infrastructure that reduces waste and enables reuse
  - Developing markets for recycled materials

Status Update on the Implementation of Baseline Report Improvements

While progress has been made in all of the improvement areas identified in the Baseline Report, in many cases it is difficult to determine the extent. For example, while we have data to indicate our recycling rate is improving, we are in the process of analyzing waste characterization data to understand where there may be gaps. This plan identifies recommendations that when implemented will drive California towards further, measurable progress.

Two of the improvement areas: waste emission reductions and combating environmental health and justice issues associated with waste, saw significant progress in the last year with the closing of the final California waste incinerators at the Covanta plant in Stanislaus County and the Southeast Resource Recovery Facility (SERRF) in Long Beach, California. There are a number of recommendations in the report to support communities transitioning away from incinerators to strategies that help achieve air quality goals. Examples of key recommendations include creating a financial mechanism that aligns market signals with zero waste, developing infrastructure to grow circular businesses and develop systems for equitable distribution of materials, and engage with communities to promote continuous and inclusive input from all voices. Every recommendation in the plan prioritizes managing materials consistent with California's Materials Management Hierarchy.

Evaluation of Newly Established and Recently Expanded Programs' Alignment with Intended Goals

Several significant pieces of new and expanded legislation have passed in the last five years. Many of these new laws are still in the rule-making process and have not been fully implemented to the degree that one could evaluate the alignment with intended goals. These include:

- SB 54, the Plastic Pollution Prevention and Packaging Producer Responsibility Act
- SB 707, the Responsible Textile Recovery Act of 2024
- SB 1053, Solid waste: recycled paper bags: standards: carryout bag prohibition
- SB 343, "Truth in Recycling"
- AB 660, Food and beverage products: labeling: quality dates, safety dates, and sell-by dates

SB 1013 and SB 353 both expanded the Container Redemption Value system to include new beverage container types (wine, beer, spirits, and juices in large containers), a change which has already gone into effect. This has increased the total number of containers returned. SB 353 has also worked to increase the viability of recycling centers by adjusting recycling payments to be more in-line with market values. This change has appeared to stabilize the recycling payments for a few commodities which have experienced price fluctuations in the period since the adjustments came into effect (less than one year). A longer review period will be necessary to understand the full picture of impacts.

SB 1013 provides grant funding that focuses on transportation, collection, and processing of empty glass beverage containers. These programs are in various stages of development and implementation.

AB 179 (Budget Bill of 2022) provides grant funding for reusable beverage container infrastructure ($25 M), infrastructure for sorting for cleaner material streams of beverage containers ($50 M), to reclaimers and manufacturers in the Plastic Market Development Program-PMDP ($47 M), and innovation redemption opportunities in the Beverage Container Recycling Program to increase consumer convenience (over $200 M).

SB 1383 has been instrumental in increasing organics diversion from landfill. Approximately 91 percent of jurisdictions in California have residential organics collection, and organics diversion efforts have reduced estimated landfill volumes of organics by 7.5 percent between 2018 and 2021 (most recent Material Characterization Study results).

SB 793, Plastic Minimum Content Standards and Reporting for Beverage Manufacturers, has been in effect since 2022 for reporting. It established recycled content standards for beverage manufacturers that sell more than 16 million units per year, starting at 15 percent recycled content, then increasing to 25 percent in 2025, and up to 50 percent by 2030. A study is currently underway to analyze the availability of PCR material available in the market.

AB 1857 (Zero-Waste Transition Act of 2022) successfully aligned with the intended goal of disincentivizing the use of incinerators as renewable energy and landfill diversion solutions. The legislation redefined incineration as disposal, preventing a portion of incinerated waste to be counted towards a jurisdiction's landfill diversion credit. Adjusted incentives in combination with incinerators no longer being able to classify their energy sold to the market as "renewable energy" and realizing the associate higher rates, resulted in the last two incinerators in California closing over the last two years.

Zero Waste Plan Structure and Its Components

California's transition to a circular and zero waste economy requires a **holistic and adaptable approach**. The Zero Waste Plan is intentionally high-level to provide **clear direction while remaining flexible** enough to accommodate needs and emerging opportunities.

The Plan connects long-term vision with immediate, tangible actions to ensure **lasting environmental, economic, and social benefits**, while aligning interests and fostering collaboration.

Focus Areas: The Plan is organized into **eight Focus Areas**, each representing a thematic area.

These Focus Areas are divided into **five Strategic Pillars** (Policy and Regulation, Financial Mechanisms, Infrastructure for Circularity, Research and Innovation, and Communications for Cultural and Behavioral Change) that address systemic changes needed for materials management and **waste prevention**, as well as **three Cross-Cutting Foundations** (Data and Monitoring, Community Engagement and Capacity Building, and Partnerships) that support implementation of the other recommendations (Figure 3).

Future States: Each Focus Area has an associated **Future State**, which describes the long-term vision for what successful implementation should achieve.

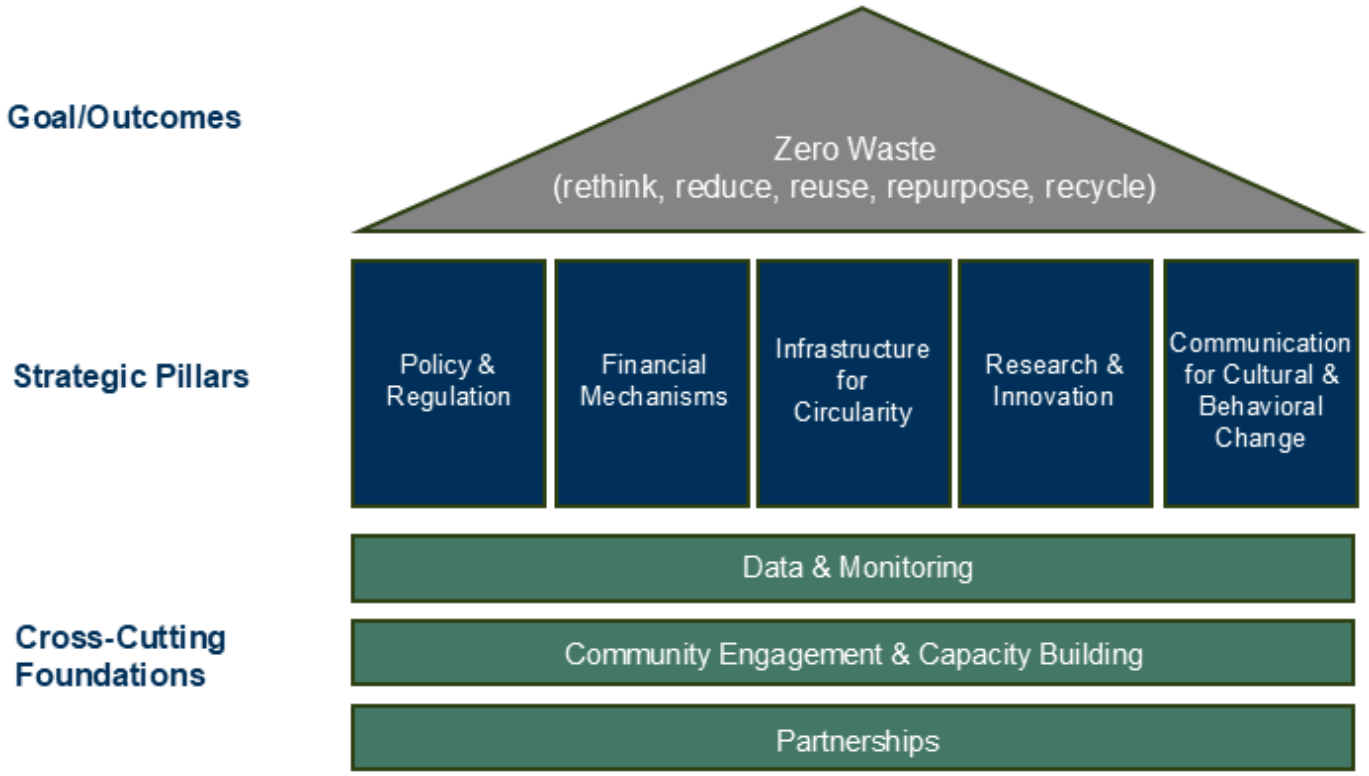


Figure 3: California's Zero Waste Plan

Recommendations: The Plan outlines **15 Recommendations** that are **material-agnostic**, meaning they are intended to be applied to all materials and products. They are **inclusive of both upstream and downstream interventions, demonstrated by example outcomes across the Materials Management Hierarchy**.

Pathways: Each Recommendation includes two to five specific Pathways, which outline **primary avenues for implementing** a given

recommendation. These Pathways are **not exhaustive** – recommendations offer infinite avenues for small- and large-scale initiatives for implementation. The flexibility of these Pathways ensures that the Plan remains **adaptive to new opportunities, technologies, and policies** that support circularity.

Key Actions: The Plan identifies several Key Actions, which are **specific steps for implementation**. These Key Actions serve as a **starting point for implementation** and are not a comprehensive list of every step needed to implement a recommendation.

Key Parties for Implementation: Achieving zero waste requires **action and collaboration across many interested parties**. The individuals and entities who support and execute the actions to implement this Plan are included in each Recommendation table.

Timeline Scenario: In the What's Next for California section, the Zero Waste Plan includes **a 2045 scenario for implementing the 15 zero waste recommendations.** This provides a structured yet flexible approach to planning.

Visual Guide

Focus Area:

thematic areas essential to advancing zero waste

Future State:

long-term vision following a successful implementation of a given Focus Area

Recommendations:

specific actions for California's zero waste transition within each Focus Area

Key Parties for Implementation:

individuals and entities who support and execute the actions to implement a Recommendation

Pathway:

primary avenues for implementing a given Recommendation

Key Action:

specific steps to start implementing a given Recommendation

Figure 4: Visual Guide

Focus Area	Recommendations
Policy and Regulation	A: Adopt a circular-first framework for policies that prioritize highest and best use based on Materials Management Hierarchy
	B: Review and refine existing policies, programs, regulations, and statutes for highest and best use based on Materials Management Hierarchy
Financial Mechanisms	C: Align market signals with zero waste and circular behavior
	D: Establish sustainable public sector funding that supports a circular economy
Infrastructure for Circularity	E: Reduce challenges and increase benefits for infrastructure development and modifications
	F: Grow circular businesses and develop systems for equitable distribution of materials
Research and Innovation	G: Support research initiatives and the development, adoption, and scaling of circular solutions
	H: Increase use of circular design principles in products and business models
Communication for Cultural and Behavioral Change	I: Develop tailored communication and education campaigns based on research of Californians' behaviors, beliefs, needs, and interests
	J: Make it easier to find and use resources and tools for zero waste
Data and Monitoring	K: Expand and standardize data visibility across material types and management pathways through open and crowdsourced data
	L: Improve and expand data analysis and monitoring to inform new solutions and refine existing systems
Cross-Cutting: Community Engagement and Capacity Building	M: Foster open dialogue with community members to integrate continuous and inclusive input from all voices
	N: Proactively engage and support capacity building for Tribal, rural, and environmentally burdened communities to participate in California's circular transition
Cross-Cutting: Partnerships	O. Lead local, national, and international multi-party collaboration to support zero waste implementation

Policy and Regulation

Future State: **Circular principles** are embedded into California government systems and structures, and there is clarity and consistency on zero waste priorities. Policies and programs consistently incentivize circular behavior.

Recommendations:

A. Adopt a circular-first framework for policies that prioritize highest and best use based on Materials Management Hierarchy

B. Review and refine existing policies, programs, regulations, and statutes for highest and best use based on Materials Management Hierarchy

These recommendations integrate zero waste and circular economy principles into programs and policies to enable circular behavior, address material and system gaps, accelerate action, and increase investment in needed infrastructure.

Policy and Regulation example outcomes along the MMH include:

Rethink: Incorporate circular design principles that extend the life of a product

Reduce: Include source reduction requirements to use less materials

Reuse: Revise program and legislation to support reuse, repair, and refurbishment

Repurpose: Expand opportunities for materials management by changing the function of the product or material

Recycle: Redefine what is considered as recycling in California's circular management framework to ensure materials considered to be recycled are returned to use.

Policy and Regulation Recommendations and Pathways:

Policy and Regulation Recommendation A:

Adopt a circular-first framework for policies that prioritize highest and best used based on Materials Management Hierarchy

More than 90 percent of materials in circulation today are virgin materials.[ix] Changes in manufacturing, consumption, and material types have led to disposal volumes that outpace recycling. Expanding CalRecycle's ability to influence materials upstream before waste is generated could reduce overall waste generation and extend material lifecycle. This includes prioritizing higher up on the Materials Management Hierarchy with redesign, reduction, reuse, repurposing and establishing the use of responsible end markets which is a critical component of a circular system and ensures materials are truly recycled.

Pathways for Policy and Regulation Recommendation A:

Two primary pathways for exploration have been identified to support the adoption of a California circular materials management framework to develop and implement policies that prioritize waste prevention and proactive circular materials management.

Value for Economy:
Businesses are more **predictably able to reduce operational costs** when waste regulations are clear, consistent, and navigable.

First Cycle	2028-2040
Key Parties for Implementation	CalRecycle, Elected Officials, State Agencies, Local Jurisdictions
Pathway	**Key Action**
A1: Develop a circular-first framework to guide policy design, implementation, and materials management, and work with relevant agencies to include circularity in policy development A framework can help align statutes, policies, and regulations for coordinated materials management across state agencies. Additional analysis is needed to identify where there are gaps, including for materials not under CalRecycle's authority, that enable cross-agency collaboration. Best practices could incorporate zero waste into the legislative and regulatory processes, including checklists during the legislative analysis and regulatory processes, cross-education of lawmakers and decision makers on zero waste, and cross-agency sharing for on-going materials management. This pathway could model Extended Producer Responsibility (EPR) frameworks and policies, e.g., incorporate producers into the management process, consider upstream options including redesign, and provide compliance and enforcement mechanisms.	Identify priority areas based on Materials Management Hierarchy
	Host workshops with interested parties to identify key circular policy opportunities for increasing source reduction
	Educate policymakers to increase understanding of zero waste, in particular source reduction, and connections across state policies, legislation, and regulations
	Draft and publish circular materials management framework
	Pilot the framework within existing authority
	Review policies from other agencies for circular potential
	Collaborate with relevant agencies to incorporate circular criteria into their policy development processes
	Highlight impacts/benefits of new policies that successfully adopt circular frameworks to interested parties
A2: Elevate circular economy as a key avenue for meeting California's key environmental, economic, health, and equity goals	Conduct collaborative review of California's statewide goals for circular integration opportunities

This would leverage the Zero Waste Plan and existing initiatives to demonstrate the links to other statewide goals and communicate the concepts of zero waste and circular economy to those engaged in working towards other priority goals.	Integrate circular economy priorities into statewide environmental and equity strategies
	Develop a public engagement strategy to raise awareness about circular economy benefits and impact on California goals
	Set measurable KPIs to track progress in achieving state goals supported by circular economy principles

Policy and Regulation Recommendation B:

Review and refine existing policies, programs, regulations, and statutes for highest and best use based on Materials Management Hierarchy

Redesigning systems for circularity uses less materials and keeps products in use for as long as possible to preserve material value and reduce waste.

