State of California
CalRecycle

Proposed Regulations for the Plastic Pollution Prevention and Packaging Producer Responsibility Act

Standardized Regulatory Impact Assessment (SRIA)

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Introduction

This report presents a conservative estimated economic impact of SB 54 (Allen, Chapter 75, Statutes of 2022) the Plastic Pollution Prevention and Packaging Producer Responsibility Act (the Act) and Proposed Regulations, based on the best available, applicable data. Many factors will affect the actual, realized impacts, most notably decisions by the Producer Responsibility Organization (PRO) and producers regarding their compliance pathways, as well as individual consumer decisions. These decisions may result in a reduction of the actual costs to implement and a potential increase in benefits from the estimates presented in this report.

In 2021, Californians discarded over 11 million tons of packaging, including nearly 5.5 million tons of plastics, and only six percent of this plastic waste was recycled; the rest was disposed.[1] Improperly discarded packaging, including plastics, can end up in the environment. Harmful chemicals contained in the plastics can enter natural water systems, potentially causing harm to natural ecosystems and human health.

The waste hierarchy is a strategy for waste management that prioritizes waste prevention through waste reduction and reuse. Recycling materials rather than disposing of materials results in decreased greenhouse gas emissions and less waste in the environment, improving ecosystems and human health. The first component of the waste hierarchy is to "reduce." One strategy to reduce the amount of waste in the waste stream is to reduce the amount generated, also known as source reduction. Source reduction, especially for plastics, can be achieved in a variety of ways, including eliminating some of the plastic components, reducing the plastic to product ratio (e.g., by shifting to bulk or large-format packaging), and switching to non-plastic packaging. The second component of the waste hierarchy is "reuse." Much of the packaging currently produced is single-use by design. Reuse can be accomplished by switching single-use packaging to reusable or refillable packaging. For plastic packaging that remains single-use, recycling returns some of that material into the manufacturing stream to make new products, reducing the amount of single-use plastic needed and reducing the associated environmental impacts.

While recycling is key in addressing the problem of packaging waste, it has its challenges. For example, some types of plastic resins, such as polyethylene terephthalate (PET/PETE), are easily recycled; however, polystyrene (PS) resin types are more difficult to recycle. Certain plastic forms, regardless of resin type, are difficult to recycle because of their shape or size. While low-density polyethylene (LDPE) resin is recyclable, its typical forms, like plastic bags, make recycling of LDPE difficult as the bags interfere with the operation of sorting machinery. Small plastic components, like bottle caps and rings, can also cause issues when they get caught in or fall through sorting machinery, causing stoppages or necessitating repairs.

The Act applies waste hierarchy strategies to reduce the environmental and health impacts of single-use packaging and plastic food service ware pollution by focusing on waste reduction and moving to a circular economy. The Act facilitates shifting the burden of managing single-use packaging and plastic food service ware waste from local governments to the producers of the material. The Act requires producers of covered materials to source reduce plastic covered material by 25 percent, meet a 65 percent recycling rate goal and ensure that all covered material offered for sale, distributed in, or imported into the state on or after January 1, 2032, is recyclable or compostable. The Act also requires producers to establish a PRO for the purpose of developing and implementing an Extended Producer Responsibility (EPR) program for packaging and single-use food service ware. The Act prohibits a producer from selling, offering for sale, importing, or distributing covered materials in the state unless the producer is approved to participate in the producer responsibility plan of a PRO or alternatively complies as an independent producer. The Act imposes requirements on PROs and participant producers, and independent producers, including registration, reporting, recordkeeping, and auditing requirements; remittance of surcharges; and budget and annual report preparation. The Act also requires that local jurisdictions and recycling service providers include all covered material deemed by CalRecycle as recyclable and compostable in their collection and recycling programs, except as specified.

Statement on the Need for the Proposed Regulations

Product packaging and single-use food service ware made up 30 percent by weight, which is 50 percent by volume, of the waste discarded in California in 2021. Approximately 33 percent of packaging and food service ware is plastic.[2] Even though some plastics can be easily recycled, most plastics are disposed of, ending up in landfills or as pollution, which leads to persistence in the environment for decades to potentially hundreds of years. The production and use of single-use packaging and plastic food service ware results in numerous impacts on human health and the environment, including greenhouse gas (GHG) emissions, toxic chemical release, water quality, and respiratory effects. Recycling and source reduction of plastics reduces the amount of petroleum that needs to be extracted and reduces the corresponding GHG emissions. Finding solutions that reduce the amount of GHG emissions reduces impacts on historically disadvantaged, low-income, and rural communities, which are disproportionately affected by climate change and other forms of pollution from fossil fuel extraction and plastic manufacturing.

The Proposed Regulations address these concerns by implementing the statutory requirement for manufacturers to source reduce plastic covered material in California by 25 percent. This will lessen the negative impacts of single-use packaging and plastic food service ware on the environment and human health. Producers are required to ensure that all covered material sold, offered for sale, or distributed within California is

recyclable by the year 2032, ensuring there is a pathway for the responsible management of covered materials. The requirement for a 65 percent plastic recycling rate will help ensure that plastic is diverted to responsible end markets (REMs). The PRO is responsible for reimbursing local jurisdictions, recycling service providers, alternative collection systems, and others for the cost of the actions necessary to meet the statutory and regulatory requirements. The legislation requires local jurisdictions and recycling service providers to include the covered material in their collection and recycling services. All packaging must be recyclable or compostable, and local jurisdictions and recycling service providers are required to collect it. This will reduce the confusion consumers face regarding the recyclability and compostability of packaging. Additionally, since all packaging will be recyclable or compostable, it will relieve the burden on local jurisdictions and recycling service providers responsible for its disposal. Instead, the responsibility is on the producers to ensure that their packaging is compliant and can be recycled or composted.

Major Regulation Determination

Local governments and ratepayers have historically borne the costs of managing the end-of-life costs of single-use packaging and plastic food service ware. The Act will shift this burden to those entities that are most able to make design changes that could reduce end-of-life impacts (economic as well as environmental) of their products and packages. CalRecycle determined that the Proposed Regulations constitute a Major Regulation because the economic impacts associated with the implementation of statutory requirements, through the Proposed Regulations, for producers to take on these end-of-life costs is projected to exceed $50 million in a 12-month period.[3] To meet the goals mandated by statute, the PRO and independent producers will need to source reduce approximately 716,000tons of plastic covered material. The PRO is required to pay $500 million into the California Plastic Pollution Mitigation Fund, to help mitigate disproportional impacts on communities from plastic pollution and climate change every year beginning on July 1, 2027, and ending on January 1, 2037.[4]

Baseline Information

CalRecycle evaluated the economic and waste generation impacts of the Act and the Proposed Regulations against a “business-as-usual” (BAU) scenario for each year from 2022 through 2032. The baseline for the Act and the Proposed Regulations assumes full compliance with the existing regulations governing plastic waste, recycling, and composting, including the recently implemented Short-lived Climate Pollutants (SLCP) regulations.[5] For the BAU scenario, CalRecycle used the 2021 Waste Characterization Study (WCS),[6] 2021 Recycling and Disposal Reporting System (RDRS)[7] data in CalRecycle’s material reporting database, and the Source Reduction Baseline Study (SRB)[8] to estimate a baseline for the covered material generated. Statute requires the use of data from the 2023 calendar year when determining the source reduction baseline.[9] The covered material generation rate was assumed to equal disposal plus recovery (recycling and composting). CalRecycle is preparing a 2025 WCS that will

contain estimates for the weights of all of the covered material categories. CalRecycle expects to publish this data by the end of the 2025 calendar year. This data was not available for use in CalRecycle's economic impact analyses as the study is still ongoing. As 2021 WCS is the most recently available data for disposal, the corresponding data for 2021 in RDRS was used to estimate the amount of covered material generated in 2023 for paper, metal, glass, and organics. CalRecycle published the SRB in 2024,[10] which provides more precisely estimated values for total plastic covered material and total plastic components than is available from the 2021 WCS and RDRS data. The plastic weight and component number estimates from the SRB were used in place of the plastic estimates from the 2021 WCS and RDRS data throughout the analysis. CalRecycle used this baseline, referred to as the Baseline, as the foundation for several estimates discussed throughout the report. The Baseline was adjusted for each year through full implementation to account for compliance with intermediate source reduction and recycling rate goal achievement.

In addition to the generation, disposal, and recovery components, the Baseline scenario also assumes infrastructure development required for compliance with existing law. The Short-Lived Climate Pollutant Act (SB 1383, Lara, Chapter 395, Statutes of 2016) and the Sustainable Packaging for the State of California Act (SB 1335, Allen, Chapter 610, Statutes of 2018) include requirements that impact the regulation, handling, and processing of similar materials as those included in the Act. These requirements include expanding collection and processing infrastructure for organic materials (including paper and compostable plastic). Infrastructure and collection expansion for these existing laws are ongoing. As these infrastructure improvements were required by previous law, CalRecycle has not included these costs in its estimates to implement the Act.

The Act requires California to fundamentally change its approach to managing the production and disposal of single-use plastic packaging and plastic food service ware. It is designed to address plastic pollution through source reduction and by requiring producers of covered material to verify that their products are recycled. As such, CalRecycle projects this shift to more recyclable and compostable materials and greater accountability will impact all 39 million Californians and its 13.8 million households. An estimated 559,884 businesses will be impacted compared to the baseline scenario. The affected businesses encompass producers of covered material, retailers, wholesalers, and restaurants. Within this business landscape, it is estimated that 5,741 may be classified as large producers (fully regulated) of covered material, while 7,874 may be classified as small producers (potentially eligible for an exemption from most of the requirements).

COVID-19 Impacts

The RDRS data offers insights into the recovery of material categories in accordance with SB 54, delineated by annual breakdowns from 2019 to 2022. Notably, the 2019 data encompasses information collected only in the third and fourth quarters, prompting CalRecycle to estimate the total material recovered for that year by doubling the

reported totals from these last two quarters. The 2021 RDRS Analysis worksheet within the Direct Impacts Model (DIM) provides a breakdown of this data.

Over the period from 2019 to 2022, there was a noticeable overall increase in recovery, with the peak recovery observed in 2022. The data is categorized into distinct material types, including Plastic, Paper, Metal, Glass, Organics, and Mixed Recyclables. Recovery for most categories demonstrates a consistent year-on-year increase, except for Mixed Recyclables, which notably declined in 2021 and 2022 when compared to the figures from 2019 and 2020. One explanation for this decline is the enhanced familiarity with the reporting system, allowing operators to furnish more precise quantifications of materials.

An analysis of waste management trends within the context of the COVID-19 pandemic, commencing in late 2019 and substantially impacting 2020 and subsequent years, sheds light on potential correlations between the pandemic and waste generation patterns.

The pandemic significantly altered consumer behavior due to lockdowns, remote work arrangements, and business restrictions. The shift towards staying at home led to heightened consumption of packaged goods, particularly plastics and paper-based products. This contributed to the increase in recovery within these categories. Furthermore, the surge in online shopping during lockdowns, driven by safety concerns, amplified the demand for packaging materials, notably plastics and paper, as evidenced by the increased recovery rates in these segments.