Pathways for Policy and Regulation Recommendation B:

Three primary pathways for exploration have been identified to support reviewing and refining existing policies, programs, regulations, and statutes to align incentives and requirements with materials' highest and best use.

First Cycle	2027-2039
Key Parties for Implementation	CalRecycle, Elected Officials, State Agencies, Local Jurisdictions
Pathway	**Key Action**
B1: Review key policies across state agencies to address gaps/overlaps and revise them for highest and best use at each decision point. This pathway includes: • Aligning statutes, regulations, and policies as well as rules, targets, and definitions to support the highest and best use principles • Simplifying policies where allowed action is unclear, definitions/guidance/targets are conflicting, or where current fees or financial structures disincentivize upstream solutions • Coordinating across state agencies to address conflicts with circular behavior or standardize definitions and reporting. SB 1383 has demonstrated what is possible through statute and regulations by expanding opportunities to manage organics and edible food recovery.	Review and refine existing policies, programs, regulations, and statutes to identify where we need to align definitions, incentives, and requirements with materials' highest and best use Establish cross-agency materials management collaboration groups to share findings and discuss alignment, where necessary Draft and socialize unified definitions, targets, and rules for key terminology. Collaborate on solutions (e.g., proposals) for adjustments to policy implementation via cross-agency collaboration group Identify implications of adjustments and develop consensus-based recommendations Submit final recommendations to relevant policymaking bodies where necessary for approval
B2: Adopt proactive strategy for shared responsibility (new and existing) of circular materials management and responsible end market development across CalRecycle, other agencies, and local governments This pathway involves collaboration to address overlapping policies that would clarify ownership and solutions (e.g., to manage agricultural materials, universal waste, C&D).	Develop cross-agency frameworks, including new statutory requirements, as needed, for shared responsibility in managing circular materials Where feasible, align local, state, and federal initiatives to support end-market development for circular materials

Successful collaborations such as **Pacific Coast Food Waste Commitment** could be a good model. Learning from interagency collaborations that work with rural and/or Tribal communities for circularity would enhance this effort. This could also expand into existing programs. For example, the State Agency Buy Recycled Campaign could broaden covered products or increase procurement of remanufactured or repairable products.	Provide tools and guidance to local governments for implementing circular strategies
B3: Adopt state-wide policies to address influx of sources of high volume and/or valuable waste, or materials of concern This pathway can develop policies to address emerging issues and materials that need solutions, such as wood, products with lithium, and contamination in the organics stream. For example: • Developing a strategy for high volume materials or high-value materials (e.g., energy transition materials) • • Creating policies focused higher on the Materials Management Hierarchy • Collaborating with agencies managing non-traditional materials.	Identify material streams of concern
	Convene working sessions for each material stream to inform strategy for material management
	Draft strategy for each high priority material stream
	Conduct public consultation and feedback
	Finalize and adopt circular strategy for each high priority material stream
	Implement, monitor, and evaluate each strategy's impact

Case Study

Edible Food Recovery in California

Copia is a technology company reducing food waste and combating hunger by connecting businesses with surplus food to local nonprofits. Since February 2020, Sutter Health has used Copia's platform across 16 hospitals in Northern California to divert excess hospital food to communities in need. Food service employees track surplus food and submit donations using Copia's software, which dispatches drivers to deliver it to nearby nonprofits. This system optimizes purchasing decisions, reduces waste, and maximizes tax benefits for businesses. **In 2023 alone, Copia helped deliver 68,600 meals from Sutter hospitals to 45 nonprofits serving food-insecure populations. These efforts saved 18.8 million gallons of water, 253,400 pounds of CO2 emissions, and 12,900 gallons of gas.**

Copia facilitates food pickup through a streamlined logistics system, ensuring that donations are matched with nearby nonprofits, to minimize transportation time and maintain food quality. Copia has diverted over 7 million pounds of edible food from landfills with their commercial (for-profit) model. Donations were distributed to shelters, family support centers, and food recovery programs.

With an estimated 1.5 million tons of donatable food sent to landfills annually in California and 20 percent of Californians facing food insecurity, food recovery engines and solution providers can make edible food recovery easy and financially attractive while supporting SB 1383 compliance. CalRecycle can accelerate food recovery and improve compliance visibility by connecting large food generators to food recovery engines such as Copia.[x]

Financial Mechanisms

Future State: Market signals and public sector funding are aligned with circular economy principles and provide a stable source of funding to accelerate California's circular economy.

Recommendations

C. Align market signals with zero waste and circular behavior

D. Establish sustainable public sector funding that supports a circular economy

Shifting economic incentives and investments will grow circular economy jobs, reduce material loss, and keep critical resources within the state.

Financial Mechanisms example outcomes along the MMH include:

Rethink: Dedicate economic development funding for companies developing circular solutions

Reduce: Expand state funding for food waste reduction efforts

Reuse: Reduce sales tax on remanufactured products

Repurpose: Provide funding options for circular businesses that repurpose materials into new items

Recycle: Develop EPR program for low volume, hard to recycle products such as solar panels.

Financial Mechanisms Recommendations and Pathways:

Financial Mechanisms Recommendation C:

Align market signals with zero waste and circular behavior

Current financial systems in California and around the world often make disposal a cheaper option compared to circular solutions, putting the cost of waste reduction or diversion on jurisdictions and residents. This is due to subsidies and pricing structures that favor material extraction and energy use, externalizing environmental and human health costs. California has successfully used economic tools to promote sustainability (e.g., emissions reductions) and could apply similar strategies to align market signals and support circular economy efforts that are higher up on the Materials Management Hierarchy like redesign and reduction.

Pathways for Financial Mechanisms Recommendation C:

Three primary pathways for exploration have been identified to align market signals with zero waste and circular behavior.

First Cycle	2027-2039
Key Parties for Implementation	CalRecycle, State of California, State Agencies, Local Jurisdictions, Non-governmental/Community Based Organizations, Foundations, Federal Government, Impact Investors, Tribes, Corporate Enablers, Waste Collectors/Haulers
Pathway	**Key Action**
C1: Review prices set by public-sector and revise as needed to incentivize circular behavior This pathway could include: • Increasing the cost of undesirable behavior and/or decreasing the cost of zero waste-aligned behavior • Creating EPR programs with producer fees to fund reuse and recycling • Implementing new recycled content mandates • Increasing landfill fees overall or specifically for materials with strong reuse or recycling markets • Expanding the application and amounts of grants, loans, and enforcement penalties.	Conduct a study to identify effective price signals for circular behaviors Convene working group to facilitate pricing mechanism adjustments through public and private parties Make outlines/guidelines to adjust pricing mechanisms to favor circular practices Pursue policy change for price signal adjustments Monitor market responses and make additional changes, if needed
C2: Support local jurisdictions in expanding circular solutions and services while minimizing rate-payer burden This pathway would support local governments with funding and technical assistance to create cost-effective solutions like resource recovery parks, edible food recovery, repair cafes, refilleries, community composting, and lending libraries. It can take the form of: • Advising or facilitating guidance on rate structures and contracting • Reducing regulatory costs (e.g., Environmental Impact Report or EIR requirements) for new infrastructure • Supporting development of regional infrastructure to alleviate local costs • Advising development of reuse infrastructure • Investing in innovative, circular services • Supporting access to external funding sources, loans and other financing.	Conduct listening sessions on local jurisdiction successes and challenges with expanding circular infrastructure and services and develop action steps Identify funding sources and develop and/or expand grant and loan programs to support local circular initiatives Provide technical assistance for local jurisdictions in implementing circular solutions Pursue policy change that provides additional financial support

C3: Support the financial viability of businesses with circular services to enable them to mature and scale This pathway could address financial barriers faced by circular businesses through incentives and support such as: • Reducing permit costs or approval times (e.g., programmatic EIRs) • Expanding or creating new EPR programs that financially support circular business models • Prioritizing investments for disadvantaged communities • Providing access to technical resources e.g., grant application support, GO-Biz permitting assistance • Progressive adjustments to tax structures (i.e., lower rates for lower incomes) to reduce labor and tax burden costs	Conduct a study of financial barriers and necessary support Identify funding opportunities and sources and develop funding or incentive programs to reduce cost burdens Promote partnerships between public and private sectors for financial accessibility

Financial Mechanisms Recommendation D:

Establish sustainable public sector funding that supports a circular economy

Value for People:
Residents and small businesses save money with affordable zero waste services and better access to reuse options.

This recommendation seeks to establish sustainable public sector funding to support California's zero waste efforts and ensure the long-term financial viability of CalRecycle's work.

A significant portion of CalRecycle's implementation costs are funded by landfill tip fees, but as recycling increases and disposal drops, these revenues shrink—creating a funding gap that conflicts with the state's zero waste goals. The Integrated Waste Management Account Disposal Tipping Fee has remained at $1.40 per ton since 1995, with statute prohibiting further adjustments for inflation. The California Air Resources Board Short-Lived Climate Pollutant Reduction Strategy highlighted the need to adjust funding mechanisms to provide consistent financial and institutional support for CalRecycle's evolving priorities.[xi] CalRecycle's 2015 report on **Landfill Tipping Fees in California** also addressed this issue, emphasizing the need for updated funding strategies to ensure sustainable waste management practices.

Other sources of state funding, beyond funds generated from the Tipping Fee, typically have strict limitations for use as dictated by the funding source. Funding use is also restricted to ensure focus on implementation of existing regulations. At the local level, programs and administrative costs are funded by ratepayer dollars, and these mechanisms do not often reward or incentivize waste reduction or diversion.

Pathways for Financial Mechanisms Recommendation D:

Three primary pathways for exploration have been identified to establish sustainable public sector funding that supports California's circular transition.

First Cycle	2027-2039
Key Parties for Implementation	CalRecycle, State of California, State Agencies, Local Jurisdictions, Federal Government, Impact Investors, Traditional Financial Institutions
Pathway	**Key Action**
D1: Redesign public sector funding for materials management to align with circular outcomes	Assess current public sector funding mechanisms and identify gaps and opportunities for adjustments
This pathway involves restructuring CalRecycle's funding sources to ensure they are not solely reliant on landfill tip fees.	Create a framework to guide new/revised funding mechanisms for circular solutions
New financial structures should prioritize and reward activities in line with the MMH to ensure materials are turned into new products through responsible end markets.	Develop working groups with relevant parties to identify adjustments that align funding and financial incentives with zero waste priorities
	Implement revised funding structure(s) which prioritize zero waste outcomes
D2: Expand flexibility of funding use to align with circular principles	Review and identify gaps where public sector funding does not support circular systems (where appropriate)
Future zero waste legislation could direct general fund use to ensure MMH considerations are included in fund allocation	Identify policy changes to address gaps, fund circularity, and prioritize activities (e.g., those with responsible end markets)
Flexibility in funding could also allow more investments that optimize community benefits, fill in gaps for overburdened communities, and prioritize disadvantaged communities.	Adjust grant and loan criteria to provide funding for early-stage innovations and developments.
Public funds could seed private investment through tools like risk guarantees, revenue sharing, and technical support.	Utilize existing monitoring systems to ensure funding allocation supports zero waste transitions
D3: Integrate circular funding mechanisms into other state agencies' programs	Identify opportunities for cross-agency circular funding collaboration
Circular economy funding should be incorporated across all agencies responsible for materials management. By creating financial incentives within other agencies, this pathway can increase the impact of circular initiatives and develop California-based responsible end markets.	Pilot funding mechanisms for circular solutions
	Encourage state agencies to develop and implement a materials management plan for material generated/created by their individual policies
	Develop interagency coordination and oversight

Case Study

Decoupling Revenue from Consumption

The electric utility industry offers an example of how we might design financial structures that separate revenue from consumption.

Decoupling strategies reduce or reevaluate the connection between consumption and revenue by increasing a utility's certainty of revenue and investing in lower cost efficiency initiatives with equal or greater returns compared to high-cost generation investments. Simultaneously, rate payers are incentivized to conserve electricity with a lower fixed fee and higher usage charges.

Electric utility revenues and rates have historically been driven by consumption. Rate payers were charged per kwh consumed—the more electricity used, the more a utility earned. This volumetric rate and revenue structure was challenging for utilities:

1. Higher financial risk: Volumetric rates result in higher volatility in revenues
2. Profitability depended on consumption: Utility costs are largely driven by the fixed costs of operating facilities and infrastructure, which limit the ability to reduce operational costs. Profitability depended on increased electricity sales and electricity consumption
3. Disincentivized efficiency: Energy efficiency initiatives required complex structures or financial loss from reduced consumption

An NRDC analysis of five investor-owned utilities in the years following decoupling showed a 131 percent – 425 percent increase in energy efficiency investments and 28 percent – 438 percent increase in MWh savings, reducing operating costs.[xii]

Infrastructure for Circularity

Future State: California has expanded physical and non-physical infrastructure to make it easy and/or desirable to prevent materials from becoming “waste.”

Recommendations:

E. Reduce challenges and increase benefits for infrastructure development and modifications

F. Grow circular businesses and develop systems for equitable distribution of materials

Infrastructure that aligns with activities higher on the Materials Management Hierarchy (e.g., reuse, repair, refill) will be important for zero waste. Building the needed infrastructure to transition to a circular economy will require collaboration across many groups.

Infrastructure for Circularity example outcomes along the MMH include:

Rethink: Invest in lending libraries tailored to community priorities in economically disadvantaged communities

Reduce: Identify retrofits that increase facility capacity and avoid new infrastructure

Reuse: Repurpose existing supply chain infrastructure to expand rescue of edible food

Repurpose: Support infrastructure upgrades that maximize value through repurposing of materials

Recycle: Upgrade Material Recovery Facilities to enable more efficient, effective, and safe processing of disaster debris to recover valuable materials

Infrastructure for Circularity Recommendations and Pathways:

Value for Economy:
Local governments reduce waste costs and create **stable, local jobs** through circular infrastructure investments.

Infrastructure for Circularity Recommendation E:

Reduce challenges and increase benefits for infrastructure development and modifications

This recommendation is driven by the need to build more zero waste infrastructure capacity while maintaining environmental protections through coordination between industry partners, optimization of existing infrastructure, and partnerships with existing networks to share resources and expertise.

The ambitious scope of California's 75 percent target as well as recent new legislation, such as SB 1383 and SB 54, highlight the need to expand existing capacity of infrastructure.[xiii]. Today's Material Recovery Facilities (MRF) are not as efficient as they could be and well behind the target processing rate of 95 percent hovering on average at 87 percent processing efficiency.[xiv] CalRecycle's grants have improved infrastructure and added processing equipment, resulting in increased diversion.

Pathways for Infrastructure for Circularity Recommendation E:

Four primary pathways for exploration have been identified to support reducing barriers for infrastructure development and modifications.

First Cycle	2027-2035
Key Parties for Implementation	CalRecycle, State Agencies, Local Government/Jurisdictions, Infrastructure Owners/Haulers, Technology Providers, Producers/Manufacturers, Raw Material Suppliers, Tribes, Intermediate Manufacturers, Secondary Manufacturers, Wholesalers/Distributors, Material Recovery Facilities, Composting/In-Vessel Digestion Businesses
Pathway	**Key Action**
E1: Improve timelines for permits and reduce uncertainty in the permitting process With this pathway, timelines for getting permits or zoning challenges with regulatory entities could be reduced (e.g., through parallel permitting path reviews and inputs such as consolidated permitting). Technical assistance in the permitting process for new or expanded infrastructure projects could reduce uncertainty.	Examine common permitting processes and challenges (e.g., time, cost, zoning) through interested party and interagency consultation
	Collaborate with interested parties to develop and test solutions to identified challenges (e.g., Emission Reduction Credit funding challenges, siting challenges)
	Develop and implement best practices for community engagement in the permitting process, including guidance for community members.
	Develop and publish tools to reduce process redundancy such as model community benefit agreements and Programmatic EIRs. (e.g., current Programmatic EIR for in-vessel digestion)
	Provide updates to the General Plan Guidelines and provide training to planners
	Train agencies and staff on new tools and processes
	Provide technical assistance on new and expanded infrastructure (e.g., GO-Biz permitting assistance team)
	Monitor impact on infrastructure permitting and development and make changes as needed
E2: Facilitate coordination of feedstock access and improved confidence in feedstock volumes and where it can be accessed Feedstock access could be coordinated through public-private partnership and industry collaboration, ensuring that there is reliable information on feedstock volumes and locations.	Consult with facilities and interested parties to identify regional material feedstock supply and demand
	Create a strategy to connect and introduce feedstock suppliers, such as processing facilities and brokers, with reuse and recycling businesses to build out the circular economy

This pathway will help identify the need and opportunity while de-risking the feasibility and economics of infrastructure development.	Establish feedstock logistics partnerships, including contacts to connect feedstock suppliers, projects managers, and CalRecycle's data systems.
	Leverage existing international partners to share feedstock data and identify international supply opportunities
E3: Increase benefits and address/mitigate negative impacts of infrastructure in local and Tribal communities	Identify community benefit priorities (e.g., health outcomes, job creation)
This pathway emphasizes the importance of incorporating Tribal cultural resource protections, and equity considerations.	Create and deploy model Community Benefit Agreements to facilitate engagement, mitigate impacts, and result in community benefits.
Projects should minimize environmental and health impact concerns (e.g., fully enclosed, negative pressure, dust control, landscaping) and include community and economic benefits, such as improved access to circular systems, small business development, and local job creation.	Conduct Tribal consultations to improve permitting
	Evaluate cumulative impact of new and expanded infrastructure to inform future investments
	Define metrics to measure community benefits
	Create playbook for engaging and incorporating community considerations
	Launch Tribal consultation and community engagement initiatives, engaging in Tribal consultation early in the design process
	Promote models and successful examples
E4: Optimize utilization and efficiency through retrofits, upgrades, and use of excess capacity, while reducing impacts	Identify infrastructure types with un- or under-used capacity to support zero waste (e.g., wastewater treatment facilities)
This pathway would efficiently leverage existing infrastructure with excess capacity to expand the capacity of circular infrastructure.	Create mechanisms to maximize utilization of excess capacity and pilot projects
Upgrading infrastructure could make it more cost-effective to source separate materials and products for reuse or repurpose (e.g., food recovery, wood reuse) or as inputs into new products.	Conduct research into infrastructure retrofit technologies and identify possible upgrades and retrofits (e.g., retooling existing construction demolition providers to offer deconstruction services)
Upgrades could include technologies like AI sensors, improved robotics, or additional sorting pass/lines.	Assess potential for environmental impact mitigation and gather public input
Support could include: • Providing financial incentives and support, such as lower taxes, access to vacant land, permit exemptions, creative funding solutions to lower upfront costs, or absorbing material market volatility through a guarantee arrangement. The support that the City of Berkeley provided to	Review permitting requirements for relevant retrofits and upgrades (e.g., at manufacturing facilities, recyclers, MRFs, etc.)

Urban Ore can serve as a model for the state and other local jurisdictions. • Providing technical assistance or partnership coordination to increase ease and attractiveness of infrastructure investments.	
	Identify financing and regulatory challenges for these types of projects and develop innovative solutions
	Develop publicly available guidelines for retrofitting infrastructure for circular solutions, while mitigating adverse impacts
	Coordinate collaborations or connections from infrastructure owners to technical solution providers or technical assistance
	Showcase successful retrofits to promote adoption

Case Study

Resource Recovery Park

Berkeley-based **Urban Ore** is a center for salvage of reusable materials from the city's transfer station. They have a resource recovery park for processing, resale and recycling where customers can drop off reusable goods at no cost and get cash or store credit. The City of Berkeley supported the growth and success of Urban Ore by contracting with the organization to manage salvageable materials at the city's transfer station, offering a sales location lease that was rent free and subsequently charged as a percentage of income. The City helped the organization adjust zoning restrictions to allow the business to later move to a larger location. Urban Ore reported $2.7M in sales in 2020, created more than 30 jobs, and the value of the nearly 900 tons of salvaged materials annually helped to offset operation costs and reduce transportation for material that would otherwise be sent to landfill.

Expanding this model with pilots can provide key insights to achieve goals, divert materials from landfills, and enhance waste management safety. Scaling this model will require partnership with municipalities, expertise in reuse, adequate warehouse capacity, and long-term contracts for stability.[xv]

Infrastructure for Circularity Recommendation F:

Grow circular businesses and develop systems for equitable distribution of materials

Circular business models that are higher on the Materials Management Hierarchy such as reuse, resale, repair, and sharing models are critical to source reduction efforts – reducing waste before it is generated and extending the life of products and materials.

Circular business models offer local economic benefits when compared to disposal options. Reuse and repair models are estimated to create 50 times more jobs than landfill-related employment and more than eight times more jobs than recycling.[xvi] However, circular models often require higher start-up costs compared to waste-generating alternatives and can face challenges to grow. EPR programs like California's Responsible Textile Recovery Act can build circular systems for materials that are funded by industry.

Case Study

Circular Solutions for Dairy Packaging and Energy

Straus Family Creamery, a certified organic dairy in California, has a reusable packaging system to reduce waste generation. Since 1944, Straus has used reusable glass bottles with a refundable deposit to encourage returns (currently set at $3). Glass bottles are used for over 90 percent of milk sales, which amounts to over 2.75 million bottles returned and reused and the equivalent number of plastic jugs avoided annually.

Straus has developed a **Sustainable Packaging Roadmap** to guide their transition to a future where all their packaging material is reused, recycled or composted. Related efforts include use of reusable pallet covers instead of shrink wrap and a 15 percent reduction in plastic use in yogurt and sour cream packaging,

Straus also utilizes circular solutions to generate energy. The facility's biodigester converts animal manure into methane biogas, which powers the farm and charges electric vehicles.[xvii]

These circular efforts demonstrate the source reduction possible in the dairy industry.

Pathways for Infrastructure for Circularity Recommendation F:

Four primary pathways for exploration have been identified to spur the development and expansion of proven, equitable circular business models and distribution systems.

Value for Environment:
Cities and farmers cut organics disposal costs and **improve soil health** through expanded community composting.

Timeline	2028-2035
Key Parties for Implementation	CalRecycle, State Agencies, Local Governments/Jurisdictions, Infrastructure Owners and Haulers, Technology Providers, Reuse/Donation Centers/Food Recovery Entities, Producers/Manufacturers, Waste Collectors/Haulers, Raw Material Suppliers, Tribes, Wholesalers/Distributers, Retailers, Californians
Pathway	**Key Action**
F1: Facilitate the growth of circular services (e.g., refill/delivery, lending libraries, repair businesses, edible food recovery, secondhand clothing) that can become economically self-sustaining	Identify circular service gaps that need support to grow / develop (e.g., lending libraries, repair cafes or businesses) and barriers to development / expansion including accessibility concerns.
• Public sector funding can help develop pilot projects, such as the **Petaluma Reusable Cup Project**.	Identify projects that are working and what key components were needed.
• This pathway should focus on accessibility for economically disadvantaged communities and individuals through reducing costs	Co-create financial and technical support solutions, which facilitate growth of reuse/repair/refill services (e.g., grants/incentives for underserved communities)
	Identify relevant solution partners and build solution implementation pilot plan including funding needs
	Identify under-utilized labor markets to support circular infrastructure (e.g., individuals on social assistance, correction workforce)
	Provide technical assistance and financial resources to expand circular services.
	Create funding for pilot projects.
	Share and promote successful circular service support systems across communities
F2: Invest in and accelerate adoption of systems for CRV containers that can be used multiple times	Identify materials and products suitable for multi-use containers through infrastructure analysis, industry engagement, and health and safety studies
Recent bottle bill amendments authorize reusable glass containers to be included in the existing CRV system. Recycling of single-use containers occurs at a high rate but results in lost material value from uncollected containers, lost material quality/value through processing, and higher environmental impacts from material transport and processing.	Establish multi-use container and infrastructure requirements
This pathway could include: • Providing technical assistance to help meet state standards and support growth	Establish system of technical assistance for infrastructure supporting multi-use containers
• Coordinating the development of standard multi-use packaging	Conduct public outreach campaigns to promote adoption of multi-use containers and systems
• Locating financial support to establish pilot areas and grow.	Conduct pilot programs to test feasibility and adoption

• Replicating models such as the Canadian beer industry[xviii] and Latin America's universal soda bottle. [xix]	Monitor adoption rates and adjust strategies as needed
F3: Facilitate coordination in areas of high-volume, source-separated outflows and develop matchmaking platforms This pathway requires CalRecycle to act as a facilitator—both for identifying potential sites for circular benefits sharing and to match those producing materials with those who need them as circular inputs. This includes: • Cataloging relevant sites with high potential for collaboration • Using data collection to identify potential materials in close proximity to production sites • Collaborating with other agencies to expand resource use and recycling in successfully established clusters Digital platforms will connect key players looking to exchange materials, resources, or services. They could be run by third parties and will function as matchmaking tools that facilitate collaboration and material exchanges between industries, municipalities, and other relevant actors.	Identify and map available by-product materials produced in large volume (e.g., wood waste, agricultural byproducts) Compile relevant sites with current or potential capacity for participation, including identifying leading practices Establish task force(s) to explore potential resource exchange, identify needs for implementation, such as funding, and develop matchmaking strategy Create a digital resource exchange platform or enhance existing solutions to connect material generators with users Select and engage key facilities to participate in pilots Monitor and report outcomes as appropriate, including successful matches Continuously optimize platform performance
F4: Expand options for source reduction and diversion, and support collection and access for source-separated materials Materials already collected by a disposal facility or recycling facility that has significant value could be rescued. The development and growth of infrastructure such as resource recovery parks, digital material matchmaking solutions, etc. can consolidate and manage these source-separated materials. This pathway includes: • Identifying materials that could support local bioeconomies, where economic activity is derived from biotechnology and biomanufacturing from agriculture by-products or "wastes" • Similar to Recommendation E, Pathway E4, direct and indirect financial support through lower taxes, access to vacant land, or permit exemptions • The development of a digital marketplace.	Identify high-potential source-separated materials and identify barriers and solutions to recovery including gaps in collection service and infrastructure expansion / development Provide financial and technical assistance for source-separated material distribution systems Develop partnerships with industries to enable rescue and reuse and with community organizations to increase awareness of local and regional collection and reuse/recycling options Implement pilot programs and evaluate their feasibility, scalability, and performance through the establishment of standardized monitoring system Expand successful programs statewide

	Launch public education campaigns to encourage participation in source -separated material programs.
	Adjust support mechanisms based on data and community feedback.

Case Study

Chumash Casino Resort

Since 2004, Chumash Casino Resort in Santa Ynez, CA, **has achieved a 90 percent waste diversion rate by revamping its waste management system.** The resort aimed for net zero waste by 2019 through innovative methods and partnerships, including food waste recycling and specialty recycling for hard-to-recycle items. They also created a dedicated custodial technician role and a Chumash Green Team. From 2008 to 2024, waste generation was cut by 45 percent while visitor numbers increased. Additionally, the resort processes 2,700 lbs. of organic waste into 700 lbs. of compost every 24-36 hours using an on-site in-vessel digester.[xx]

Installing a composter provides numerous advantages, such as saving money on labor and transportation costs. Through their commitment to zero waste, the Santa Ynez Band of Chumash Indians established a model that they hope will inspire others to take similar actions to benefit the environment.

Research and Innovation

Future State: California accelerates the circular economy by becoming a leading market in attracting and growing circular innovation and innovators.

Recommendations:

G. Support research initiatives and the development, adoption, and scaling of circular solutions

H. Increase use of circular design principles in products and business models

Applying the state's research and innovation capabilities to the circular economy can help reach a circular transition tipping point while growing the economy for the benefit of all Californians.

Research and Innovation example outcomes along the MMH include:

Rethink: Connect industry, research institutions/universities, and government to speed transition from research to application

Reduce: Showcase examples of research initiatives that have successfully reduced or avoided waste

Reuse: Accelerate reuse business model innovation by replicating reuse hubs like Urban Ore

Repurpose: Support innovations that repurpose and add value to low-value, hard-to-recycle materials

Recycle: Collaborate with peer agencies to pilot solutions for priority challenges such as contamination in organics.