In the wake of the pandemic, there was a noticeable increase in packaging consumption. Some of CalRecycle's assumptions and baseline data rely on these pandemic-induced consumption patterns. Consequently, there is a potential for direct cost estimates to be on the higher side when compared to estimates in a typical, non-pandemic scenario. However, it is important to note that the exact magnitude of this inflation remains uncertain due to a lack of comprehensive recovery data from non-pandemic years within CalRecycle's dataset. The Needs Assessment will enable a more accurate assessment of packaging consumption and its associated costs since it will address the necessary steps and investment needed for implementation of the Act based on a post-pandemic baseline.

In the aftermath of the COVID-19 pandemic, the packaging landscape is set to undergo transformative shifts driven by the Act and evolving consumer behavior. Sustainability will likely remain at the forefront for producers and consumers, with a notable inclination towards packaging solutions with less environmental impact. The sectors affected by the Act are likely to witness a wave of innovation to optimize packaging while prioritizing sustainability. Adherence to emerging regulations, and an understanding of changing consumer preferences will collectively shape the packaging trends in the post-COVID era, aligning with a more environmentally conscious and dynamic consumer base.

Public Outreach and Input

Public Workshops and Meetings

CalRecycle conducted a series of publicly noticed informational sessions, nonregulatory workshops, and informal rulemaking workshops on topics related to the Act. These hybrid sessions and workshops were held in-person at CalRecycle in the Byron Sher Auditorium, Coastal Hearing Room, or Sierra Hearing Room at the California Environmental Protection Agency (CalEPA) headquarters building in Sacramento, California. The public sessions and workshops were simultaneously webcast, which allowed interested parties and members of the public to either attend in person or participate virtually to provide input and feedback on topics. A notice announcing each workshop was sent out via listserv prior to the scheduled date and posted on the CalRecycle website. Workshop notices distributed via the CalRecycle listserv included discussion documents explaining the proposed regulatory concepts in detail, and presentation slides were made available following each session and workshop. A summary of CalRecycle's public workshops on the Act is shown in Table 1. Interested parties who have attended and participated in workshops are listed in Appendix A.

Table 1: Topics of CalRecycle's Public Sessions and Workshops on the Act

Date	Informational Topics	Non-Rulemaking Topics	Informal Rulemaking Topics
Jan. 31, 2023	Overview of SB 54 Statute, Rulemaking in California, Materials Characterization Studies		
Feb. 28, 2023*	Advisory Board, Needs Assessment		
March 29, 2023†	PRO, PRO Plan		PRO Plan, Document Submittals, Annual Report
April 25, 2023	Covered Materials	Producer Reporting Systems	Covered Materials

* Held in the Sierra Hearing Room
† Held in the Coastal Hearing Room

Date	Informational Topics	Non-Rulemaking Topics	Informal Rulemaking Topics
May 31, 2023	Source Reduction, Responsible End Markets	Source Reduction Baseline	Source Reduction, Responsible End Markets
June 28, 2023	Covered Material Category (CMC) List, Recyclability, Compostability	CMC List	CMC List, Recyclability, Compostability
June 29, 2023	Local Jurisdiction Impacts; Independent Producers; SRIA Data Requests		Local Jurisdiction Impacts; Independent Producers; Exemptions for Small Producers, Small Retailers, and Small Wholesalers
July 24, 2023	Recycling Rate, Compostable Materials, Reusable/Refillable, Producers, PRO and Independent Producer Plan, Data Reporting		Recycling Rate, Compostable Materials, Reusable/Refillable, Producers, PRO and Independent Producer Responsibility Plan, Data Reporting
July 25, 2023	Needs Assessment, Ecomodulation, Advisory Board, Enforcement		Ecomodulation, Advisory Board, Enforcement
September 27, 2023*	CMC List, Material Characterization Study, Needs Assessment	CMC List, Needs Assessment	
October 12, 2023	PRO Application		
December 14, 2023	Needs Assessment		
February 1, 2024	Proposed Regulations Text Questions and Answers Session		

Date	Informational Topics	Non-Rulemaking Topics	Informal Rulemaking Topics
May 1, 2024	Needs Assessment and CMC updates		
November 19, 2024	Draft Program Environmental Impact Report		
February 3, 2025*	CMC List, Source Reduction Baseline		
May 27, 2025	SRIA		Draft Proposed Regulations

Interested Parties Meetings

In addition to the sessions and workshops, CalRecycle has engaged with multiple affected stakeholder groups via e-mail, teleconference, and in-person meetings. Groups who CalRecycle has engaged with outside of the public sessions and workshops are listed in Appendix A.

Educational Presentations

CalRecycle has given virtual and in-person presentations on the Act at a variety of venues, including the UN Intergovernmental Negotiating Committee on Plastic Pollution and the Southern California Solid Waste Association of North America Conference. CalRecycle has also shared information about the Act during speeches to interested groups. Complete lists of these presentations and speeches are given in Appendix A.

Public Outreach

CalRecycle maintains a web page on the Act that is featured on CalRecycle's home page, giving it high visibility. The page provides a high-level overview of what the law requires and up-to-date information on the Act, including related events, a legislative timeline, infographics, and a fact sheet. The web page also provides links to:

- A page on the Advisory Board
- Circular Action Alliance's PRO Applicant Package
- A page on the needs assessment that CalRecycle is required to perform
- Presentation slides and discussion documents for all past and upcoming public meetings and workshops
- The Draft Regulatory Text
- The Covered Material Categories List and Supplemental Material
- The Plastic Pollution Prevention and Packaging Producer Responsibility Act Report to the Legislature

CalRecycle provides information on the Act through multiple listservs totaling 7,868 recipients. Additionally, CalRecycle monitors and responds to a Packaging email inbox to which the public can send input regarding the Proposed Regulations for the Act.

CalRecycle's Office of Public Affairs has developed an informative video[11] to educate interested parties and the public about the new law and presented it at public meetings and on social media. CalRecycle's Office of Public Affairs has provided media advisories to both industry associations and news media to further draw attention to the public workshops. All advisories are also posted to CalRecycle's website. CalRecycle's posts content related to the Act on its multiple social media channels. Lists of media stories and examples of social media postings are given in Appendix A.

Benefits

The actual realized benefits derived from the Proposed Regulations will be affected by several factors, most notably decisions by the PRO and producers regarding their compliance pathways, as well as individual consumer decisions. These decisions may result in the actual benefits being greater than the estimates presented here.

CalRecycle finds that the Act and the Proposed Regulations will provide benefits to the environment, human health, the economy, and the health, safety, and welfare of California residents. There is no indication that worker safety will be negatively impacted due to the Act or the Proposed Regulations. Pollution associated with single-use packaging and plastic food service ware will decrease as a result of source reduction and recycling rate increases, leading to a decrease in negative human health and environmental impacts. The reduction in single-use plastic packaging and food service ware will result in less material being disposed of in landfills and will lead to a decrease in GHG emissions. Reducing virgin plastic production will also decrease the amount of crude oil consumption. The Act and the Proposed Regulations will help California shift to a circular economy as it will hold the producers of covered material responsible for its management rather than local jurisdictions and consumers. California residents will benefit from having a consistent recycling system and increased access to reuse and refill packaging infrastructure. CalRecycle also expects a decrease in pollution resulting from litter.

Avoided Costs

Benefits from implementing the Act are expected to be the result of a number of changes to the solid waste system, namely:

1. As the recycling rate targets are met, less virgin material will be manufactured as it is replaced with recycled material. This results in fewer emissions to the environment.

2. The source reduction targets will also result in fewer manufacturing emissions, fewer emissions from end-of-life management of materials, as well as less litter.
3. As packaging material becomes consistently recyclable or compostable and as access to recycling and composting infrastructure becomes more universal, there will be fewer instances of contamination in the recycling streams, resulting in greater efficiency.

The expected benefits, as described in Table 2, can be categorized into three main groups:

1. Lifecycle model impacts to the environment and human health based on the State of Oregon's Waste Impact Calculator (WIC) tool[12] and informed by the United States Environmental Protection Agency's (US EPA) Tool for Reduction and Assessment of Chemicals and Other Environmental Impacts (TRACI) tool.[13]
2. Infrastructure and process management impacts associated with reduced litter and greater efficiency at recycling facilities.
3. Chemical pollution impacts not accounted for in the Oregon lifecycle analysis (LCA) tool, specifically, PFAS and PFOA.

Each impact category listed in Table 2 includes the total amount of that chemical or chemical category in column 2 (quantity reduced) along with the economic impact or damage valuation in column 3 (damage costs per impact unit). These two numbers are multiplied to provide a total economic impact avoided as a result of implementing the Act for each impact category. California residents will experience these savings as a result of the Act and the Proposed Regulations in the form of reduced incidences of health impacts and reduced impacts to the environment. CalRecycle does not anticipate that most of these savings will be passed on to local or state government agencies. Government agencies may experience savings in the form of reduced litter cleanup resulting from plastic source reduction, but CalRecycle is currently unable to quantify exactly how much agencies would save.

Table 2: Avoided Costs through Implementation of the Act

Impact Category	Quantity Reduced (Units)	Damage Cost per Impact Unit (Average)	Benefits through Implementation (Avoided Cost)
Per- and Polyfluorinated Substances	1,274,221 kg	$19,943	$25,412,377,447
Litter Cleanup	381 days	$1,172,603	$447,022,222
Double Handling Material	107,850 tons	$56	$6,058,363

Impact Category	Quantity Reduced (Units)	Damage Cost per Impact Unit (Average)	Benefits through Implementation (Avoided Cost)
Carbon Dioxide (CO_2 Equivalents)	13,127,904metric tons	$251	$3,295,103,991
Non-Carcinogenic Effects from Toxics	4,463 cases	$3,565,489	$15,914,388,431
Carcinogenic Effects from Toxics	623 cases	$5,181,435	$3,225,550,387
Respiratory Effects from Particulates (Particulate Matter 2.5 Equivalents)	7,656 metric tons	$607,000	$4,646,935,012
Ground Level Smog Formation (Ozone Equivalents)	726,915 metric tons	$245	$177,730,769
Waterways Eutrophication (Nitrogen Equivalents)	6,094 metric tons	$24,963	$152,113,613
Aquatic Ecosystems Toxicity (Comparative Toxicity Units)	6,508,487,833 units	$0.005	$32,542,439
Acidification (Sulfur Dioxide Equivalents)	68,610 metric tons	$412	$28,233,207
Ozone Layer Depletion (Chlorofluorocarbons Equivalents)	0.19 metric tons	$56,880	$10,731
Total	N/A	N/A	$53,338,066,613

A summary of the estimated avoided cost (benefit) per fiscal year over the implementation period is shown in Table 3. CalRecycle expects the annual avoided cost to be greatest in the last two years of implementation, reflecting the increase in the plastic recycling rate goal from 40 percent to 65 percent and the increase in the plastic source reduction goal from 20 percent to 25 percent.

Table 3: Annual Avoided Cost

Fiscal Year	Total Avoided Cost
2024-25	$1,482,851,497
2025-26	$2,943,483,273
2026-27	$4,381,895,327
2027-28	$5,798,087,661
2028-29	$7,172,402,715
2029-30	$8,527,249,992
2030-31	$10,531,949,407
2031-32	$12,500,146,741

Per- and Polyfluorinated Substances (PFAS)

PFAS are a group of synthetic chemicals widely used in various industrial and consumer plastic products for their water and grease resistant properties. Despite their usefulness, PFAS have raised significant concerns due to their persistence in the environment and bioaccumulation in living organisms. The contamination of water supplies with PFAS has led to widespread environmental and public health challenges, prompting regulatory efforts to mitigate their usage and address the associated societal impacts. Limited methodologies are available to assess the costs associated with PFAS impacts on society. CalRecycle chose an approach that closely aligns with the prevailing waste system in the California economy to quantify these costs. Additional studies indicate impacts of PFAS, including water clean-up, resulting in much higher costs than estimated in this report. CalRecycle is using a conservative approach and utilizing information that reflects the impacts from waste systems for this analysis. CalRecycle expects that through source reduction efforts, the amount of PFAS introduced into the California market will decrease and ultimately lead to a decrease in these negative effects. The average damage cost associated with negative effects of PFAS is approximately $20,000 per kg.[14] CalRecycle estimates a reduction of approximately 1.3 million kg of PFAS as a result of plastic source reduction, leading to a savings of over $25 billion over the implementation period.

Litter Cleanup

Litter poses a dual threat to both land and aquatic environments, with significant implications for ecosystems. The costs associated with cleaning up litter are substantial and encompass various aspects, reflecting both direct financial expenditures and indirect societal and environmental impacts. Direct costs involve manpower, equipment, and disposal expenses associated with the collection and removal of litter from public spaces, water bodies, and natural environments. Municipalities often bear the financial burden of these cleanup efforts, allocating funds for regular maintenance and waste management. Additionally, there are indirect economic ramifications, such as reduced

property values and tourism revenues in areas marred by litter. The environmental toll includes the expenses related to the impacts of litter on ecosystems, biodiversity, and soil and water quality. CalRecycle estimates 381 fewer days of litter cleanup[15] over the implementation period as a result of plastic source reduction and increased recycling of covered material, a savings of $447 million.

Double Handling Recycled Material

Currently, materials collected in the recycling bin system must be sorted and screened before further processing. Sometimes, consumers mistakenly include non-recyclable items (contaminants) within the bins. This leads to some material being handled twice; first through the recycling collection and sortation system and second as those contaminants are sent through a disposal system. This two-step handling process has increased expenses associated with it. The implementation of the Act will mandate the use of recyclable or compostable packaging, reducing consumer confusion and, by extension, contamination of the recycling bins. This is expected to reduce the incidence of inappropriate placement in the recycling bin and consequent double handling costs. The average cost of sorting material in a recycling stream is $56 per ton.[16] CalRecycle anticipates that approximately 107,850 tons of material would avoid these duplicated handling expenses, resulting in a projected savings of $6 million over the Act's implementation period.

The Social Cost of Carbon (SCC)

The SCC is a metric used to estimate the economic damage associated with each additional ton of carbon dioxide emitted into the atmosphere. It reflects the broader societal impact of climate change, encompassing factors like health, agriculture, property damage, and other related consequences. Essentially, it quantifies the long-term economic harm caused by the release of carbon dioxide, offering a means to assess the true cost of climate change and guide efforts to reduce GHG emissions. The estimated damage cost of GHG emissions over the implementation period is $251 per metric ton of carbon dioxide equivalents.[17] CalRecycle estimates that the 25 percent source reduction of plastic would lead to a decrease in GHG emissions of over 13 million metric tons through the implementation period, resulting in savings of over $3 billion.

Lifecycle Model Benefits Determined by Waste Characterization Study and Waste Impact Calculator

The production, transport, and end-of-life management of covered material contribute to negative environmental and human health effects, including ozone depletion, ground level smog formation, eutrophication, respiratory diseases, and cancer. CalRecycle quantified the benefit that the recycling and source reduction of covered material would have on these negative impacts using the methods developed by the Oregon Department of Environmental Quality (DEQ) in their Waste Impact Calculator (WIC).[18] While there are several approaches to approximate costs associated with similar impact

factors under different programs, there are fewer that apply directly to the Act and the Proposed Regulations. CalRecycle chose to use the WIC as it is the most relevant tool for evaluating the environmental and human health impacts of waste materials throughout their lifecycles and is therefore the most appropriate tool available to use to model the avoided impacts associated with the Act and the Proposed Regulations.

CalRecycle identified covered materials examined in the WCS that were represented in the impact factors table from the WIC to estimate the impacts.[19] Impact factors representing covered materials were summed to provide a single impact factor for each material destined for disposal (production + production transport + landfilling + landfilling transport) and for recycling/composting/reuse (production + production transport + recycling/composting/reuse + recycling/composting/reuse transport). For landfilling, the impact factors for each material were multiplied by the estimated weight of the material destined for disposal. For recycling/composting/reuse, the impact factors for each material was multiplied by the estimated weight of the material destined for recycling/composting/reuse. CalRecycle adjusted the total amount of plastic covered material (disposal and recycling) for each year to account for the source reduction targets before calculating the amounts of disposed and recycled plastic.

CalRecycle translated the impacts into monetary benefits by using the recommended damage cost per impact unit for each impact category by the Source Resource Management Group (SRMG) in a report prepared for DEQ.[20] Average damage costs per unit estimates are shown in Table 2. Impact values were multiplied by the average damage cost to obtain the avoided cost (benefit) for each category, which are described in their respective sections below.

Non-Carcinogenic Effects from Toxics

The manufacturing of covered materials causes a release of several toxic materials and pollutants. Human exposure to these pollutants is associated with a range of adverse health effects, including heart diseases, kidney failure, reproductive disorders, and cognitive impairments. The average damage cost per case of disease from these toxins is approximately $3.6 million.[21] CalRecycle estimates that 4,463 cases of disease will be avoided due to recycling of covered material and plastic source reduction, resulting in savings of $15.9 billion.

Carcinogenic Effects from Toxics

The manufacturing of covered materials releases various pollutants which are identified as carcinogens. The average damage cost per case of cancer for these toxins is approximately $5 million.[22] CalRecycle estimates that 623 cases of disease from carcinogens will be avoided as a result of increased recycling of covered material and plastic source reduction, a savings of approximately $3.2 billion.

Respiratory Effects from Particulates

The release of particulate matter through production and manufacturing processes poses a potential human health risk including respiratory conditions, symptoms, and

diseases. The negative effects of particulate matter on respiratory health can be evaluated using a variety of methods, some of which have higher estimates than those used in this analysis. CalRecycle used the WIC lifecycle analysis tool to estimate the avoided cost of particulate matter on respiratory health as the WIC is specifically designed for evaluating environmental and human health impacts of waste materials, including packaging and single-use food service ware, and most accurately reflect the expected impacts associated with the recycling and manufacturing activities. The average damage cost per metric ton of particulates is $607,000.[23] CalRecycle estimates that 7,656 metric tons of particulates will be avoided throughout the Act's implementation period, with a savings of $4.6 billion.

Ground Level Smog Formation

Ground-level smog forms when pollutants such as nitrogen oxides (NOx) and volatile organic compounds (VOCs) are emitted from vehicles, industrial facilities, and other sources react in the presence of sunlight. Ground-level smog can have adverse effects on air quality, posing human health risks such as respiratory problems and aggravating pre-existing conditions. Urban areas with high concentrations of traffic and industrial activities are particularly susceptible to ground-level smog formation. The average damage cost per metric ton of ozone equivalents is $245.[24] Through recycling of covered material and source reduction, CalRecycle estimates a reduction of approximately 727,000 metric tons of ozone equivalents and a savings of approximately $178 million.

Waterway Eutrophication

Waterway eutrophication is a process in which water bodies, such as lakes, rivers, and estuaries, become enriched with excess nutrients, particularly nitrogen and phosphorus. These nutrients often originate from agricultural runoff, sewage discharges, and other human activities. As nutrient levels increase, they stimulate the rapid growth of algae and other aquatic plants in the water. The subsequent decay of these plants depletes oxygen levels, negatively impacting fish and other aquatic organisms. Eutrophication can result in harmful algal blooms, loss of biodiversity, and a decline in water quality, posing ecological and economic challenges for affected ecosystems. Average damage cost for eutrophication is approximately $25,000 per metric ton of nitrogen equivalents[25] and CalRecycle estimates approximately 6,094 tons of nitrogen equivalent emissions will be avoided over the implementation period. This results in savings of $152 million.

Aquatic Ecosystems Toxicity

Disposal practices and production processes of covered material contribute to aquatic ecosystems' toxicity through the release of harmful substances into water bodies. Improper disposal of industrial waste, including chemicals and pollutants, often leads to the contamination of rivers, lakes, and oceans. Industrial production processes, such as manufacturing and mining, release liquid wastes containing heavy metals and toxic compounds that can accumulate in aquatic ecosystems, posing serious threats to aquatic life and the overall health of the ecosystem. Aquatic ecosystems toxicity is measured in comparative toxicity units (CTU), which is a measure of the potentially

affected fraction of aquatic species. Average damage cost per CTU is $0.005.[26] CalRecycle estimates savings of $32.5 million over the implementation for avoided aquatic ecosystems toxicity.

Acidification

Disposal practices and manufacturing processes contribute to acidification through the release of sulfur dioxide and nitrogen oxides, leading to the formation of acid rain. This phenomenon adversely affects trees by leaching nutrients, weakens soil structure, corrodes buildings and infrastructure, and disrupts aquatic ecosystems. Human health is indirectly impacted through the consumption of contaminated water and crops, and respiratory issues can arise from the release of acidifying pollutants. Mitigating these effects requires sustainable waste management and pollution control measures to minimize the environmental and health consequences of acidification. Average damage cost per metric ton of sulfur dioxide equivalents is $412.[27] CalRecycle estimates a reduction of 68,610 metric tons of sulfur dioxide equivalents over the implementation period, leading to savings of approximately $28.2 million.

Ozone Layer Depletion

Current waste disposal practices contribute to ozone depletion primarily through the emission of chlorofluorocarbons (CFCs) and halons. CFCs, commonly used in refrigeration, air conditioning, and aerosol propellants, are released into the atmosphere during product disposal and can persist for long periods, eventually reaching the stratosphere. Once in the stratosphere, CFCs release chlorine atoms that break down ozone molecules, contributing to the depletion of the ozone layer. Average damage cost per metric ton of ozone equivalents is $56,880.[28] CalRecycle estimates savings of approximately $11,000 over the implementation period in avoided ozone layer depletion.