Research and Innovation Recommendations and Pathways:

Research and Innovation Recommendation G:

Support research initiatives and the development, adoption, and scaling of circular solutions

Innovation of circular technologies has increased in recent years. These technologies span physical, digital, and biological technologies across the Materials Management Hierarchy, from redesigning waste out of our systems and preventing waste in the first place, to extending the useful life through reuse and repurpose and processing materials for recycling. They create greater efficiencies, reduce waste, drive innovation, increase information transparency and enable data analysis for valuable insights that can help identify circular opportunities and deploy circular solutions.[xxi] At the same time, technological innovation does not come without challenges. The use of AI creates efficiencies but could have unintended consequences, from environmental impacts to informational inaccuracies and security concerns.

California is home to some of the best research institutions and leading businesses in the world that are interested in developing new insights and solutions. There are university-based research initiatives with both specific and broad applications. This recommendation encourages broad knowledge sharing to increase adoption of circular behaviors and technologies.

Case Study

Circular Bioeconomy Hub

The Beam Initiative, led by **BEAM Circular**, a nonprofit in California's North San Joaquin Valley, transforms waste in underserved agricultural regions into economic and environmental solutions. Serving as a hub for the circular bioeconomy, the portfolio's anchor project is a bioindustrial manufacturing testbed facility and innovation campus – which will support scale-up of technologies that convert agricultural products like nut shells, food scraps, and livestock waste—into valuable products such as building materials, renewable energy, and consumer goods. By driving public-private projects that align with community priorities and industry needs, **BEAM Circular accelerates innovations in bio-based products, creating a supportive ecosystem for sustainable biomanufacturing and positioning the NSJV as a regional leader in this field.** Recent successes led to a 10-year, $30M in venture capital funding commitment for circular bioeconomy start-ups in the North San Joaquin Valley.

Pathways for Research and Innovation Recommendation G:

Four primary pathways for exploration have been identified to support the adoption and scaling of circular innovation and learnings.

Value for Economy
Circular economy startups access **financing more easily**, reducing barriers to growth.

First Cycle	2027-2031
Key Parties for Implementation	CalRecycle, Educational/Research Institutions, Circular Solution/Technology Providers, Raw Material Suppliers, Corporate Enablers, Secondary Manufacturers, Tribes, Producers/Manufacturers, Wholesalers/Distributors, Retailers, Waste Collectors/Haulers, Material Recovery Facilities, Reuse/Donation Centers/Food Recovery Entitities, Composting/In-Vessel Digestion Businesses, Educational/Research Institutions, Federal Government
Pathway	**Key Action**
G1: Establish an innovation roadmap to guide areas for investment, establish standards for consistent designing, testing, and solution validation, and support subsequent scaling through funding and financing solutions This pathway reviews the successes and learnings from internal and external programs to create a document with a standard innovation approach into a custom playbook that takes into account CalRecycle's role and funding requirements.	Identify key areas for innovation and define innovation approach with interested parties Develop roadmap of steps for each stage of innovation, establishing KPIs

Existing and new sources of funding and financing will be utilized to support circular innovation projects, both within CalRecycle and among external parties. There are many examples of municipal and corporate innovation approaches for circularity, such as the **WEF Scale 360 Circular Innovation Playbook**. Additional details on funding and financing pathways are included in Financial Mechanisms recommendations.	Conduct a review of international innovation frameworks and incorporate into roadmap
	Identify sustainable funding sources. Outreach to investors and grant-making organizations to partner and connect to external sources
	Identify gaps between funding (both internal and external) and solutions, factoring in highest and best use on MMH
	Seek authority and dedicated funding to finance innovative circular solutions
	Co-create funding structure options for startups, small businesses, and funders/financial institutions
	Prioritize research and innovation approaches and investments that benefit underserved and overburdened communities to advance equity
	Support early-stage projects with existing collaborations with GO-Biz, State Treasurer's Office funding, and CalRecycle loans/grants
	Using roadmap and gap analysis, develop investment plans for new programs and opportunities, adjust existing programs, market development, and outreach to solution providers
	Monitor utilization and outcomes of funding mechanisms by conducting benefits analysis and tracking KPIs
G2: Showcase circular solution successes from CalRecycle programs and elsewhere, which can be broadly applied to improve existing and develop new programs This pathway shares success stories via CalRecycle channels (website, social media pages, virtual and in-person workshops or others to-be-determined) and to broader media outreach, to raise awareness of the circular transition and CalRecycle's role. Documenting case studies will inspire further innovation and adoption of circular economy principles and technologies. For example, **CEC's Energize Innovation Project Showcase** and Ellen MacArthur Foundation's **CE100 list**.	Identify and document successful circular economy projects in California
	Develop case study repository to highlight best practices and outcomes
	Share case studies through digital platforms, proactive media outreach and interested party events and conferences
	Identify common themes of success and encourage replication of successful models across sectors
G3: Identify, consolidate, and publish key research interests This pathway involves CalRecycle helping share research by partnering with the networks developed by its staff and existing programs, including EPR programs such as mattresses and carpet, which have funded research in priority topics.	Conduct outreach to value chain representatives to identify key research needs (e.g., reusable container system innovation, availability of material market data)
	Create guidelines for vetting external research

By listing high-priority research topics based on new laws and publicizing that list, CalRecycle can guide research centers and beyond. AI could be used to monitor and find additional research, with results being vetted for quality and relevance. One example of crowdsourcing for key sustainability challenges is **WEF's Uplink Innovation Network**. To date, UpLink has had over 7,700 solutions submitted worldwide through their platform across more than 65 innovation challenges	Review academic and private sector research underway to identify gaps and opportunities
	Publish repository of consolidated findings
	Develop list of research needs to share with collaborators/research institutions
G4: Facilitate coordination between entities developing solutions and parties interested in piloting, testing or supporting solution development This pathway consists of CalRecycle actively facilitating connections between researchers and those who may be interested in testing or scaling their findings. This process would tap into existing innovations, laboratories, programs, and networks to expand circularity through a connection to other value chain players. Current connections require individual attention and coordination, with special consideration to ensure CalRecycle is not endorsing a specific technology or entity. Additional opportunities for scaled connections are included in the Data and Monitoring Recommendation K. Examples: CalRecycle's various EPR programs have developed networks of experts in circular innovations that could help support this pathway. Universities and colleges serve as hubs for innovation and research.	Create a database of entities developing circular economy solutions (e.g., a California-specific version of the Circular Startup Index) in partnership with interested parties
	Establish a matchmaking mechanism for connecting solution developers with potential partners
	Host or sponsor networking events to foster collaboration (e.g., tabling at relevant workshops)
	Work with a startup incubator or host, showcase relevant research for public
	Prioritize and conduct pilots in disadvantaged communities, addressing economic gaps that discourage innovation
	Assess impact of facilitated partnerships through self-reported outcomes

Research and Innovation Recommendation H:

Increase use of circular design principles in products and business models

Value for Economy:
Manufacturers save on manufacturing costs by designing products that prioritize source reduction.

A product's expected environmental impact is determined during the design stage. Designing out waste from systems and products is at the top of the Materials Management Hierarchy and a crucial component of achieving zero waste—according to the Ellen Macarthur Foundation (EMF), design choices will account for 80 percent of a product's environmental impact.[xxii] Universities can serve as innovation labs, testing circular materials, reuse ideas, and business models. California Native American Tribes can be partners in developing and piloting innovative approaches to circularity that integrate traditional ecological knowledge.

Through EPR programs and other initiatives, there is increased industry engagement, creating opportunities for manufacturers to focus on designing for reuse, repair, and recyclability. For example, the **Mattress Recycling Council** (MRC), the stewardship organization that operates the mattress EPR programs, invests nearly $1 million a year in research to develop efficiencies in mattress collection, transportation and deconstruction activities as well as developing new uses for recycled mattress materials.

Case Study

California's Paint Stewardship Program (EPR)

Launched in 2012, California's Paint Stewardship Program manages leftover paint through a comprehensive recycling system. PaintCare, a nonprofit that operates the program on behalf of CalRecycle, manages the program. The program includes year-round drop-off sites that are searchable on the **PaintCare website**. Additionally, PaintCare identifies reuse locations that provide good quality leftover paint at low or no cost back to the public. To encourage reuse, PaintCare will compensate paint drop-off sites operating a reuse program under a contract with PaintCare. Since its inception, the program has achieved impressive results, exemplifying the effectiveness of EPR initiatives in reducing waste. As of 2023, the paint steward program ensured that **99.1 percent of Californians live within 15 miles of a drop off site** with **875 sites** across the state. In 2023 PaintCare **processed 3,317,702 gallons** of paint with **88 percent being reused or recycled**. Finally, since the program's inception in 2012, PaintCare has **collected 35.7 million gallons of paint** and has **recycled 2002 tons of paint cans**. In 2024 the program underwent an extension to accept a greater range of paint products, an initiative other EPRs could consider to increase impact. Applying findings from this program to other product EPRs can accelerate California's progress towards a circular economy.[xxiii]

Pathways for Research and Innovation Recommendation H:

Three primary pathways for exploration have been identified to facilitate research initiatives to accelerate innovation in circular product and business model design.

First Cycle	2028-2034
Key Parties for Implementation	CalRecycle, State Agencies, Federal Government, Educational/Research Institutions, Producers/Manufacturers, Secondary Manufacturers, Corporate Enablers, Circular Solution/Technology Providers
Pathway	**Key Action**
H1: Establish innovation hubs and incubators focused on circular solutions and design to support startups and research institutions This pathway would establish new or expanding existing innovation hubs working on the circular economy to attract and support companies developing more zero waste products. Incubators draw a workforce, capital, and knowledge to a local economy, and almost double the survival rate of businesses.	Conduct scan of successful existing circular design hubs and incubators for key elements and create repository of leading practices
	Identify existing hubs, such as the Los Angeles Cleantech Incubator's textiles program and BEAM Circular's bioindustrial manufacturing campus, and evaluate their focus areas, resources, and impact
	Identify strategic partners for innovation hubs
	Conduct search for hub operator(s) (e.g., universities, startup accelerators, NGOs)
	Draft operational plan for hub(s) to support startups and researchers
	Support launch of hub(s) with expertise, networking opportunities
	Track innovation outcomes to ensure ROI on investment (e.g., job creation, SMBs launched, etc.)
H2: Develop principles for incentivizing or requiring circular design innovation Other regions, such as the European Union (EU), have adopted **sustainable product design standards** that include circular indicators. This pathway is focused on CalRecycle adapting or creating its own set of guidelines to inform products that are made in California. CalRecycle may want to initially focus on materials with particularly high volumes. This could include establishing standards for refillable packaging and including design for reuse in EPR programs.	Identify California's priority products for circular design principles
	Engage with industry leaders to work on circular design principles (e.g., CGF's Golden Design Rules) or EPR framework in line with relevant statutes
	Develop incentives to promote adoption of circular design principles among packagers/producers (e.g., material subsidies, recognition programs)
	Launch time-bound challenge or pilot program to promote circular design approaches
	Evaluate pilot outcomes and refine principles for broader adoption
H3: Support transition to zero waste operations for key sites to model circular economy opportunities and influence zero waste behavior. This pathway consists of CalRecycle connecting with sites that are already integrating zero waste and	Select sites and engage partners to serve as models of circular value and feasibility
	Provide technical assistance and training to conduct facility waste audits and resource assessments

circular economy into their strategies to understand their successes and challenges. CalRecycle could also offer capacity-building support to those who are earlier in their journey to zero waste. This could include:	
• Identifying closed-loop systems like universities and colleges that implement zero waste with a high likelihood of success and knowledge transfer.	Develop customized zero waste plans that incorporate capacity building
• Engaging event organizers and facilities preparing to host the LA 2028 Summer Olympic Games, 2026 World Cup competitions, or other large-scale events.	Implement and monitor zero-waste plans including engagement and communication
• Working in partnership with Tribes to incorporate Tribal priorities, apply traditional ecological knowledge, address challenges unique to Tribes, and support knowledge sharing with other Tribe	Highlight and share success stories.
• Partnering with existing networks who are already doing this work. For example, the California Resource and Recovery Association (CRRA) Zero Waste Campus Council or entities that have a TRUE certification with Green Business Certification	Develop plan to implement at more sites, including identifying if legislation and funding is needed, etc.

Case Study

Innovative Beverage Container Redemption

Sacramento County partnered with California RVM Solution, also known as Simply Recycle, to implement the Sacramento County Pilot Project. Simply Recycle was awarded $1.5 million through the Redemption Pilot Project Grant Program. Simply Recycle's clean loop redemption center serves as an innovative approach to beverage container redemption.

Currently, customers have the option to redeem their beverage containers through bulk feed reverse vending machines (RVM). Soon, customers will also have access to a bag drop option which will further increase recycling opportunities. Each redemption technology can print a voucher for immediate cash payment or electronic payment options via an app. The array of technology provided at the center allows customers to redeem mixed beverage containers at once instead of sorting by material type.

Since first opening in November 2024, Simply Recycle has redeemed and recycled over 944,000 containers at its new facility. Simply Recycle was awarded Sacramento County's 2025 Sustainable Business Award in September of 2025.

Communication for Cultural and Behavioral Change

Future State: Individuals, businesses, organizations, governments and other interested parties understand how and what they can do to participate in the circular economy and where to access the resources to help.

Recommendations:

I. Develop tailored communication and education campaigns based on research of Californians' behaviors, beliefs, needs, and interests

J. Make it easier to find and use tools and resources for zero waste

Studies indicate that knowledge and awareness can impact recycling behavior.[xxiv] While most individuals self-report knowing how and what to recycle, field testing has shown mistakes due to outdated information or gaps in understanding.

Communication for Cultural and Behavioral Change example outcomes along the MMH include:

Rethink: Develop industry-specific campaign for redesigned low/no waste commercial packaging and pallets

Reduce: Compile and share school related information on existing resources and practices

Reuse: Offer business-tailored information on available reuse solutions

Repurpose: Provide training on simple but effective repurpose solutions

Recycle: Use historical data on mis-sorted recyclables to communicate behavior change opportunities by household or neighborhood.

Communication for Cultural and Behavioral Change Recommendations and Pathways:

Communication for Cultural and Behavioral Change Recommendation I:

Develop tailored communication and education campaigns based on research of Californians' behaviors, beliefs, needs, and interests

Behavior change is a critical component of achieving zero waste, particularly higher up on the MMH before waste is generated. California's circular transition will require a cultural shift from disposable lifestyles to purchasing more circular products and services, repairing and repurposing products, and improving recycling behaviors.