Plastic Pollution

The landfill disposal of plastics releases methane and carbon dioxide into the atmosphere, and percolation of fluids through trash leaches contaminants that if not controlled can enter soil and groundwater. These pollutants are an environmental and public health concern and can lead to adverse effects on human health such as cancer, asthma, and birth defects.[29] The Act and the Proposed Regulations would reduce the disposal of plastic material, decreasing these negative impacts.

Source reduction reduces the amount of material in the disposal stream by reducing the amount of material that is generated. The Proposed Regulations implement the requirement that plastic covered material to be source reduced by 25 percent by 2032. This will require the elimination of approximately 716,000 tons of plastic material.[30] As a result of plastic source reduction, there will be less plastic in the system that could potentially make its way into the environment. CalRecycle expects that there will also be a decrease in the amount of plastic litter.

The Proposed Regulations implement not only the requirement for the source reduction of plastic covered material, but also the Act's requirement that all covered material, including plastics, must be recyclable or compostable by January 1, 2032. However, not all materials that can be recycled or composted end up actually being recycled or composted. The Proposed Regulations implement the Act's requirement to increase the recycling rate by requiring that plastic covered material meet a minimum 65 percent recycling rate in 2032. Using the WCS and RDRS data, CalRecycle estimated that plastic covered material was recycled at a rate of six percent in 2021.[31] To meet the recycling rate requirement, approximately 1.5million tons of plastic covered material must be diverted from disposal each year. The expansion of new infrastructure that improves the recycling capacity for plastic will also likely lead to an increase in recycling of other materials, such as glass and metals. These covered materials do not have statutory recycling rate requirements, but the increase in infrastructure to meet the plastic recycling rate requirement will allow for a higher volume of other materials to be recycled.

The increased recycling rate of single-use plastic packaging and single-use food service ware would increase the volume of plastic material that is captured and processed, leading to a further decrease in plastic pollution. Through source reduction and increased recycling, the Act and the Proposed Regulations would lead to a decrease in contaminants released, thus reducing the associated environmental and public health risks.

Greenhouse Gas Emissions

Eliminating plastic packaging has the potential to reduce emissions up to 4.3 metric tons of CO_2 equivalents (t CO_2 eq) per metric ton of plastic avoided if no replacement technology is needed.‡[32] CalRecycle estimates that the decrease in plastic covered material will result in a reduction of approximately 13.1 million t CO_2 eq emissions by 2032. CalRecycle expects that the increase in recycling of covered materials will also lead to a decrease in GHG emissions over what is saved from source reduction. Switching from lighter packaging to other types of packaging which may be heavier, is expected to result in an increase in transportation emissions. This may result in lower net emissions reductions than expected from the reduction due to plastic packaging elimination and recycling alone.

Resource Conservation

Recycling leads to a decrease in virgin material resource use. It takes 0.4 gallons of crude oil to make one pound of plastic.[33] Through the implementation of the Act, CalRecycle estimates there will be a reduction of 1.4 billion pounds of plastic material, equating to a reduction of 573 million gallons of crude oil.

‡ Such as removal of second layer packaging as in individually wrapped product within another package.

Economic Resilience and Responsibility

CalRecycle is committed to helping California transition to a circular economy. A circular economy supports the reduction in use of new virgin plastic, increases plastic reuse, improves recycling, and reduces the amount of waste generated. Moving to a circular economy can shift the responsibility of product management to the producers of the products. Frameworks such as EPR hold producers responsible for product management throughout the product's lifecycle. EPR supports recycling and materials management goals that contribute to a circular economy and can also encourage product design changes that minimize environmental impacts.[34] With the construction and support of diverse recycling and composting infrastructure, California's recycling system will be more stable and less dependent on large foreign recycling infrastructure.

Social Benefits

Currently, acceptance of covered materials for recycling varies from jurisdiction to jurisdiction. CalRecycle expects that the Act and the Proposed Regulations will create a more consistent recycling system within California, reducing confusion around the recyclability of covered material. Implementing the Act and the Proposed Regulations will ensure consistency by ensuring uniform acceptance of recyclable covered materials in every jurisdiction's collection program by January 1, 2032. Increased access to reuse and refill infrastructure will allow more consumers to make the switch from disposable materials to recyclable or reusable materials. The decline in pollution and litter resulting from plastic source reduction will lead to cleaner public spaces, like roads and parks, and cleaner waterways.

Benefits to Businesses

Plastic packaging is ubiquitous in the marketplace. CalRecycle expects that a wide range of businesses would see benefits from the Act and the Proposed Regulations. The Act and the Proposed Regulations would increase revenue from the sale of products made from recycled materials. Businesses will have to expend less effort to review claims from producers regarding recyclability of packaging and it will be easier to provide products packaged in a way that consumers want. California businesses are also likely to observe a reduction in the cost of disposal services as they will be generating more recyclables rather than disposables. However, this material may shift to recycling and composting streams, and businesses may also see cost increases in those collection services.

Packaging manufacturers would need to design and engineer new packaging that is compliant with the Act and the Proposed Regulations, providing opportunities for innovation. An increase in recyclable and compostable materials would increase the demand for responsible end markets to process both the existing and new packaging and food service ware types.

In addition to receiving the benefits described above, producers of covered material with gross sales of less than $1 million in the most recent calendar year may be exempt from the requirement to join a PRO and the requirement to report information to CalRecycle, except for reporting information relevant to prove their status as a small producer as defined in statute.[35]

Benefits to Individuals

In addition to the environmental, social, health, safety, and welfare benefits mentioned above, California residents will also benefit from greater accessibility to recycling and composting due to the increase in infrastructure for collection, sortation, and processing of recyclable and compostable materials. Greater reliance on local recycling and composting facilities can create more jobs locally and reduce emissions from the transport of recyclable and compostable materials. CalRecycle anticipates that new jobs will be created as a result of the Act and the Proposed Regulations, especially in the collection and recycling industries, due to the increased amount of recyclable and compostable material that will need to be properly managed. Low-income communities will have more access to the monetary resources of covered material producers through the PRO to build up infrastructure for recycling and composting that was previously unavailable due to lack of funding. These communities will also benefit from the funds set aside in the California Plastic Pollution Mitigation Fund for disadvantaged and low-income areas to reduce the environmental and public health impacts of plastic pollution.

Direct Cost

The direct cost determination includes many conservative assumptions for factors that will impact the actual, realized implementation costs, most notably decisions by the PRO and producers regarding their compliance pathways, as well as individual consumer decisions. These decisions may result in the actual implementation costs being less than the estimates presented here.

CalRecycle created the DIM to calculate the estimated direct cost of the Act and the Proposed Regulations. The DIM contains over 100 individual sheets with data inputs and separate sub-models for each impact category. Total direct cost for the Act and the Proposed Regulations is approximately $21.0 billion over the ten-year implementation period. A summary of the estimated direct cost per year is provided in Table 4. The methods and assumptions used within the DIM are detailed in the following sections. For this estimated direct cost, the total cost and average cost per year will vary due to inflation rates and the phased implementation schedule for recycling and source reduction goals laid out in statute.

Table 4: Direct Cost Per Year Summary

Fiscal Year	Direct Cost
2022-23	$9,317,168
2023-24	$2,375,706,171
2024-25	$2,385,207,100
2025-26	$2,383,008,090
2026-27	$2,705,561,736
2027-28	$2,305,498,653
2028-29	$2,299,004,868
2029-30	$3,279,581,499
2030-31	$3,269,535,673
2031-32	$7,538,123
Total	$21,019,959,079

Direct Cost Inputs

PRO Operations

CalRecycle reviewed the operational cost of several existing EPR stewardship organizations, including the Paint, Carpet, and Mattress EPR programs, as well as the operational cost from Recycle BC, a packaging program operator in British Columbia, Canada to determine the types of expenses these programs incur and estimate operational cost for the PRO under the Act and the Proposed Regulations. The availability of detailed category distribution of cost data allowed CalRecycle to use the Mattress EPR program as a model to estimate cost for the PRO. The proportions of cost for expenses in the Mattress EPR program was used to determine the cost and allocation of expenses for the PRO.

The number of expected participant producers approved under the PRO's plan is expected to be much higher than the number of participants in other EPR programs. For this reason, the model was developed so that it would scale with the number of estimated participating entities. Several linear and logarithmic functions were evaluated to determine the represented relationship of cost and the number of participating entities. After identifying the optimal correlation, staff inputted the estimated participating entities into the chosen function, resulting in the total expenses for the PRO. To calculate the direct cost, CalRecycle grouped operation cost from the EPR program into seven categories: staffing, professional services, travel, database services and development, annual reporting, research and development, and education and outreach. The expected cost for the PRO through implementation of the Act and the Proposed Regulations is estimated to total $117 million through calendar year 2031, at an average annual cost of $14.6 million.

Producer Reporting

Producers are expected to incur costs to comply with the reporting requirements in the Act and the Proposed Regulations. Producers are required to maintain data on their covered materials, including the total weight of material, the number of plastic components, and the weight of disposed material. They are required to provide this information to CalRecycle as part of the PRO's annual reporting and provide additional data upon request by CalRecycle. Producers are required to register with CalRecycle within 30 days of the adoption of the Proposed Regulations and maintain accurate contact information within the registration system. CalRecycle modeled costs for compliance records, covered material records, and producer registration as time for producers to prepare records and register with CalRecycle's system. Producer reporting costs are estimated at $99.6 million through the implementation period. CalRecycle estimates that annual reporting will cost each producer an average of $2,478.

Environmental Mitigation Surcharge

The PRO is required to remit a surcharge of $500 million per year, starting on July 1, 2027, and ending on January 1, 2037, to the California Department of Tax and Fee Administration for environmental mitigation of plastic pollution.[36] The PRO is authorized to collect up to $150 million of this yearly fee from the plastic resin manufacturers of participating producers who sell plastic covered materials. Independent producers are responsible for a portion of the surcharge, to be determined by CalRecycle. The environmental mitigation surcharge, if unchanged over the next 10 years, will total $5 billion. In 2030, CalRecycle may increase the surcharge amount to ensure that the plastic source reduction targets are maintained after January 1, 2032. This determination would be made based on the increase in number of plastic components and/or the increase in plastic covered material weight determined by CalRecycle in its investigation of plastic covered material in the state.

Circular Economy Fund

The Circular Economy Fund provides funding to CalRecycle and other state agencies for staffing, contracts, and fully implementing and enforcing the Act and the Proposed Regulations. The PRO is responsible for reimbursing cost incurred beginning January 1, 2023, and is required to begin paying the California circular economy administrative fee starting in Fiscal Year (FY) 2026-27 and every three months thereafter, to cover these implementation and enforcement cost. To calculate the Circular Economy Fund fee amounts for each year, CalRecycle used the 2022 Budget Change Proposal (BCP)[37] and existing compliance and enforcement programs and contracting cost at CalRecycle to estimate the cost of staff salaries, field visits, and contracting. Through FY 2031-32, the total cost of the Circular Economy Fund is anticipated to be $76.8 million, as shown in Table 5.

Table 5: Circular Economy Fund Cost

Fiscal Year	Total Cost
2022-23	$9,317,168
2023-24	$7,597,479
2024-25	$7,504,735
2025-26	$7,504,735
2026-27	$7,142,603
2027-28	$7,538,123
2028-29	$7,538,123
2029-30	$7,538,123
2030-31	$7,538,123
2031-32	$7,538,123
Total	$76,757,333

CalRecycle Staffing Needs

As stated in the 2022 BCP and shown in Table 6, CalRecycle will need to hire 62 permanent staff members, over a period of six years to fully implement and enforce the Act and the Proposed Regulations.

Table 6: Staffing Requirements

Branch/Division/Section	Number of New Staff Positions
Division of Circular Economy	16
Materials Management and Local Assistance Division	1
Knowledge and Integration Section	8
Waste, Permitting, Compliance, and Mitigation Division	16
Administrative Services Division	6
Legal Office	5
Public Affairs	2
Office of Audits	5
Information Technology	3

As indicated in Table 7, the total cost for full staffing through FY 2031-32 is $63.4 million. Costs are anticipated to average $6.3 million per year through FY 2031-32, with an annual cost of $6.8 million starting in FY 2027-28. The average cost of staffing each

year increases as additional staff are hired. Staffing requirements are expected to remain the same following FY 2031-32.

Table 7: Staffing Numbers and Staffing Expense by Fiscal Year

Fiscal Year	Number of Staff	Cost
2022-23	34	$4,047,168
2023-24	57	$6,306,096
2024-25	57	$6,306,096
2025-26	57	$6,306,096
2026-27	58	$6,413,964
2027-28	62	$6,809,484
2028-29	62	$6,809,484
2029-30	62	$6,809,484
2030-31	62	$6,809,484
2031-32	62	$6,809,484

Travel Costs

Travel costs include costs for CalRecycle staff to visit regulated entities, inspect records to determine compliance, and conduct material characterization studies at facilities. To calculate these costs, CalRecycle estimated the aggregated travel hours available for staff, and using existing enforcement programs, estimated costs typically associated with a local, medium, and long-range field visit. Visits were categorized into local, medium, and long ranges based on the proximity of a jurisdiction from the CalRecycle headquarters office located in Sacramento, California. As the distribution of producers or other entities requiring on-site evaluations are unknown, an assumption was made that these entities are evenly distributed throughout the State and would need to be visited with equal frequency. These assumptions were used to calculate the estimated number of local, medium, and long-range field visits that will be required.

CalRecycle estimated the total number of travel hours available for staff based on the number of staff outlined in the 2022 BCP, the average number of working hours each month, and the maximum amount of allowable travel time specified in the duty statements for each position type anticipated to travel. The average cost for each field visit range, including costs such as such as gas, lodging, per diems, and flights, were applied to the estimated percentage of available travel time for each range to calculate the annual and total cost per year from FY 2023-24 through FY 2031-32.

The workbook titled "Field Visit Travel Cost Analysis" in the data sources for the DIM provides details regarding anticipated costs. The total travel costs through FY 2031-32 are $5.95 million.[38] Costs are anticipated to begin incurring in FY 2023-24 at $121,383

and are expected to be $728,639 per year from FY 2023-2024 through FY 2031-32. Field visit costs are expected to remain the same following FY 2031-32.

Contracts

In addition to staffing needs, the 2022 BCP also outlined the costs of several contracting jobs required to implement the Act and the Proposed Regulations. CalRecycle is required to conduct a Needs Assessment[39] at a one-time cost of $4.8 million to determine necessary steps and investment needed to manage covered materials and develop an economic impact report. This Needs Assessment will be conducted once before the approval of any PRO plan and then at least every five years afterward. The BCP also outlines contracting costs at about $700,000 in FY 2023-24 to conduct a waste characterization study. Additionally, contracting costs for IT infrastructure are in the BCP at $470,000 per year for FY 2022-23 through FY 2025-26. The total contracting cost from FY 2022-23 through FY 2031-32 is $7.4 million.

Meeting Major Program Goals

By January 1, 2032, all covered material must be recyclable or compostable, and plastic covered material must be source reduced by at least 25 percent and meet a minimum recycling rate of 65 percent.[40] The PRO, producers, and independent producers have a number of potential options and pathways to achieve compliance with these goals, including, but not limited to: investing in recycling and composting infrastructure; switching to recyclable or compostable packaging options; ensuring collection programs will collect recyclable or compostable material to meet recycling rate targets; and improvements to collection, sorting, decontamination, remanufacturing, and other infrastructure necessary to achieve recycling rates.

To estimate the direct costs and impacts of meeting source reduction, reuse and refill, recyclability, and recycling rate requirements, CalRecycle developed the DIM to project generation rates for materials in the disposal and recovery streams at various periods of times throughout the implementation of the Act.

It was assumed that to meet source reduction and recycling rate requirements, producers will replace a portion of their existing packaging with packaging from non-plastic covered material categories such as paper, metal, glass, and compostables. To meet the statutory plastic recycling rate, as compared to the Baseline, some producers must switch their packaging to materials that are recyclable. This is detailed in the Material Switching worksheets in the DIM.

Source reduction and material switching result in a reduction in the amount of plastic covered material produced and collected in disposal and recovery streams. Thus, the availability for collection and management (disposal or recovery) is adjusted for each year. This allows a quantification of packaging landscape changes and estimates the amount of additional plastic covered material that will need to be recycled to meet the 65 percent recycling rate.

In the SRB, CalRecycle calculated plastic covered material weight and component number estimates for the 2023 calendar year, as required in statute.[41] CalRecycle used these values to estimate costs for plastic source reduction by weight and number of components. Additionally, CalRecycle analyzed data from a packaging and component study[42] to estimate average weights of covered material packages across multiple packaging categories. Furthermore, the Baseline was adjusted to account for source reduction activities to determine the amount of plastic covered material that would need to be converted to recyclable packaging to achieve the 65 percent recycling rate.

Source Reduction

By January 1, 2032, plastic covered material must be source reduced by at least 25 percent by weight and 25 percent by the number of plastic components generated in calendar year 2023. The Act requires that a minimum of 10 percent of the source reduction requirement must be met by either switching to a reusable or refillable system or through elimination of a plastic component. The remainder shall be achieved through other source reduction options, which include concentration, right-sizing, lightweighting, shifting to bulk or large format packaging, or from shifting plastic covered material to non-plastic covered material. A summary of the statutory source reduction targets is provided in Table 8.

CalRecycle used the Baseline to estimate each direct cost associated with meeting the following targets: reuse or refill, reduction of plastic covered material by weight, and the reduction of the number of plastic components. Through source reduction efforts, the plastic covered material is estimated to reduce from 2.9 million to 1.9 million tons, equating to a 33 percent reduction from the Baseline. The source reduction cost is estimated to be $5.4 billion (see Table 11 for additional detail).

Table 8: Statutory Source Reduction and Reuse or Refill Rates

Implementation Date	Other Source Reduction Options	Reuse or Refill Rate	Total Source Reduction Rate
Jan 1, 2027	8%	2%	10%
Jan 1, 2030	16%	4%	20%
Jan 1, 2032	15%	10%	25%

The Act requires that a minimum of 10 percent of the source reduction requirement must be met by either switching to a reusable or refillable system or through elimination of a plastic component.[43] The cost to implement and fund reuse and refill systems will differ as reuse infrastructure recovers and collects packaging materials to be returned to the producers for reuse, while refill systems allow consumers to bring their own containers to a refill store. There are various pathways and options available to meet reuse and refill requirements, including establishing or expanding systems for not only

packaging and food-service ware, but also secondary or tertiary packaging and other types of transport packaging.

CalRecycle recognizes that there will be costs associated with establishing new and expanding existing reuse and refill infrastructure and programs. The cost associated with establishing, improving, and funding these systems will depend on various factors, including whether the program will be implemented on an individual producer level or as a statewide program, logistical arrangements with supplier and retailer locations, and the materials used for the reusable and refillable packaging or food-service ware. The Needs Assessment required by the Act will identify the investments needed to develop reuse and refill infrastructure and to provide consumers with convenient access to infrastructure to grow and market the use of reusable and refillable packaging and food-service ware.[44]

CalRecycle estimated the cost to develop a reusable marketplace to be $575 million over the ten-year implementation period. To quantify the cost of developing reusable infrastructure, CalRecycle relied upon a returnable packaging study.[45] The study focuses on modeling the economic and environmental performances of reusable packaging systems in France, where reusable packages are either returned from home or at a drop-off point, sorted, cleaned, filled at the manufacturer's production line, and redistributed to retail stores. The study's model distributes packaging across four industry sectors: beverages, personal care, fresh food, and cupboard food. This study focused solely on primary packaging. While secondary and tertiary packaging may be included in California's reuse and refill marketplace, many of these packaging types have already been created to be reusable. CalRecycle's model was created based on the consumer-level primary packaging data included in the report from France and the industry sectors most likely to experience significant expansion as a result of the Act.[46]

Consistent with the study's methodology, CalRecycle projected reuse and refill infrastructure costs across three scenarios (fragmented effort, collaborative approach, and system change), each of which assumed different scaling for packaging system efficiencies, return rates, and the number of times packaging is returned (reusable packaging use cycles). The fragmented effort scenario in which producers independently collect, transport, sanitize, and return packaging to shelves or consumers without sharing infrastructure with other producers, is the least efficient and most costly system. It is also the most likely system to be utilized during the early development period. The collaborative approach scenario in which producers collaborate to share reuse and refill infrastructure assumes a shared and expandable reuse system and is slightly more efficient compared to the fragmented effort scenario. This scenario represents the start of the evolution of the system to a more cooperative and cohesive system that is likely to represent the middle of the development period. The system change scenario utilizes a fully scaled and standardized effort and is the most efficient scenario modeled in the study. This is the fully developed scenario that is expected at full program maturity.

CalRecycle leveraged the study's methodology to calculate the total cost for the production, conversion, filling, collection, sorting, washing, and transportation of reusable packaging. To calculate direct cost, CalRecycle converted source reduction data from the DIM to comparable terms in the study's model. The statutorily mandated reuse or refill rates of 10 percent were multiplied by the Baseline to calculate the weight and number of plastic packages needing to be converted to a reusable or refillable system, equating to 286,472 tons or 6.1 billion plastic packages. The 6.1 billion plastic packages were distributed across the four industry sectors using the model in the study's distribution of packages. CalRecycle assumed, consistent with the study's assumption, that the 6.1 billion single-use packages were equivalent to 6.1 billion single-use cycles. This number was applied to the total cost values across all three scenarios for each industry sector to calculate the direct cost. Details on these cost calculations are included in the Source Reduction Summary worksheet in the DIM. The distribution of packages across each packaging industry sector in CalRecycle's model and the total cost by scenario and industry sector are summarized in Table 9.