CalRecycle provides education and engagement through its website, **virtual and in-person meeting series**, and **social media presence**. The **I Recycle Smart** campaign and **Recycling Reimagined** campaign both encouraged specific recycling behaviors. These examples can serve as the foundation for broader communications on zero waste and a circular economy through resources and education.

Action on this recommendation should be aligned with existing requirements (e.g., SB 1383, SB 54, EPR programs), be science-based, embrace innovation, and result in clear, standardized messaging and tools that can be utilized by interested parties, such as local jurisdictions, haulers, schools, faith groups, and community-based organizations.

Pathways for Communication for Cultural and Behavioral Change Recommendation I:

Five primary pathways for exploration have been identified to develop communication and education campaigns based on Californians' behavior patterns, needs, and interests to enable a human-centered circular transition.

First Cycle	2028-2031
Key Parties for Implementation	CalRecycle, State Agencies, Local Jurisdictions, Waste Collectors/Haulers, Community Groups, Tribes, Non-**governmental Organizations,** Community Based Organizations, Educational/Research Institutions, Producer Responsibility Organizations, Californians
Pathway	**Key Action**
I1: Conduct research to understand Californians' geographic and demographic patterns and differences in consumption, behavior change motivators / interests, zero waste challenges, and trusted mediums and sources for information	Identify potential research partners and align on desired scope of initial research including research plan
Different audiences value different benefits and understanding what matters most to them will help create effective outreach efforts on zero waste.[xxv] Research, in partnership with research institutions and other relevant organizations, would provide valuable insight.	Analyze research to develop insights on individual behaviors, consumption, and challenges, and identify trends in community groups
Research questions could include: What do current behaviors look like and what is the sentiment on zero waste? Who finds zero waste actions frustrating and difficult and why? Who are the zero waste champions?	Identify motivators, trusted information mediums by population groups, and common values (e.g., decreased wildfires)
	Assess regional and demographic differences and similarities of insights
	Use findings to build personas and share research with interested parties and relevant local communities
I2: Establish baseline of Californians' familiarity with circular and zero waste topics and actions	Identify potential supplemental research tools (e.g., focus groups, sentiment analysis)
Using the research findings from the preceding pathway, CalRecycle can analyze and test whether Californians may already practice zero waste behaviors and whether they identify those behaviors as zero waste. This will be important to ensure messaging is simple and understandable, which is critical for influencing behavior.[xxvi]	Combine existing and supplemental research to assess awareness and understanding of circular economy principles
Not all Californians will be motivated by societal or environmental sustainability benefits. However, there are other motivators that drive sustainable behavior.	Benchmark Californians' current-state engagement with zero waste behaviors (e.g., composting, reuse program participation)

If sustainability can become relevant to someone, they can change behavior, as found in the **Our Human Moment** report.	
	Use benchmark findings to inform action plans
	Share benchmark findings and localized data with local communities
I3: Define target actions for each audience, factoring in key geographic and demographic trends identified through research, including digital engagement data on social media, search engines and increasingly AI platforms. This pathway is an important step to encourage zero waste behaviors. CalRecycle can work with research/digital media contractors to identify words, images, and strategies that engage individuals' behaviors by region and demographics to determine key messages and behavior change objectives. This includes outreach for all interested parties, e.g., residents, community groups, industry groups, and businesses.	Conduct geographic and demographic analysis on existing or new research to determine audience-specific trends
	Identify barriers and motivators for circular behavior within each audience group
	Define targeted zero waste actions by audience segments based on findings
	Monitor actions to ensure relevance across time
I4: Develop messages that motivate action by emotionally connecting to what personally matters most to audience group demographic This pathway takes existing research that uses psychological insights (such as attitudes, values, and behaviors) to understand how different groups engage with sustainability and zero waste and creates new campaigns and messages. Human behavior and motivations vary by demographics, attitudes, values, and lifestyles, so messaging must go beyond a one-size-fits-all approach and apply best practices for language access.[xxvii]	Design messages that emphasize audience-specific benefits of circular behaviors
	Collaborate with local interested parties to ensure message relevance
	Test and refine messages through small-scale campaigns
I5: Align communication channels and messengers to best reach the target audience, including digital tools for different ages and skill levels This pathway identifies the best and most appropriate communication channels and potential ambassadors, such as community groups, by evaluating research findings. This includes: • Understanding who/what are considered trusted messengers and meeting the target audience "where they are at"	Compile data on existing communications channels (e.g., email, social media)
	Identify most effective communication channels for each audience group (e.g., for youth, place-based learning and experiences)

• Factoring in different languages, including for print and media • Adding targeted messaging in existing communications from schools, local communities, nonprofits, industry, etc. • Building a robust educational program that uses evolving AI abilities to create effective digital tools like infotainment • Using community-based organizations as trusted messengers to address equity concerns.	Identify most effective digital tools for each audience group (e.g., for youth, online apps and games that engage and educate) Select most credible messengers for each audience group Share resources and campaign materials with interested parties, such as local governments, community groups, and faith-based groups who can help amplify the message Implement campaigns using selected channels in collaboration with interested parties and track their performance

Communication for Cultural and Behavioral Change Recommendation J:

Make it easier to find and use tools and resources for zero waste

Resources to engage in sustainable behavior have become widely available in recent years. How-to guides and detailed guidance on accessing recycling programs in California are offered by nonprofits, local jurisdictions, educational institutions, and haulers to name a few – in addition to CalRecycle's own resources.

Public awareness of the circular economy as a concept is also on the rise. Californians make use of circular business models and products through reuse, resale, or recycle programs on a daily basis. A recent study found that 60 percent of US consumers agree that "shopping secondhand…gives them the most bang for their buck" signaling increased awareness.[xxviii]

CalRecycle's website and social media channels provide detailed information for both the general public as well as businesses across the value chain. Making resources and tools easier to find and use will help Californians support circular economy and zero waste efforts. To keep up with fast-changing AI technology, the state needs strong systems and funding for integrated, accessible tools.

Pathways for Communication for Cultural and Behavioral Change Recommendation J:

Three primary pathways for exploration have been identified to improve visibility and usability of circular resources and tools:

First Cycle	2027-2031
Key Parties for Implementation	CalRecycle, Local Jurisdictions, Waste Collectors/Haulers, Non-governmental Organizations, Community Based Organizations, Producer Responsibility Organizations
Pathway	**Key Action**
J1: Consolidate local and statewide resources and tools to be easier to find and use This pathway could create a public directory with reputable sources on recycling facilities, local recycling requirements, zero waste actions, and circular alternatives, etc. If resources are limited, it could initially focus on the most effective resources and actions higher on the MMH. This would require coordination with partners such as nonprofits, research organizations, jurisdictions, and businesses, to add specific tools and information such as AI resources and available circular services and facilities. It could also involve working with AI chat platforms to ensure that reputable resources and messengers are prioritized over other information.	Analyze existing resources and tools (e.g., recycling guides, zero-waste focused mobile applications) to identify gaps in the use and usefulness of waste reduction tools. Identify intuitive access points for tools and resources (e.g., unified platform) Optimize tools for accessibility and ease of use, including mobile compatibility
J2: Develop additional resources and tools for awareness and utilization based on need determined, including for businesses and school-aged children, via market research	Review research to identify unmet needs for circularity (e.g., region-specific guides where recycling rates are lower, limited instruction on recycling a material, waste industry training)

The market research and directory from previous Pathways could help design a strategy for new resources – toolkits, curriculum, etc. This could include educational resources and messaging for specific audiences.	
	Prioritize and develop new resources which address gaps in collaboration with interested parties
	Launch new tools with targeted campaigns to drive adoption
	Assess effectiveness of new resources
J3: Provide education, resources, training, certification, grants, and technical assistance to local jurisdictions, schools, Tribes, non-governmental organizations, and businesses	Review successful technical assistance programs to model best practices (e.g., Massachusetts MAC program, Colorado Circular Communities Enterprise)
To support local governments, businesses, and other interested parties, this pathway would provide resources and other support	In collaboration with local jurisdictions and businesses, determine priority needs to support circular innovation and learning
Technical assistance could be modeled after existing efforts. For example, the Municipal Assistance Coordinators (MAC) in Massachusetts provide technical assistance to local jurisdictions.	Develop tools, templates, and other support materials based on consultation
Resources for businesses could emphasize financial benefits to increase participation in zero waste activities (e.g., reducing tax burden with edible food recovery participation).	Share technical assistance resources through local government listserv, CalRecycle website, other State of California websites, and targeted communications

Cross-Cutting Foundations

Three categories support and enable the implementation of the Strategic Pillars in the Plan. These categories are called Cross-Cutting Foundations, and include Data and Monitoring, Community Engagement and Capacity Building, and Partnerships. They are supporting categories that enable the implementation across all Strategic Pillars.

The Zero Waste Plan includes recommendations for improvements in the Cross-Cutting Foundations to better support a transition to a circular economy.

Data and Monitoring

Future State: California has a more complete picture of what and how materials are produced, used, and managed to facilitate circular opportunity identification, performance tracking across all avenues for circular materials management.

Cross-Cutting Recommendations:

K. Expand and standardize data visibility across material types and management pathways through open and crowdsourced data

L. Improve and expand data analysis to inform new solutions and refine existing systems

The following recommendations will enable California to significantly enhance its data and monitoring capabilities and gain a clearer picture of how materials are produced, used, and managed. This will make it possible to identify source reduction opportunities and track progress and impacts across various programs.

Data and Monitoring example outcomes along the MMH include:

Rethink: Track perishable material flows to identify supply chain challenges leading to food spoilage

Reduce: Update and revise material generation calculation to account for source reduction

Reuse: Develop material markets to facilitate material matching and increase access for reuse

Repurpose: Track and highlight successful repurpose efforts

Recycle: Increase visibility into self-haul and other materials which should be redirected to recycling.

Data and Monitoring Recommendations and Pathways:

Cross-Cutting: Data and Monitoring Recommendation K:

Expand and standardize data visibility across material types and management pathways through open and crowdsourced data

Currently, there is an incomplete view of material flows due reporting exemptions for certain waste generators, such as self-haulers, and certain materials, such as MRF residues and contamination. These gaps limit the usability of metrics, while generation and consumption data gaps limit accurate data analysis.

The CalRecycle Integrated Information System (CRIIS), a single enterprise data solution, will facilitate data visibility across material types, improve ease of data entry/collection, and offer standardization. New and expanded EPR programs like SB 54 will provide more producer data on generation.

New data should also support tracking of any negative impacts to better understand lifecycle costs for materials management solutions and to help protect our communities.

Case Study

AI Contamination Detection

Prairie Robotics leverages machine learning and AI to enhance recycling efficiency by equipping collection trucks with cameras, GPS, and AI-enabled computers. Their technology automatically detects recycling contaminants and generates tailored educational materials for households. This approach allows administrators to access real-time data to monitor improvements and identify trends. Through such innovations and strategic partnerships, Michigan has created 72,000 jobs in the recycling, reuse, and remanufacturing sectors, and the recycling rate in East Lansing has increased to from 14 percent in 2019 to 21 percent in 2023.[xxix]

Pathways for Data and Monitoring Recommendation K:

Four primary pathways for exploration have been identified to expand and standardize material flow data visibility across material types and management pathways.

First Cycle	2028-2034
Key Parties for Implementation	CalRecycle, State Agencies, Local Jurisdictions, Tribes, Raw Material Suppliers, Producers/Manufacturers, Composting/In-Vessel Digestion Businesses, MRFs, Wholesalers/Distributers, Retailers, intermediate Manufacturers, Nonprofits/Community Based Organizations, Waste Collectors/Haulers, Reuse/Donation Centers/Food Recovery Entitites, Educational/Research Institutions
Pathway	**Key Action**
K1: Integrate existing data from cross-agencies, local governments, NGOs, public, and commercial sources into an online platform accessible to all users	Establish criteria for including external data into state data and co-create data format standards to improve data useability
This pathway could include diverse data sources such as jurisdictions, Caltrans litter, illegal dumping, stormwater, procurement, and imports/exports, to provide a holistic view of material flows that is accessible to many groups, including local governments, businesses, researchers, and nonprofits.	Explore existing Open Data solutions for integration and use. If an existing Open Data solution is not used, launch a secure, accessible Open Data platform.
A standardized format will result in comparisons for better alignment between state, local, and commercial efforts, to find barriers and patterns and enhance overall decision-making.	Translate relevant, existing state data to align with co-created format standards.
Accessible, easily integrated data can increase the number of interested parties working to identify circular opportunities, foster innovation, and promote resource-sharing across sectors.	Standardize and update key datasets to address current and anticipated changes while enabling multi-year comparisons
Other dashboards like the California Health and Human Services Open Data Initiative and the California School Dashboard have integrated cross-agency data to improve tracking and performance.	Establish agreements and a centralized repository for data sharing. Train interested parties on data protocols
	Develop mechanisms for easy integration with other tools (e.g., APIs, editable data files)
	Continuously improve solution and expand available data based on feedback
K2: Expand data collection through voluntary disclosure (including crowdsourced data) and, when necessary, additional required reporting	Determine priority areas, gaps, and details needed from data.
By encouraging industry to voluntarily share data with this pathway, California can broaden its dataset, particularly for materials that are difficult to track or emerging. Where feasible and appropriate,	Explore existing crowdsourced data and related initiatives which could address gaps.

safeguards should be added to protect voluntary data disclosures.	
Crowdsourced data can complement traditional data by providing timely, granular insights. This could include identification of circular businesses and community science-based initiatives.	Explore data gaps best addressed through required reporting
Although some data gaps can be addressed through voluntary reporting, existing data, and third-party analysis, there are still data gaps on what is collected, who provides it, and how it can be used, largely due to differences in self-reporting.	Identify potential regulatory/statutory updates to close gaps where necessary
Expanding who reports data and what they report will help track material flows and metrics.	Create incentives and user-friendly platforms for voluntary disclosure and new public data contributions
Mandatory data reporting should include specific and detailed requirements to ensure accurate, meaningful data. It could include data from MRFs (such as residuals, contamination, and unsold sorted materials) self-haulers, and jurisdictions (such as provided services and participation rates).	Establish protocol for reporting fields and process, and confirming voluntary data is representative
	Conduct training with relevant entities for any newly required reporting
	Engage interested private-sector parties to increase voluntary participation
	Use insights to prioritize and inform zero waste decisions
	Monitor and showcase the impact of voluntary data
	Support compliance of required reporting through audits, additional training, and continued process improvements
K3: Conduct material characterization studies to estimate consumption and material flows beyond reported data	Prioritize materials/regions for characterization (e.g., on basis of material volume, etc.)
Current material generation estimates rely on outdated consumption data from 1990 to 2010, which are adjusted only for population growth. Current material characterization studies are limited to disposal data, which does not address all materials generated across California. This pathway calls for a detailed material characterization study to improve accuracy, reflect current consumption patterns, and capture unreported material flows. Updated data would help identify gaps and opportunities, especially in environmentally burdened or economically disadvantaged communities.	Identify potential local organizations or jurisdictions looking to complete similar studies to consider merging of studies or collaboration
	Develop custom methodologies for conducting characterization
	Identify collaboration opportunities along the value chain for conducting characterization (e.g., PROs, academia)

	Compile findings to increase shared understanding of material flows
	Communicate results to interested parties

Cross-Cutting: Data and Monitoring Recommendation L:

Improve and expand data analysis and monitoring to inform new solutions and refine existing systems.