Table 9: Total Costs by Scenario and Packaging Industry Sector (Million Dollars)

Packaging Industry Sector	Number of Packages to be Converted	Fragmented Effort	Collaborative Approach	System Change
Non-Exempt Beverages	1,953	$273	$180	$131
Personal Care	1,709	$222	$152	$124
Fresh Food	1,953	$191	$135	$110
Food Cupboard	469	$53	$36	$28
Total	6,083	$739	$504	$392

CalRecycle utilized the different packaging system efficiencies for the scenarios to model the cost of establishing reuse or refill system infrastructure through the implementation period in conjunction with the goals outlined in statute. CalRecycle assumed the fragmented effort scenario to be the primary reuse system from 2024 through 2026, shifting to the collaborative approach scenario for 2027 through 2029, and then shifting to the system change scenario for 2030 through 2031. The total implementation costs, in millions of dollars, and the primary reuse system for reuse or refill infrastructure across the implementation period, are described in Table 10.

Table 10: Cumulative Implementation Costs for Reuse or Refill Infrastructure (Million Dollars)

Reuse/Refill	2024	2025	2026	2027	2028	2029	2030	2031	Total
Cost	$99[§]	$99[§]	$99[§]	$67[**]	$67[**]	$67[**]	$39[††]	$39[††]	$575

The remaining source reduction requirement was calculated by applying a 15 percent rate to the total weight of plastic covered material in the Baseline, which equates to 0.43million tons or 9.1 billion plastic packages. It was assumed this material would be source reduced by switching from plastic covered material to non-plastic covered material. To estimate the cost associated from converting a package from one covered material to another, the cost per ton conversions provided by a packaging study were used.[47] By applying conversion cost per package to the number of packages switched, the associated cost is estimated to be $3.12 billion.[48] Details on these cost calculations are included in the in the Source Reduction worksheets in the DIM.

Cost estimates for source reducing 25 percent of the number of plastic components required analysis of a packaging and component study to estimate the percentage of plastic components by weight across a sample of packages used in the study.[49] Analysis of data from this study was used to estimate that plastic components represent 9.8 percent of the total weight of packages. This ratio was applied to Baseline data to calculate the weight of plastic components generated in 2023, which was divided by the average weight of a plastic component.[50] A 25 percent source reduction of the number of plastic components equates to 42.9 billion components, or 0.24 million tons, and the associated cost is estimated to be $1.67 billion.

The total source reduction cost is the sum of the costs to meet the 10 percent (by weight) requirement for reuse or refill, the remaining 15 percent (by weight) source reduction requirement, and the additional material needed to meet the 25 percent source reduction requirement (by number of plastic components). These costs were individually estimated by averaging the cost of various scenarios and packaging category distributions to account for the multiple pathways that will be utilized by the producers. As described previously, it was assumed the material converted to reuse refill systems included recyclable plastic, glass, metal, and compostable packaging, and the cost associated with the remainder assumed the material switched from plastic covered material to non-plastic covered material. To estimate the cost associated from converting or switching a package from one covered material to another, a conversion cost per ton provided by a packaging study was used.[51]

[§] Fragmented Effort
[**] Collaborative Approach
[††] System Change

A summary of the data established in the Baseline data, the estimated amount of material reduced and the associated estimated costs to meet each source reduction goal is provided in Table 11.

Table 11: Plastic Covered Material Source Reduction Summary

Category	2023 Baseline (Total)	15% Source Reduction by Weight	10% Reuse or Refill by Weight	25% Source Reduction (Number of Plastic Components)
Plastic Covered Material (Tons)	2.9 million	0.43 million	0.29 million	0.24 million
Plastic Components (Count)	171.4 billion	N/A	N/A	42.9 billion
Plastic Packages (Count)	60.8 billion	9.1 billion	6.1 billion	N/A
Cost (US Dollars)	N/A	$3.12 billion	$0.58 billion	$1.67 billion

Recycling Rate

The Act requires that plastic covered material achieve a recycling rate of 30 percent by January 1, 2028, 40 percent by January 1, 2030, and 65 percent by January 1, 2032. Data from the 2021 WCS and RDRS were used to estimate a six percent recycling rate for plastic covered material. Additional detail can be found in the "CM Summary" worksheet in the DIM.[52]

CalRecycle assumed the technological and logistical conditions that currently render some plastic packages difficult or impossible to recycle will remain and those packages will need to be switched to a recyclable package. This was modeled through a material switching component in the DIM. It was assumed that some, but not all plastics are recyclable, and that all non-plastic covered materials are either recyclable or compostable under existing conditions. In 2023, 0.17 million tons of plastic covered material were recycled, compared to an estimated 1.5 million tons needed by 2032, meaning an additional 1.3 million tons of packaging need to be switched to other materials.

Anticipating a source reduction in the plastic covered material, CalRecycle adjusted the Baseline by accounting for the amount of plastic material estimated to exist following a 15 percent source reduction component and the amount of plastic covered material recycled in 2023. This shifts the Baseline from 2.86 million tons of plastic to 2.26 million tons of plastic.

As infrastructure expansion for plastic covered material would be much more costly than switching to materials with existing infrastructure, CalRecycle modeled a shift from

plastic covered material to recyclable plastics and other existing material categories, such as paper, metal, glass, and compostable packaging. To calculate the amount of material or packages that need to switch to achieve the required recycling rates, CalRecycle analyzed different packaging distribution scenarios like the methodology presented in the Source Reduction worksheets in the DIM. Table 11 summarizes these calculations.

The total estimated cost associated from switching packages from one covered material to another, factoring in a per ton conversion cost provided by a packaging study,[53] equates to $10.2 billion. Approximately 1.4 million tons, or 30 billion packages of difficult to recycle plastic covered material are expected to transition to recyclable packaging.

Source reduction and material switching alter the existing packaging landscape, assisting producers in meeting recycling rates. The estimated total cost for these activities is $15.6 billion. CalRecycle expects additional costs for improvements to infrastructure in order to recycle the rest of the packages remaining after source reduction and material switching efforts. Details on infrastructure improvements and their associated costs, aimed at recovering the remaining packages, are provided in the Infrastructure section of this SRIA. To achieve a 65 percent recycling rate by 2032, an estimated 1.5 million tons of plastic covered material will need to be recycled. A summary of recycling rate targets and the amount of difficult-to-recycle plastic material anticipated to switch to recyclable material types is presented in Table 12.

Table 12: Summary of Recycling Rate Targets and Material Switching

Implementation Date	Plastic CM Recycling Rate	Plastic CM Switched (Tons)	Plastic CM Packages Switched (Count; Running Total)
Jan 1, 2028	30%	0.56 million	11.9 billion
Jan 1, 2030	40%	0.80 million	17.0 billion
Jan 1, 2032	65%	1.4 million	30.0 billion

Infrastructure

Additional Capacity Requirements

Meeting the Act's 2032 recycling rate target will require California to develop infrastructure to optimize its recycling and disposal waste streams. The total cost to expand infrastructure is estimated to be $2.6 billion.

CalRecycle has estimated that an additional 1.3 million tons of plastic covered material will need to be recycled to meet the 65% recycling rate target in 2032. In estimating the cost of expanded infrastructure needs, CalRecycle has included additional types of covered material which will also increase in tonnage in the recycling and disposal streams due to the Act and the Proposed Regulations. This ensures that the projected

infrastructure cost will include additional types of covered material beyond the statutory requirement for recycled plastic. CalRecycle estimates that an additional 0.38 million tons of paper, metal, glass, and organic/compostable covered materials will need to be collected, sorted, and processed using the existing infrastructure. Expanded infrastructure for collection, sortation, and processing will need to accommodate almost nine times the current capacity for plastic covered material and approximately two times the total capacity for all covered materials in the existing recycling systems due to the Act and the Proposed Regulations.

Collection

The Act and the Proposed Regulations require local jurisdictions to collect all covered material categories in their collection and recycling programs. CalRecycle estimates recycling stream collection costs to be $154.8 million; however, there will be savings of $201.2 million in the disposal stream collection due to the increased recycling of covered materials. The net savings associated with changes to collection infrastructure for both the recycling and disposal streams is estimated to be $46.4 million. These cost savings emphasize the need to both expand recycling infrastructure and source reduce the amount of solid waste being generated.

To estimate the administrative, collection, and transportation costs associated with the recycling and disposal streams, CalRecycle has used existing cost data from "Overview of Scenario Modeling: Oregon Plastic Pollution and Recycling Modernization Act" and its associated data model.[54] This report and model were developed by Cascadia Consultants for Oregon's Department of Environmental Quality. The Cascadia model contains extensive data regarding Oregon's collected tonnages for the disposal and recycling streams, as well as in-depth data for the collection process.[55] CalRecycle extracted cost data from this model with the assumption that collection infrastructure in Oregon is similar to that in California. Using waste generation tonnage differences between the two states, CalRecycle scaled single family, multi family, and commercial collection and disposal fees in California across the years of implementation.

The Cascadia model contains a Baseline scenario for collection cost projected statewide in 2026, using Oregon recovery and disposal tonnages and population estimates. These costs are separated into the recycling system and disposal system. In estimating the total collection cost per ton for the recovery and disposal stream in California, the following costs were extracted from the model: recycling customer engagement, collection, administration, and transportation. CalRecycle generated a cost per ton value for each category. Transportation cost in the disposal stream is greater than the recovery stream due to the greater frequency of disposal collection. The values are shown in Table 13.

Table 13: Collection Expense Categories for Disposal and Recovery Streams (Cost per Ton)

Collection Expense Category	Disposal ($/Ton)	Recovery ($/Ton)
Customer Engagement	N/A	$2.98
Administration	$26.43	$26.43
Retrieval Services	$91.11	$84.30
Transportation	$19.22	$3.40

CalRecycle adjusted the inputs to account for 2031 California disposal and recovery data from the 2021 WCS,2021 RDRS, and 2024 SRB as well as population increases, anticipated increases in recovery tonnage, and decreases in disposal tonnages due to the Act and the Proposed Regulations. These values were applied to the cost per ton values to generate total collection infrastructure costs needed for the Act's implementation. The implementation costs for collection infrastructure needed in the recycling and disposal streams are shown in Table 14.

Table 14: Cumulative Implementation Costs for Collection Infrastructure by Recycling and Disposal Stream (Million Dollars)

Collection	2024	2025	2026	2027	2028	2029	2030	2031	Total
Recycling	$18.4	$18.1	$17.8	$17.5	$17.0	$16.8	$24.8	$24.4	$155
Disposal	($23.9)[‡‡]	($23.5)	($23.2)	($22.8)	($22.1)	($21.8)	($32.3)	($31.7)	($201)

Sortation

Expanded sortation infrastructure will be needed to sort and recover the increased tonnages of covered material due to the Act and the Proposed Regulations. The total infrastructure cost to meet the new sortation requirements is estimated to be $938 million. CalRecycle has assumed materials recovery facilities (MRF) will be the primary infrastructure used to recover plastic, paper, glass and metal materials; and composting facilities will be the primary infrastructure used to recover compostable and organic materials.

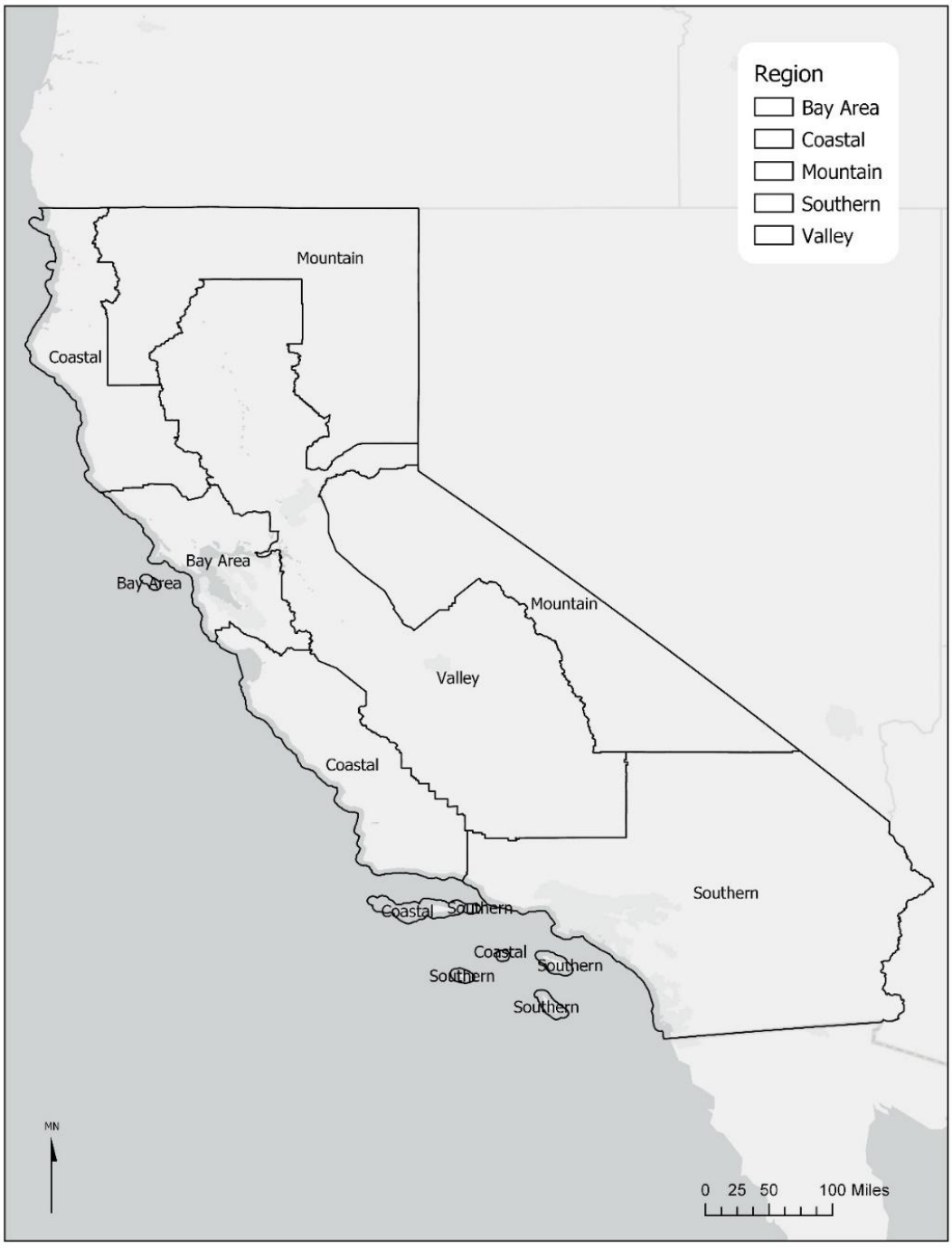
The direct impact cost analysis for sortation infrastructure relies on the report "MRF Feasibility Study" conducted by the Iowa Metro Waste Authority.[56] The study estimates the 2022 cost of single-stream MRF construction and expansion using a baseline throughput of 20,000 tons per year (TPY), then provides analysis on the cost to increase that capacity by three options (30,000 TPY, 45,000 TPY, and 60,000 TPY). The study focuses on capital, equipment, and operational cost per each option. It assumes that capital cost, which includes costs associated with site acquisition,

[‡‡] Parentheses represent a negative value

development, and direct construction, remain constant throughout each option.[57] It also assumes each option to utilize a 54,000 ft^2 structure, which has an average throughput of 72,000 TPY. Equipment cost varies by scenario and includes a process system, equipment installation, mobile equipment, and contingency costs. Operational cost also varies by scenario and includes labor, insurance, facility maintenance and utilities, equipment operating and management, residuals haul and disposal, and contingency cost. CalRecycle has extracted capital, equipment, and operational cost across each scenario to estimate the cost per ton of constructing a new MRF or expanding an existing facility. Construction cost per ton values were used to estimate the cost of constructing three different sized facilities: large facilities with an average throughput of 160,000 TPY, medium facilities with an average throughput of 72,000 TPY, and small facilities with an average throughput of 20,000 TPY. Facility sizes were informed by an assessment conducted by Resource Recycling, which quantifies annual throughput averages by 300 MRFs in the United States.[58] This study indicated the distribution of MRFs by throughput capacities. CalRecycle determined large, medium, and small MRF throughputs by the study's findings.

CalRecycle used a per capita estimation to determine 2031 infrastructure capacity needs across five California regions: Bay Area, Coastal, Mountain, Southern and Valley. Figure 1 shows the regional breakdown of California. These boundaries were informed by the current data infrastructure utilized for the WCS. CalRecycle applied census population estimates to these regions to create a more specialized analysis and a better understanding of covered material generation at the regional scale. These estimations were used to determine the number of new large, medium, or small MRFs and the scale of expansion per each region. The construction of large facilities is assumed to be the most cost-effective pathway and is prioritized in its contribution to meeting each region's sortation infrastructure needs. Remainder tonnages for new construction are distributed across medium and small facilities. CalRecycle estimated the direct cost for expansion by applying the residual needed capacity after construction to achieve the Act's target to a fixed cost per ton ratio. By 2032, CalRecycle expects new construction of 8 large, 4 medium, and 2 small MRFs. CalRecycle also expects a 53,000 TPY expansion of existing facilities to come online to recover the additional 1.7 million tons of plastic, paper, metal, and glass covered material in the 2031 estimate.

Figure 1: Regional Map of California



CalRecycle estimated the direct cost for composting facilities using a cost per ton ratio across each region's generation. Compostable and organic covered material generation across implementation years was distributed across five regions. Capital, operational,

and transportation costs to run a composting facility were estimated by ton and adjusted to accommodate capacity needs.

CalRecycle averaged data from a San Diego organics processing facility proposal[59] and a SB 1383 cost model by California Air Resources Board (Lara, Chapter 355, Statutes of 2015), Short-Lived Climate Pollutants (SLCP) Organic Waste Methane Emissions Reductions, [60] to determine the cost per ton to process organic and compostable materials. CalRecycle applied regional tonnages of additional covered material generation to this cost per ton value to determine the total cost of processing compostable and organic covered materials needed to comply with the Act and the Proposed Regulations.

CalRecycle assumed a single composting facility to have an average throughput of 100,000 TPY. To accommodate the statewide 46,000 tons of compostable and organic covered materials determined by the capacity needs assessment, CalRecycle expects existing composting facilities to expand. The regional distribution and accommodation of expansion and capacity needs through various MRF and composting facilities is shown in Tables 15 and 16.

The implementation costs of sortation and composting infrastructure needed to process increased tonnage are shown in Table 17.

Table 15: Estimated Number of MRFs to be Constructed and Expanded by 2032

Region	2032 Capacity Needs (Tons)	Number of Large Facilities (160,000 TPY)	Number of Medium Facilities (72,000 TPY)	Number of Small Facilities (20,000 TPY)	Expansion of Existing Facilities (Tons Needed)
Bay Area	318,434	1	2	0	14,434
Coastal	78,279	0	1	0	6,279
Mountain	22,672	0	0	1	2,672
Southern	910,918	5	1	1	18,918
Valley	330,858	2	0	0	10,858
Total	1,661,160	8	4	2	53,160

Table 16: Estimated Capacity Needs for Compostable Infrastructure in 2032

Region	2032 Capacity Needs (Tons)
Bay Area	8,412
Coastal	2,289

Region	2032 Capacity Needs (Tons)
Mountain	404
Southern	23,545
Valley	10,962
Total	45,612

Table 17: Cumulative Implementation Costs for Sortation Infrastructure (Million Dollars)

Facility Type	2024	2025	2026	2027	2028	2029	2030	2031	Total
Material Recovery	$111	$110	$108	$106	$103	$102	$150	$148	$938
Compost	$1.3	$1.2	$1.2	$1.2	$1.2	$1.1	$1.7	$1.7	$10.6
Total	$112.6	$110.9	$109.2	$107.5	$104.3	$102.9	$152.2	$149.4	$949

Processing

CalRecycle anticipates increased infrastructure is needed to process sorted plastic, paper, metal, and glass covered material into new feedstocks. The total cost for processing infrastructure is estimated to be $1.5 billion. The estimated cost values for processing infrastructure across implementation years are shown in Table 18.

CalRecycle determined the processing infrastructure costs for 2023 using the Baseline covered material generation tonnages and a sum of both baled material acquisition costs and conversion costs. CalRecycle used current regional industry sorted material values to determine the average value per ton for plastic, paper, metal, and glass baled material.[61] The conversion system of materials includes but is not limited to the following mechanical processes: transportation, cleaning, shredding, melting, crushing, and remolding. The conversion costs to convert baled material into new feedstocks were estimated using the cost needed to convert raw material into new packages generated by Plastic IQ.[62] CalRecycle assumes Plastic IQ conversion cost data includes additional mechanical processes, which are beyond the scope of the Act and the Proposed Regulations, and is using a small factor of the conversion cost when estimating the conversion cost of baled material into new feedstock.[63] CalRecycle was unable to find much processing industry data regarding the conversion of baled material into new feedstocks. Baseline recycled covered material tonnages were applied to the acquisition and conversion cost per ton values. CalRecycle compared these costs against estimated 2031 projected volume processing costs to get the total costs of infrastructure needed to process the anticipated tonnages of sorted material. Table 19 displays the cost breakdown of processing infrastructure by material type.

CalRecycle included transportation costs associated with transferring new recycled material feedstocks to manufacturers in the processing infrastructure total calculation. This analysis considered the cost per ton per mile needed to move recycled material feedstocks by truck or rail.[64] CalRecycle assumed the total mileage needed to transport recycled materials would encompass the greatest distance from Northern to Southern California and that newly recycled material would be sent to a manufacturing facility within the state. CalRecycle applied these costs per ton to the difference between the Baseline and 2031 generation tonnages to determine the cost to accommodate the increased transportation of recycled materials. CalRecycle averaged the transportation costs by rail and by truck to determine the estimated transportation cost, which was $171,930 across implementation years.