This recommendation would make data analysis faster and more comprehensive. By analyzing zero waste performance and gaps, CalRecycle can identify circular economy opportunities and make near real-time, data-informed changes. Analysis can also offer localized insights and performance comparisons to guide implementation changes or investments, uncover areas that need targeted technical assistance, and help direct compliance outreach and enforcement actions.

Currently, data analysis is time-intensive due to challenges and gaps identified in Recommendation K and is primarily focused on evaluating the performance of existing programs which mostly focus on end-of-life recycling. This narrow data analysis limits the state's ability to establish a baseline for material generation or conduct trend analyses.

Pathways for Data and Monitoring Recommendation L:

Four primary pathways for exploration have been identified to improve and expand data analysis and monitoring to inform new solutions and improvements on current systems.

First Cycle	2027-2030
Key Parties for Implementation	CalRecycle, Elected Officials, State Agencies, Tribes, Raw Material Suppliers, Producers/Manufacturers, Wholesalers/Distributers, Retailers, Intermediate Manufacturers, Nonprofits/Community Based Organizations, Educational/Research Institutions
Pathway	**Key Action**
L1: Establish a baseline to measure progress for reduction/reuse/remanufacturing and revise and expand all performance metrics to enable comparisons and shared learning Performance metrics currently rely on outdated estimates. This pathway creates an updated generation baseline and methodology that adjusts for changes in consumption and includes activities that are higher on the MMH. Modeling and projections using outside data can help fill in gaps where direct data isn't available.	Define benchmarks and aggregate historical data, focusing on data gaps (source reduction, reuse, remanufacturing)
	Periodically assess and revise current or new metrics, baselines, and calculations
	Monitor key indicators and publish progress reports
	Train interested parties on applying new and revised metrics where relevant
L2: Expand data analysis to focus on identifying material priority areas and circularity opportunities This pathway will help identify locations and material types that are ready for upstream interventions AI is an emerging tool that can assist data collection analysis, especially with large amounts of data. However, it would be wise to de-risk AI implementation before using it widely.	Analyze data to identify material management inefficiencies and opportunities and find priority areas
	Collaborate with interested parties to understand and develop plan to address priority areas
	Use findings from collaboration to guide policy and funding
L3: Proactively monitor emerging materials of concern While important, Material Characterization Studies have significant lags in between studies, which limit their ability to understand disposal including for products with longer lifespans. Monitoring new materials in the waste stream is essential to stay ahead of challenges and create programs or policies that address changes in material use before they become problems.	Establish systems to track and assess emerging materials
	Collaborate on risk mitigation strategies with interested parties
	Create adaptive policies to address emerging trends
L4: Monitor the additional impacts of supporting a circular economy Expanding circular solutions and services in a local community will support a circular economy and result in related benefits. However, to better assess the impacts of these efforts, they should be tracked and monitored.	Collaborate with interested parties to create list of impacts to monitor (e.g., community benefits, unintended consequences)
	Develop monitoring systems to track and assess impact
	Make recommendations or changes as appropriate and necessary

Community Engagement and Capacity Building

Future State: Californians are empowered to guide and participate in the state's circular transition for all.

Cross-Cutting Recommendations:

M. Foster open dialogue with community members to integrate continuous and inclusive input from all voices

N. Proactively engage and support capacity building for Tribal, rural, and environmentally burdened communities to participate in California's circular transition

Community engagement is a best practice in zero waste planning. It helps gather input, share updates, and shape strategies to meet local community needs and prevent adverse impacts.

Community Engagement and Capacity Building example outcomes along the MMH include:

Rethink: Identify common single-use products used by industry sector which have durable alternatives

Reduce: Consult with businesses on priority materials to understand and collaborate on source reduction challenges

Reuse: Support capacity building for community organizations that are connected to community needs and challenges to identify opportunities for expanded repair

Repurpose: Collaborate with local communities in co-creating new uses for decommissioned waste infrastructure

Recycle: Engage in-person with communities to understand real and perceived local composting barriers.

Community Engagement and Capacity Building Recommendations and Pathways:

Cross-Cutting: Community Engagement and Capacity Building Recommendation M:

Foster open dialogue with community members to integrate continuous and inclusive input from all voices

CalRecycle offers meaningful opportunities to provide input including monthly public meetings, needs assessments, workshops, and listening sessions. CalRecycle leverages multiple listservs with over 30,000 unique emails for outreach and engagement. The Office of Environmental Justice, Tribal Relations, Education and Outreach facilitates community engagement and Tribal consultation to inform the development of policies

and programs that optimize community benefits and prevent adverse impacts. CalRecycle's public affairs develops resources for Californians to advance zero waste and advocate for their communities. The department is currently developing more mechanisms for community members to use.

To mobilize more Californians and grow circular systems, the state needs to communicate clear solutions in regionally relevant, accessible platforms and appropriate languages. These efforts should improve the understanding of community concerns, help identify solutions, and inform the development of community benefits agreements. Key players can identify challenges, opportunities, and collaborations that make zero waste recommendations more likely to be adopted. For example, Portland created a **Waste Equity Citizen Advisory Council** to support the Oregon Metro Regional Waste Plan.

Pathways for Community Engagement and Capacity Building Recommendation M:

Three primary pathways for exploration have been identified to foster open dialogue with residents and communities to integrate continuous and inclusive input from all voices.

First Cycle	2027-2033
Key Parties for Implementation	CalRecycle, State Agencies, Local Jurisdictions, Non-governmental organizations, Community Based Organizations, Tribes, Californians
Pathway	**Key Action**
M1: Conduct meaningful community engagement through channels to share feedback, concerns, and ideas, and develop opportunities for active participation Where feasible, engagement efforts should strive to meet these groups where they are at, including faith communities, schools, businesses, and conferences/symposiums for community-based organizations, to gather input on infrastructure development concerns, community needs, and other topics. This pathway should record all the relevant opportunities for Californians to be involved as individuals, as part of the labor force, and in their communities. Making the connection between day-to-day activities and zero waste outcomes will strengthen support for the plan.	Assess current zero waste feedback channels and response rates to determine if additional mechanisms are needed
	Develop list of potential accessible platforms for sharing ideas, concerns, and feedback
	Track input for follow-up and transparency
	Promote events, workshops, and programs for circular economy education
	Facilitate community member involvement in local zero waste initiatives for input and engagement
	Highlight community contributions to increase transparency and foster ownership
M2: Highlight the benefits of the circular economy to build enthusiasm and momentum Benefits include green jobs and grant opportunities. Emphasizing the economic potential of the circular economy and engaging broader audiences will increase support and interest in zero waste.	Review effectiveness of previous educational initiatives (e.g., PRO campaigns)
	Develop educational content about benefits of circular transitions, including clear examples of how investments support community goals

This pathway should show an improved understanding of community concerns.	Conduct prioritization of initiatives informed by research from Recommendation I
M3: Facilitate Tribal consultation This pathway ensures dedicated Tribal consultation for open, on-going, and inclusive dialogue throughout Plan implementation. .	Identification of interested Tribes to participate in continuous input on elements of the Zero Waste Plan, as well as individuals assigned to roles outlined in the CalEPA Tribal Consultation Protocol.
This will follow **CalEPA's Tribal Consultation Protocol**, issued in February 2020. Tribes are a critical group to engage in government-to-government facilitation. Their community members and lands merit consideration to ensure that Plan implementation is working in concert with Tribal priorities and goals. Implementation should consider cultural and geographic context and may need to adapt to best suit community needs	Notify by issuing a letter to the affected Tribe(s) with attention to recommendations that may affect them, their natural or cultural resources Facilitate input from identified Tribes via various communications methods (e.g., written communications, public workshops and listening sessions, site visits) Provide follow-up in the form of feedback to Tribes involved in the consultation, with a description of how their inputs were considered and incorporated, in a letter from designated Consultation Official

Cross-Cutting: Community Engagement and Capacity Building Recommendation N:

Proactively engage and support capacity building for Tribal, rural, and environmentally burdened communities to participate in California's circular transition

Meaningful engagement and capacity building maximizes benefits for underserved communities, and increases effectiveness when individuals feel heard and/or involved. It ensures the circular economy reduces existing inequalities instead of making them worse.

Many Californians live near multiple sources of pollution, and some communities face greater health risks. These vulnerable communities often lack access to information about zero waste, circularity, and how to advocate for environmental and public health. Reducing waste mismanagement in low-income areas can improve health, boost economic opportunities, and support inclusion in the circular economy. By consulting with Tribes and engaging early and intentionally with overburdened communities to build capacity and empower them, California can ensure a waste-free future that benefits all.

Pathways for Community Engagement and Capacity Building Recommendation N:

Two primary pathways for exploration have been identified to **proactively engage and empower underrepresented communities to participate in California's zero waste and circular transition.**

Value for People
Community organizations reach more people and **amplify their impact** with support for zero waste work.

First Cycle	2028-2034
Key Parties for Implementation	CalRecycle, Local Jurisdictions, Non-governmental Organizations,Community Based Organizations, Tribes, Educational/Research Institutions
Pathway	**Key Action**
N1: Amplify and expand connections to community-led initiatives This pathway should identify organizations that engage with the community and find opportunities for public sector entities to collaborate with these organizations. It should empower communities and build trust through long term engagement and capacity building efforts. These efforts should leverage existing resources, such as community centers and academic institutions.	Identify and engage with community-led networks (including those currently and not yet connected with zero waste efforts) and follow models for collaboration, such as community benefits agreements
	Create a plan for early and frequent engagement across a diverse, broad network of communities to activate and amplify all voices.
	Solicit input/seek to understand current state, barriers, and zero waste needs (e.g., pollution impacts)
	Develop a toolkit of solutions to address these needs and gaps
	Broaden channels for communications and ways to participate with communities/ organizations
	Collect and highlight case studies of community efforts relevant to the Zero Waste Plan
	Provide capacity-building for identified groups to engage and activate through clear and actionable steps
	Develop/convene partnerships to provide concrete solutions with paths, steps and funding to reach zero waste.
N2: Meet groups where they are and establish liaisons to support circularity and avoid negative impacts in their communities Local-level liaisons and advocates need channels to provide input on the transition to zero waste and identify resources to address community needs. This pathway should include community engagement liaisons and sufficient government communications staff to support outreach, (especially when new programs are created) where feasible and appropriate.	Identify trusted local channels with established links to underrepresented communities (e.g., existing councils and meetings)
	Identify liaisons to provide consistent communication and support
	Gather community insights to inform policy and program development

Case Study

Zero Waste Academic Building

Chou Hall at UC Berkeley exemplifies a closed-loop system in its pursuit of zero waste, serving as a pioneering model in the Haas School of Business. As the first academic building in the US with zero waste certification through **the TRUE program, which has already diverted over 5.6 million tons from global waste streams**, Chou Hall integrates sustainability into its core operations.

The building functions as a living laboratory where sustainability solutions are tested and applied, emphasizing the importance of early engagement, comprehensive education, and waste audits. By achieving zero waste certification, Chou Hall sets a high standard for other campus buildings and reinforces the critical need for innovative waste management practices in educational settings.

Partnerships

Future State: Proactive avenues for cross-government and public/private partnerships are established which drive the circular transition in communities

Cross-Cutting Recommendation:

O. Lead local, national, and international multi-party collaboration to support zero waste implementation

This recommendation focuses on partnerships that create change for a circular economy through processes rather than infrastructure investment.

Partnerships example outcomes along the MMH include:

Rethink: Design California's cultural and entertainment venues and events as models of zero waste systems

Reduce: Expand private-public partnerships that have successfully reduced waste

Reuse: Develop shared (industry, state, national, or international) criteria for standardized, reusable containers

Repurpose: Build hubs for repurposing across the state through public-private partnerships

Recycle: Establish cross-border partnership for visibility into recycled material value chain for exported materials.

Partnerships Recommendation and Pathways:

Cross-Cutting: Partnership Recommendation O:

O. Lead local, national, and international multi-party collaboration to support zero waste implementation

Value for Economy
Governments and nonprofits reduce costs by sharing resources through strong zero waste partnerships.

Partnerships have been used to advance zero waste and circular economy efforts globally. The **Zero Waste International Alliance** (ZWIA) is a global organization promoting zero waste principles and has partnered with various global and regional entities, including municipalities, businesses, and advocacy groups, to support the transition to zero waste and promote sustainable waste management practices.

The state has a track record of building coalitions and partnerships to support ambitious policy goals. These examples can model ways of thinking about partnerships in support of the Zero Waste Plan. For example,

within the innovation ecosystem, California is home to multiple industry clusters such as the **Golden Triangle** biotechnology cluster.

Early partnerships can also serve as flagship examples to ignite cultural change and bring awareness to zero waste successes and barriers within California. For example, the planning for the Los Angeles 2028 Summer Olympics can benefit from understanding **Paris 2024's Circular Economy Strategy** and approach to partnerships. Other examples include zero waste programs and pilots in California at concert venues, university stadiums,[xxx] airports,[xxxi] and beyond.

Case Study

Olympic Circular Economy Strategy

The **Paris 2024 Olympic Games** integrated a circular economy model into every phase of the event. This innovative approach addressed resource scarcity and enhanced sustainable management well before the Games commenced, creating a reference framework for future Olympic organizing committees.

Paris 2024's success in sustainability was rooted in several key initiatives. Their strategy emphasized material reuse and recycling, **with a commitment to using 15 percent organic or recycled materials in licensed products. They targeted a 50 percent reduction in single-use plastics used for food consumption and ensuring that all temporary structures would have a 100 percent second life.** Their waste management included a collection system for pallets and plastic films and enhanced sorting practices. **These efforts aimed for 80 percent of consumption waste to be either avoided or recovered.** Importantly, **it was estimated that 65 percent of the resources mobilized for the Games will find a second life,** demonstrating a commitment to circular economy principles.

The Paris 2024 model offers lessons for CalRecycle and other regions, particularly for upcoming events like the LA 2028 Games. Strategies such as repurposing existing infrastructure, adopting policies for material reuse, and promoting eco-friendly, locally produced goods can enhance sustainability efforts and support local economies.[xxxii]

Pathways for Partnerships Recommendation O:

Three primary pathways for exploration will enable California to lead local, national, and international multi-party collaboration to support zero waste implementation.

First Cycle	2027-2032
Key Parties for Implementation	CalRecycle, State Agencies/Government, International Governments, Tribes, Nonprofits/Community Based Organizatios, Raw Material Suppliers, MRFs, Intermediate Manufacturers, Corporate Enablers
Pathway	**Key Action**
O1: Facilitate the development of local, state, national, and international public-private partnerships (PPP) to accelerate common goals and share costs This pathway would connect regional entities with the intent of exploring a PPP and creating a clear PPP pathway and function. Developing new PPPs such as these could provide a crucial missing link in North America focused partnerships for circular economy. Developing for regions or product categories could enable flexibility similar to Caltrans's PPP program, which includes demonstration projects.[xxxiii]	Conduct review of existing entities/partnerships of interest for PPPs, challenges/gaps (e.g., connecting regional parties with interest in reuse pilot)
	Integrate partnerships from national and international level to California-specific PPPs (e.g., identifying complementary partnerships to accelerate reuse)
	Facilitate connections between public and private interested parties to form partnerships (e.g., forums for recruiting partners)
	Develop joint funding and implementation mechanisms to accelerate shared goals (e.g., announce fund for reuse pilot)
	Highlight successful partnerships as replicable models for other interested parties
O2: Establish channels for intrastate, national, and international collaboration to tackle cross-border challenges This pathway builds on existing MOUs with national governments and municipalities; including but not limited to information exchange. It includes: • Sharing import and export data to find recycling gaps and guide investments • Mitigating the perceived risks of sending materials out of the country for recycling • Improving visibility of end-of-use or recovery of export materials.	Identify cross-border challenges and key areas (e.g., transparency challenges, materials-specific opportunities) for collaboration
	Initiate or further develop relationships with cross-border points of contact
	Develop shared frameworks to ensure responsible and equitable circular outcomes
	Create regular forums for knowledge exchange on circular economy initiatives (e.g., EPR, data tracking insights)
O3: Collaborate across local, state, and national agencies, as appropriate, to share key materials management data to inform full picture of California materials consumption and management This pathway increases visibility and data sharing across agencies that manage materials outside of	Evaluate existing interagency collaborations to identify key learnings and insights
	Create interagency data sharing protocol for materials management

CalRecycle, such as **DTSC** which manages highly hazardous waste. Adding data on these material streams would create a more accurate picture of waste and more opportunities to collaborate. Additional context on the benefit of these connections is included in the Data and Monitoring Recommendation K.	Conduct a comprehensive assessment of interagency material flows (what happens to disaster debris, construction waste) and management outcomes (who is responsible for their management) Use shared data to identify key leverage points for circular solutions

Case Study

Santa Cruz Food Recovery Network

Santa Cruz County, CA, is implementing a food recovery program in compliance with California's SB 1383, which mandates that commercial food generators donate surplus edible food. By partnering with local food banks and organizations, including **Second Harvest Food Bank** and its 70 partners, the county enhances food recovery and reduces waste. Meetings for SB 1383 Edible Food Recovery have evolved into a Think Tank, fostering collaboration, knowledge exchange, and resource sharing.[xxxiv] The Food Bank acts as a thought partner, collaborating with other nonprofits and government agencies. The program also focuses on reducing methane emissions, which are 84 times more powerful than CO_2. Expanding this waste management model implemented in Santa Cruz County to other regions could have a significant impact, namely substantial reductions in GHG emissions on a statewide level. Additionally, fostering increased collaboration between local jurisdictions and food recovery organizations has the potential to not only reduce food waste but also enhance food security for millions of Californians

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What's Next for California

Laying the Foundation for Implementation

The Zero Waste Plan provides the **blueprint to guide California's transition to a circular economy and zero waste**. Achieving **zero waste will require coordinated effort** across entities such as state agencies, local governments, businesses, and communities, each playing a role in turning the Plan's recommendations into action.

The next step for California's zero waste journey will be to **define the implementation plan**. This should include identifying **clear owners and active implementation actors** for initiatives and pathways as prioritized by the timelines. This is expected to require standing up working groups across agencies, Tribal, and local governments, collaborating with the private sector, elected officials, and communities.

This should include **defining CalRecycle's role** in California's full zero waste journey – in the implementation plans and could include **expanding the department's formal authority** to act on or coordinate efforts which currently fall beyond its statutory mandate.

The implementation plan should also **evaluate and identify the funding required** and available sources of funding. This should include public sector funding, private sector funding, and actions related to the Financial Mechanisms recommendations to attract and unlock investments and funding to be directed towards zero waste efforts.

With these foundational steps in place, **California will be positioned to move from planning to action**, ensuring that zero waste efforts are effectively resourced, coordinated, and advancing toward long-term success.

Tools and Solutions

To track progress and ensure accountability in implementing the Zero Waste Plan, a **variety of data-driven tools and solutions** should be leveraged. These solutions address key gaps in California's current materials management system by **improving data accessibility, program evaluation, and decision-making** through **user-friendly, actionable insights** that enable **continuous refinement of programs and policies**. Standardized data formats and reporting structures will improve comparability and analysis for KPIs and data monitoring and subsequent adjustments.

Potential Tracking and Monitoring Solutions

- **Centralized Zero Waste Data Platform** – A digital hub that consolidates reporting from state agencies, local governments, businesses, and other interested parties to improve alignment on progress and enable near real-time data analysis. This platform could serve as a comprehensive resource for tracking material flows, policy impacts, and economic benefits, helping to create a single source for circular economy progress. To ensure consistency and comparability across reporting entities, this platform should incorporate standardized data collection methods, reporting formats, and key performance metrics. By establishing common definitions and calculation methodologies, the platform

would enhance the reliability of insights and allow for more effective decision-making at both the state and local levels.

- **Circular Economy Impact Model** – A framework to measure economic growth, job creation, and material reuse in California's transition to a circular economy. This model could help quantify how investments and innovations contribute to statewide economic and environmental goals, filling a key gap in understanding the full value of circular strategies.
- **Community and Business Engagement Tools** –Solutions that facilitate participation and data-sharing from businesses and communities, ensuring that progress is informed by on-the-ground insights. This could include digital reporting tools, crowdsourced material exchange platforms, and localized waste tracking solutions to improve access to real-time material data and accelerate local circular solutions.
- **Cross-Agency Data Integration** – A collaborative approach to align material data with other state priorities, including climate action, public health, and economic development. Strengthening data coordination across agencies could improve California's ability to make informed, holistic decisions and ensure that circular economy initiatives are aligned with broader state goals.

Timeline Scenario

The Zero Waste Plan presents an implementation scenario projected out to 2045. There are various external factors – such as funding availability, regulatory momentum, and private sector participation – that will ultimately impact the speed and scale of implementation.

Rather than setting a fixed end date for zero waste, this **timeline illustrates the expected duration for one full iteration of each recommendation**, meaning the time required to achieve a meaningful cycle in California's waste and materials management system. The timeline scenario shows that **impact realization will follow the implementation** and take approximately the same duration as the implementation.

Zero waste and transitioning to a circular economy is an **exercise in continuous improvement**. California should aim to continue implementation effort and refinement on each of the identified recommendations. This is illustrated in the timeline scenario with the circular arrow at the end of each implementation bar. However, this timeline will require significant resourcing and coordination across interested parties, including but not limited to, state agencies, local governments, and the private sector.

2045 Timeline Scenario

Policy and Regulation

A: Adopt a circular-first framework for policies that prioritize highest and best use based on Materials Management Hierarchy

- 2028-2040 (iterative)
- Impact realization from 2040-2045

B: Review and refine existing policies, programs, regulations, and statutes for highest and best use based on Materials Management Hierarchy

- 2027-2039 (iterative)
- Impact realization from 2039-2045

Financial Mechanisms

C: Align market signals with zero waste and circular behavior

- 2027-2039 (iterative)
- Impact realization from 2039-2045

D: Establish sustainable public sector funding that supports a circular economy

- 2027-2039 (iterative)
- Impact realization from 2039-2045

Infrastructure for Circularity

E: Reduce challenges and increase benefits for infrastructure development and modifications,

- 2027-2035 (ongoing and iterative)
- Impact realization from 2035-2043

F: Grow circular businesses and develop systems for equitable distribution of materials

- 2028-2035 (iterative)
- Impact realization from 2035-2043

Research and Innovation

G: Support research initiatives and the development, adoption, and scaling of circular solutions

- 2027-2031 (ongoing and iterative)
- Impact realization from 2031-2035

H: Increase use of circular design principles in products and business models

- 2028-2034 (iterative)
- Impact realization from 2034-2041

Communication for Cultural and Behavioral Change

I: Develop tailored communication and education campaigns based on research of Californians' behaviors, beliefs, needs, and interests

- 2028-2031 (iterative)
- Impact realization from 2031-2034

J: Make it easier to find and use resources and tools for zero waste

- 2027-2031 (ongoing and iterative)

- Impact realization from 2031-2036

Data and Monitoring

K: Expand and standardize data visibility across material types and management pathways through open and crowdsourced data

- 2028-2034 (iterative)
- Impact realization from 2034-2041

L: Improve and expand data analysis and monitoring to inform new solutions and refine existing systems

- 2027-2030 (iterative)
- Impact realization from 2030-2034

Community Engagement and Capacity Building

M: Foster open dialogue with community members to integrate continuous and inclusive input from all voices

- 2027-2033 (iterative)
- Impact realization from 2033-2040

N: Proactively engage and support capacity building for Tribal, rural, and environmentally burdened communities to participate in California's circular transition

- 2028-2034 (iterative)
- Impact realization from 2034-2041

Partnerships

O. Lead local, national, and international multi-party collaboration to support zero waste implementation

- 2027-2032 (ongoing and iterative)
- Impact realization from 2032-2036

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Glossary Of Terms

Bioeconomy: Economic activity derived from biotechnology and biomanufacturing

Biomanufacturing: Microbes, and different organisms (bacterial cells, viruses, yeast, cyanobacteria, algae) can be programmed to make a variety of products such as food, feeds, fuels, fibers, bioplastics, natural rubbers, renewable chemicals, nutraceuticals, non-food materials, and other high value products. This process utilizes sustainable biomass or a sugar source as feedstock, providing an alternative to petrochemical-based production for many products like plastics, fuels, and material.

Biotechnology: Any technological application that uses biological systems, living organisms, biological processes, or derivatives thereof, to make or modify products or processes for specific use.

By-product: A substance, material, or product which is generated as a secondary result of making something else. This may be generated during manufacturing or processing, rejected as inferior during the process of grading or separating, or produced via an industrial or biological process. By-products which are considered to be valuable and intentionally produced as a secondary product are sometimes call “co-products”.

California Native American Tribe (Tribe): A Native American Tribe located in California that is on the contact list maintained by the Native American Heritage Commission for the purposes of Chapter 905 of the Statutes of 2004.

Capacity Building: Strengthening local coordination, leadership, knowledge, skills, expertise, and access to resources in California Tribes and under-resourced communities with the goal of helping to develop or increase the ability of that community to independently compete for grants and implement projects in the future.

Circular business models: Model to create, deliver, and capture economic value while designing waste out of the system by changing product design and inputs and/or offering services to extend product life and utilization.

Circular economy: An economic model which systematically eliminates waste by decoupling value creation from resource extraction. Circular economy serves as a systems-based framework for achieving zero waste goals by managing materials and products in a manner which keeps products, components, and materials at their highest utility and value for as long as possible to preserve the embedded labor, material, and capital costs. In a circular economy, when a product reaches the end of its useful life its materials and components are returned to the system as inputs for new products through activities such as reverse logistics, recycling, composting, and remanufacturing. Visualized in Figure 2[xxxv]

Circular materials management: A systematic approach to materials management which focuses on using and reusing materials more productively throughout their lifecycle; in line with circular economy principles. Also referred to as “Sustainable Materials Management” and is in contrast to “waste management”

Circular principles: The foundational concepts or guidelines which enable the circular economy. This includes a focus on designing waste out of the resource ecosystem, keeping materials and products in use as long as possible, maximizing the value retained in materials and products in circulation.

Closed-loop systems: Processes in which waste serves as an input, thus eliminating the notion of an undesirable by-product. In a closed-loop system, all materials are used, reduced, and reused within a closed environment.

Co-digestion: Anaerobic digestion of multiple organic wastes, such as food waste and green waste to produce renewable energy or nutrient-rich soil products.

Communities: When used without a particular modifier, "communities" in this Plan refers broadly to all groups of people sharing geographic, social, or common interests, including environmentally burdened or

disadvantaged populations, local groups and networks, Tribal communities, neighborhoods and jurisdictional groups.

Composting: The decomposition of organic materials by aerobic microorganisms. Composting facilities manage the amount of moisture and oxygen and the mixture of organic materials for optimal composting conditions. The composting process emits heat, water vapor and biogenic carbon dioxide, reducing the raw organic materials in mass and volume to create compost.

Decoupling: The separation of economic growth or value generation from resource consumption and extraction

Edible food recovery: The collection of edible food that would otherwise go to waste and redistributing it to feed people in need; sometimes referred to as food rescue.

End-of-life / End-of-use: Refers to the stage at which products or materials have reached the end of their useful life and are no longer in active use, at which point they can be recycled, composted, or disposed.

Energy efficiency investments: Investments in infrastructure that reduce the energy consumption required to achieve the same results. This includes measures such as insulation, reducing line loss in energy transmission and distribution, and other improvements that enhance energy efficiency across various settings, from homes to large organizations.

Energy transition: Refers to the global energy sector's shift from fossil-fuel-based systems of energy generation — including oil, natural gas, and coal — to renewable energy sources like wind and solar. Energy storage through technologies such as batteries are a key component of the energy transition as they enable energy reliability despite the variable nature of renewable generation.

Environmental justice: The fair treatment and meaningful involvement of people of all races, cultures, incomes, and national origins, with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies to reduce pollution burdens and ensure a healthy environment for all.

Extended Producer Responsibility (EPR): An environmental policy approach that holds producers responsible for product management throughout the product's lifecycle.

Greenhouse gas: Any gas that absorbs infrared radiation in the atmosphere. Greenhouse gases include, but are not limited to, water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N2O), hydrochlorofluorocarbons (HCFCs), ozone (O_3), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).

Landfill: A permitted facility that provides a legal site for final disposal of materials, including mixed solid waste, beneficial materials used for landfill construction, ADC, and specialized material sites, such as waste tires and construction and demolition waste.

Language access:: Providing access to information, programs, benefits, and services to people with limited English proficiency by ensuring that language is not a barrier to access.

Lifecycle (Material Lifecycle or Product Lifecycle): Product lifecycle or material lifecycle refers to the collection of all the stages (or phases) that a product or material moves through from inception (e.g., raw material) to the end of its useful life. A product's lifecycle can be extended by keeping the product in use via solutions such as repair, sharing models (e.g., rental, pay-for-service), reuse (i.e., donation to a new owner), repurpose (i.e., using the product or material for a new purpose). The stages of the lifecycle are included in the circular economy model (Figure 2). This is not to be confused with "lifecycle analysis", which is an evaluation of the environmental impacts of a product or material across all lifecycle stages and not the lifecycle itself.

Material Characterization Study (MCS): Estimates the volume and composition of the landfilled waste stream into distinct material types for the commercial, residential, and self-haul sectors in California.

Materials management: A proactive approach to managing the full lifecycle of materials and products – including before they are considered "waste"; in contrast to "waste management"

Materials Management Hierarchy (MMH): Offers a framework for material use decisions—evaluating the need for resource use and ensuring the highest and best use of resources which are deemed necessary.

Multi-use: The term multi-use describes products which serve as alternatives to single-use products. This can include refillable or reusable products such as containers, cutlery, bags, etc. and can refer to products which are managed by the California's Beverage Container Recycling Program (BCRP) as well as those that are not covered by the BCRP program.

Organic waste (as defined in the SB 1383 regulations): Solid wastes containing material originated from living organisms and their metabolic waste products including, but not limited to, food, green material, landscape and pruning waste, organic textiles and carpets, lumber, wood, paper products, printing and writing paper, manure, biosolids, digestate, and sludges.

Recycling: The process of collecting, sorting, cleansing, treating, and reconstituting materials that would otherwise ultimately be disposed of onto land or into water or the atmosphere, and returning them to, or maintaining them within, the economic mainstream in the form of recovered material for new, reused, or reconstituted products, including compost, that meet the quality standards necessary to be used in the marketplace.

Remanufacturing: Use waste materials to make recycled-content intermediate and/or final products.

Repair: Extend the useful life and value of existing products and materials by fixing a damaged or malfunctioning product to restore its original functionality and delay or avoid the need for new products or materials (i.e., replacement)

Repurpose: Transition existing products and materials to a new lifecycle by using the product/material for a different purpose or function than originally intended (without processing into new, raw material)

Responsible end-market: A materials market in which the recycling and recovery of materials conducted in a way that benefits the environment and minimizes risks to public health and worker health and safety. (Plastic Pollution Prevention and Packaging Producer Responsibility Act [42040 - 42084])

Reuse: Keeps products in use in their original form and for their original purpose

Solid waste: Refuse that may be mixed with or contain nonorganic material, processed industrial materials, plastics, or other recyclables with the potential for recovery. It includes residential, commercial, and institutional wastes.

Sorting: Is the process of separating different types of materials based on their characteristics and requirements for further materials management or processing.

Source reduction: Is any action that causes a net reduction in the generation of solid waste. This includes reusing materials, reducing volume of materials used or products consumed, replacing disposable goods with reusable goods, reducing packaging, and food reuse through edible food recovery. This is often also known as "waste prevention".

Waste management: The traditional processes of collection, transport, treatment, disposal or processing required to dispose or divert materials which are considered to be waste; only addresses materials which are considered to be waste

Waste prevention: See Source Reduction

Zero waste: Zero Waste is a comprehensive approach to conserving and managing California's resources by rethinking design to eliminate waste, reducing what we use, reusing and repurposing what we have, and responsibly recycling remaining materials to protect the environment and health for all.

Abbreviations and Acronyms

AB Assembly Bill

AI Artificial Intelligence

BCRP California's Beverage Container Recycling Program

C&D Construction and Demolition

CA California

CalEPA California Environmental Protection Agency

CalOES California Governor's Office of Emergency Services

CalRecycle California Department of Resources Recycling and Recovery

CO_2 Carbon Dioxide

CRIIS CalRecycle Integrated Information System

CRRA California Resource and Recovery Association

CRV California Redemption Value

DTSC California Department of Toxic Substances Control

EIR Environmental Impact Report

EMF Ellen MacArthur Foundation

EPA United States Environmental Protection Agency

EPR Extended Producer Responsibility

EU European Union

GDP Gross Domestic Product

GHG Greenhouse gases

GPS Global Positioning System

lbs. pounds

KPI Key Performance Indicators

M million

MMH Materials Management Hierarchy

MOUs Memorandums of Understanding

MRFs Material Recovery Facilities

MWh Megawatt-hour

NGOs Non-governmental organization

NRDC Natural Resources Defense Council

NSJV North San Joaquin Valley

PCR post-consumer recycled or post-consumer recycled content

PPP Public-private Partnerships

PRO Producer Responsibility Organization

ROI Return on Investment

SB Senate Bill

SMB Small and Medium Sized Businesses

STEM Science, Technology, Engineering, and Mathematics

UC University of California

UN United Nations

US United States of America

ZWIA Zero Waste International Alliance

Overview of the Process for the Recommendations Report Submitted to CalRecycle and the Zero Waste Plan

In June 2024, CalRecycle published a Zero Waste Plan Baseline Report consistent with SB 101 (The California Budget Act of 2023). In parallel with the Baseline Report development, CalRecycle worked with a contractor to create an internal overview 'Recommendations Report' with oversight from a Steering Committee spanning, analyses of available CalRecycle and external data, benchmarking of leading zero waste plans, synthesis of dozens of case studies of circular economy innovation, and direct engagement with key actors.

The Zero Waste Plan details fifteen (15) recommendations which were developed from the Recommendations Report, as well as pathways and actions for achieving each. Case studies demonstrating real world examples are included throughout to illustrate replicable successes.

CalRecycle engaged over 30,000 interested parties in the development of the Zero Waste Plan from 2024-2025. Engagement activities included:

- A survey sent to subscribers of all CalRecycle listservs to identify priority topics to address
- A series of Public Workshops (August 2024, January 2025, October 2025) to share progress updates and solicit feedback on the Baseline Report and Recommendations
- Cross-sector by-invitation discussions on source reduction and product design for circularity and infrastructure
- Dedicated by-invitation workshops or presentations for non-governmental organizations, Tribes, and Higher Education representatives
- Interviews to inform examples of circular economy successes in California to feature in the Zero Waste Plan
- A series of five Listening Sessions in March 2025 to gather feedback on the Recommendations and Pathways (split by sector: Public, Private, Waste/Recycling, Tribes, Social)]

CalRecycle reviewed and considered all live and written comments submitted over the course of the Zero Waste Plan development.

How California's Materials Management Hierarchy Was Developed

The Materials Management Hierarchy offers a structure to guide materials management decisions. While many Materials Management Hierarchy variations have been developed and adopted globally, all have the same design and overarching objective.

Its design as an inverted pyramid emphasizes the importance of prioritizing highest and best use, **preventing waste generation** at the source and **retaining product and material value** while minimizing environment and human health impacts at every stage. This version shown in Figure 1 was developed specifically for the State of California to highlight the layers which contribute to source reduction and emphasize the outcome of a particular stage (e.g., extending the useful life of a product) instead of a process or technology for managing materials (e.g., mechanical decomposition).

While the layers of the Materials Management Hierarchy pyramid are already ordered from most value retained to least value retained, there is also opportunity to prioritize solutions within a given layer to optimize for value retention or make material-specific versions of the pyramid. This type of framework should be incorporated into

California's overarching circular materials management framework as described in Policy and Regulation Recommendation A.

How the Zero Waste Definition Was Developed

As part of the process of developing a definition for the state, CalRecycle conducted a benchmarking exercise of zero waste definitions used across the state, country, and world. This process identified common themes, which include incorporation of the principles of the Materials Management Hierarchy, the importance of a comprehensive approach, and a connection to equity and health for our people and planet. These themes along with an interest in ensuring that the definition remains evergreen for the state were used to draft a zero waste definition for California and the Zero Waste Plan.

The final zero waste definition: **"**Zero Waste is a comprehensive approach to conserving and managing California's resources by rethinking design to eliminate waste, reducing what we use, reusing and repurposing what we have, and responsibly recycling remaining materials to protect the environment and health for all.**"**

How the Value of the Circular Transition was Calculated

To estimate the economic impact of California's transition to a circular economy, we applied the results of the United Nations Economic Commission for Latin America and the Caribbean's (ECLAC) macroeconomic model to California. ECLAC's research[xxxvi] was selected as the core starting point of our calculations due to its focus on economic transformation across industries and its applicability to economies with diverse sector compositions, making it a relevant benchmark for California.

By aligning this methodology with California's industry composition, we estimated that a full circular transition by the year 2050 would result in an incremental 531,000 new jobs and an annual increase in GDP of $411 billion.[xxxvii] The model highlights how circular strategies can drive economic growth, resilience, and competitiveness.

Driving even a portion of this circular transition has meaningful economic implications. These economic benefits can be locally targeted by focusing efforts in communities most in need of an economic boost.

This analysis reinforces that a circular transition is not just an environmental strategy, but an economic imperative. The Zero Waste Plan outlines actions that align with California's existing economic strengths, ensuring that industries can seize opportunities in the circular economy while maintaining the state's leadership in sustainability-driven innovation.

Public Input Survey Results

Overview: Aug 2024 Public Input Survey

30K+ survey requests sent out

302 individual responses

235 unique ZIP codes

41% familiar with CA's Zero Waste Plan

65% self-identified as engaged in zero waste

Count of Responses by Group

Local Jurisdiction	74
None of these options apply to me	55
Community Group	29
Non-Governmental Organization	22
Education/Research Institution	22
Producer/Manufacturer	18
State Agency	13
Federal Government	13
Collector/Hauler	9
Trade Association	8
Circular Technology/Solution Provider	7
Corporate Enabler	7
Retailer	7
Recycled Material Processor	4
Wholesaler/Distributer	4
Corporate Consumer	3
Composting/Wastewater Facility	3
Reuse/Donation Center or Food Bank	1
Tribal Government	1
Mixed Waste Processor/Transfer Station	1
State Policy Maker	1

Details: Aug 2024 Public Input Survey

Respondents rank ordered key topics with potential to "move the needle"

(in order from first choice to last choice)

Infrastructure for Circularity – ranked second highest as #1 and most respondents ranking in top 3

Financial Mechanisms – ranked third highest as #1 and m"st respondents ranking in top 3

Comms and Awareness – ranked highest as #1 and over half of respondents ranking in top 3

Policy and Regulation – ranked fourth highest as #1 and fairly equally as high and low choices

Data & Monitoring – ranked fifth highest as #1 and most respondents ranking in mid to lower rankings

Partnerships – ranked lowest as #1 and most respondents ranking as lower choices

Research and Innovation – ranked sixth highest as #1 and most respondents ranking in mid and lower choices

Other (varies) – majority ranking as last choice

Respondents want to see a transition to circularity…

"The transition to a more circular economy is important to California"

Strongly Agree 69%

Agree 19%

Neutral/I Don't Know 6%

Disagree 3%

Strongly Disagree 3%

And do not perceive the status quo as sufficient

"My community or business has what we need to participate in zero waste practices"

Strongly Agree 8%

Agree 12%

Neutral/I Don't Know 26%

Disagree 33%

Strongly Disagree 21%

Note: respondents self-identified their group based on what they felt best represented them

Definitions of Key Parties

Group	Key Parties	Definitions
Public Sector	Federal Government	United States Government
	Local Jurisdiction	California county, city, municipal government entity
	State Agencies	Executive branch of the California state government
	Elected Officials	State policy makers
	California Native American tribes (Tribes)	Native American tribes located in California that are on the contact list maintained by the Native American Heritage Commission for the purposes of Chapter 905 of the Statutes of 2004
Operational and Industry Actors	Circular Solution/Technology Provider	3rd party developer of circular solutions or technology (start-ups, etc.)
	Composting/In-Vessel Digestion (including Wastewater Facilities)	Entity which processes/treats organic waste
	Corporate Enabler	Commercial business or organization that supports the waste management industry (investors, builders, etc.)
	Corporate Generator	Commercial business or organization that purchases or uses products/materials for their own consumption or operations
	Intermediate Manufacturer	Entity which transforms recyclable materials into processed post-consumer materials
	MRF	Entity that sorts recyclable materials
	Producer/Manufacturer	Entity who uses raw materials to produce and/or manufacture products
	Raw Material Supplier	Entity who mines/excavates/sources raw materials
	Reuse/Donation Centers/Food Recovery Entity	Commercial or non-profit center that collects and distributes organic or non-organic material for re-use or re-distribution
	Retailer	Entity which sells goods or services to corporate, governmental, or individual consumers
	Secondary Manufacturer	Manufacturer or producer who uses post-consumer materials
	Trade Association	Industry group representing part of the waste or materials management industry

	Waste Collector/Hauler	Operator of waste removal services
	Wholesaler/Distributor	Entity who buys or distributes bulk goods for resale
Social Sector	Educational/Research Institution	University, school, or other research and education entity
	Non-governmental Organization	Non-governmental organization that has an interest in the environment or material management (environmental action, justice, or advocacy)
Residents	Californian	California resident
	Community Based Organization	Organizations incorporated for the purpose of providing services or other assistance to economically or socially disadvantaged persons within their designated community

References

[i] UN ECLAC, Adapted from **Modeling the Macroeconomic Effects of the Transition to the Circular Economy in Latin America: The Cases of Chile, Colombia, Mexico, and Peru** (2023)
[ii] Ibid.
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