Table 18: Cumulative Implementation Costs for Processing Infrastructure (Million Dollars)

Cost	2024	2025	2026	2027	2028	2029	2030	2031	Total
Processing	$178	$176	$173	$170	$165	$163	$241	$237	$1,503

Table 19: Cost and Volume for Processing Infrastructure by Material Types

Material Type	Anticipated Increased Volume (Tons)	Commodity Value ($/Ton)	Conversion Cost ($/Ton)	Total Processing Cost ($/Ton)
Plastic	1,325,163	$294	$720	$1,014
Paper	57,265	$99	$803	$902
Metal	50,570	$711	$735	$1,446
Glass	228,163	$22	$128	$150

Direct Cost on Businesses

The estimated costs to businesses in the analysis include many assumptions for factors that will affect the actual, realized impacts to businesses, most notably decisions by the PRO and producers regarding their compliance pathways, as well as individual consumer decisions. These decisions may result in the actual impacts to businesses potentially being different from the estimates presented here.

CalRecycle has identified two main categories of impacted businesses. The first category includes businesses that are producers of covered material who are directly regulated by the Act. The second category includes businesses that will be impacted by the Act's implementation through costs of goods and materials.

Businesses that are producers of covered material are separated into two groups. Producers that have gross annual sales of products that use covered material within California greater than $1 million will be responsible for funding the implementation costs of the Act. CalRecycle estimates there are 5,741 of these producers who will incur annual compliance costs of approximately $457,114. Many factors will contribute to the actual costs incurred by any individual producer including the type and amount of material they represent and the compliance pathways they choose. Producers with gross annual sales of products that use covered material within California less than $1 million are eligible for exemption from most of the Act's requirements. Small producers will incur a small biennial cost of approximately $309 for record keeping and application costs, an average of $155 per year. CalRecycle estimates that 7,874 producers will be eligible for this exemption.

Businesses that are not producers are also expected to experience economic impacts as a result of implementing the Act, though they are not directly regulated by the program. The estimated 546,269 businesses may see the cost of goods increase if producers raise prices in response to fulfilling their regulatory requirements. It is estimated that these costs may average $4,806 annually. These costs could be lower depending on how the PRO and producers comply with the Act and the Proposed Regulations.

To determine the maximum impact that businesses could expect to incur due to the Act and the Proposed Regulations, CalRecycle assumed that producers would pass on 100 percent of their implementation costs. Rising prices typically result in decreased demand for goods, so businesses may not choose to pass on the entire cost of EPR programs to their consumers.[65] The amount that a particular business is likely to pass on to their consumers will vary based on many factors, including price elasticity for the particular product they are selling. Identifying and calculating price elasticities for all product categories is outside the scope of this analysis; however, a recent study suggests that food and beverage producers pass on a maximum of 30 percent of EPR compliance costs in the form of increased prices.[66] If all producers of covered material pass on 30 percent of the cost of the Act and the Proposed Regulations, rather than 100 percent, to consumers, the average annual cost to non-regulated businesses (business consumers) would decrease from $4,806 to $1,442 (a decrease of $3,364).

Direct Cost on Individuals

The estimated costs to individuals in this analysis includes many assumptions regarding factors that will affect the actual, realized impacts to individuals, most notably decisions by the PRO and producers regarding their business decisions, compliance pathways, as well as individual consumer behavior and response to producer business decisions. These decisions may result in the actual impacts on individuals potentially being different from the estimates presented here.

Similar to the scenario described earlier for non-regulated businesses, individuals may face heightened costs for goods as producers bear the expenses of meeting regulatory requirements. The overall cost of implementation is projected to reach $21.0 billion throughout the Act's implementation period. As these costs trickle down from producer to consumer, the direct cost per household after full implementation could potentially reach $190 annually (about $66 per person). CalRecycle assumed that producers would pass on 100 percent of their implementation costs to consumers. As noted in the Direct Cost on Businesses section, producers may not choose to pass on all of their implementation costs due to price elasticity. If all producers of covered material pass on 30 percent of the cost of the Act and the Proposed Regulations, rather than 100 percent, to consumers, the average annual cost to households would decrease from $190 to $57 (a decrease of $133), or from $66 per person to $20 per person.

These direct costs are likely to be mitigated by an estimated increase in personal income of $14.4 billion,[§§] coupled with additional health and environmental benefits totaling $53.3 billion. It is significant to note that these annual costs are likely to be lower based on producer business decisions as well as actions taken by the PRO to realize system-scale efficiencies, and as a consequence of choices made by discerning California consumers. CalRecycle based its estimates on Department of Finance projections for the total number of households and US Census Bureau data for the average size of households, utilizing the total cost of implementation and average household data.

Fiscal Impacts

Local Government

Local Jurisdictions

The PRO is responsible for fully reimbursing the cost incurred by local jurisdictions in meeting the requirements of the Act and the Proposed Regulations. Additionally, a portion of California Plastic Pollution Mitigation Funds, upon appropriation by the Legislature, may be used to support grants for tribes, nongovernmental organizations, community-based organizations, land trusts, and local jurisdictions. The Act requires local jurisdictions as defined[***] to include all covered material deemed recyclable or compostable on the covered material category lists published by CalRecycle in their collection and recycling programs.[67] Implementing the Act and the Proposed Regulations will require coordination between the PRO, Independent Producers, and local jurisdictions to provide education and outreach; process and transport of covered materials; perform waste stream sampling and reporting; mitigate contamination;

[§§] See the Macroeconomic Impacts section for a discussion of estimated changes to personal income

[***] PRC section 42041(l) states a "Local jurisdiction" means a city, county, city and county, regional agency formed, or special district that provides solid waste collection services.

improve collection, sorting, decontamination, and remanufacturing; expand curbside collection programs; and develop other infrastructure necessary or appropriate to achieve recycling rate target goals.[68] These costs include costs related to both curbside and non-curbside collection programs. Costs may vary based on population density, distance to a viable responsible end market, and other relevant factors. As local jurisdictions will be reimbursed for these costs by the PRO, CalRecycle does not anticipate any direct savings to local jurisdictions as a result of the Act and the Proposed Regulations.

State Government

CalRecycle and other state agencies will need additional staff and contracts to fully implement and enforce the provisions of the Act. The PRO is responsible for fully funding the costs incurred by the state government in meeting statutory requirements through provision of the Circular Economy Fund. The total staffing cost is estimated to be $63.4 million, and its annual breakdown is described in Table 7. CalRecycle estimates field visits to cost $5.95 million across implementation years, and contracts hired to conduct the Needs Assessment, economic impact reports, and Information Technology (IT) infrastructure are estimated to total $7.4 million.

Moneys in the California Plastic Pollution Mitigation Fund will be distributed to various government agencies in order to monitor and reduce the negative environmental and human health impacts and to mitigate the historical and current environmental justice and public health impacts of plastic pollution. From 2027 to 2037, the Department of Fish and Wildlife, the Wildlife Conservation Board, the State Coastal Conservancy, the California Coastal Commission, the Ocean Protection Council, the Department of Parks and Recreation, the Natural Resources Agency, and the California EPA will receive 40 percent (at least $200 million annually) of these funds to monitor the impacts of plastic pollution. The Strategic Growth Council, the California EPA, the Natural Resources Agency, and the Department of Justice will receive 60 percent (at least $300 million annually) of the moneys in the California Plastic Pollution Mitigation Fund to mitigate the current and historical impacts of plastic pollution on disadvantaged, low-income, and rural communities between 2027 and 2037.

CalRecycle expects state government to see a decrease in revenue from disposal stream tipping fees of approximately $2 million, as the tonnages of covered material entering the landfill should decrease due to the Act. A loss of tip fee revenues for the disposal stream was calculated by applying the difference between the Baseline and 2031 disposal tonnages to the $1.40 fee per ton outlined in PRC section 48000(b)(1).

As discussed in the "Impacts on Individuals in California" subsection of this SRIA, CalRecycle anticipates a growth in personal income for Californians over the Act's implementation period, attributing it to macroeconomic influences. This rise in personal income is expected to contribute to an upswing in state income tax revenue. As a result of the estimated increases in personal income outlined in Table 26, CalRecycle

estimated state income tax revenue to increase by $575 million through the implementation period. The expected impact on tax revenue for each year of the analysis is provided in Table 20.

Table 20: Estimated Change in State Income Tax Revenue (Million Dollars)

Year	Change in Personal Income	State Income Tax Revenue
2024	$155	$6.2
2025	$351	$14
2026	$608	$24
2027	$1,861	$74
2028	$2,112	$84
2029	$2,580	$103
2030	$3,083	$123
2031	$3,617	$145
Total	N/A	$575

Disadvantaged, Low-Income Communities, and Rural Areas

Disadvantaged and low-income communities are disproportionately impacted by the human health and environmental impacts of plastic pollution, fossil fuel extraction, and climate change.[69] Studies have concluded that petroleum refineries and petrochemical manufacturing industries and facilities generally have higher health risks for Black, Brown, Indigenous, and poor communities. These studies indicate that the fossil fuel economy has created sites of concentrated harm, typically land, air, and water where pollution can be deposited.[70]

The Act requires money in the California Plastic Pollution Mitigation Fund to be expended by specified state agencies on purposes relating to mitigating the environmental impacts of plastic pollution. The Act incorporates multiple environmental justice principles that minimize the harmful effects of plastic pollution, thus minimizing the effects on disadvantaged and low-income communities.

Upon appropriation by the Legislature, 40 percent of the moneys in the California Plastic Pollution Mitigation Fund shall be expended to monitor and reduce the environmental impacts of plastics, including to restore, recover, and protect the natural environment. At least 50 percent of these funds shall provide benefits to residents living in a disadvantaged or low-income community or rural area.[71] This is estimated to total at least $1 billion. Upon appropriation by the Legislature, 60 percent of the moneys in the

California Plastic Pollution Mitigation Fund shall be expended to monitor and reduce the historical and current environmental justice and public health impacts of plastics, including to mitigate the historical and current impact of plastics on disadvantaged or low-income communities or rural areas.[72] This is estimated to total at least $3 billion. Of this money, 75 percent shall directly and primarily benefit residents living in disadvantaged or low-income communities.

The Act requires the establishment of a producer responsibility advisory board for the purpose of identifying barriers and solutions and advising CalRecycle, producers, and PROs in the implementation of the Act and the Proposed Regulations. The Act requires that the membership of the board include as voting members one representative from a disadvantaged or low-income community or rural area, one representative from an environmental justice organization, and one representative nominated by a statewide rural county association.[73]

The Act requires that the PRO shall ensure that the plan implementation avoids or minimizes negative environmental or public health impacts on disadvantaged or low-income communities or rural areas and vulnerable communities in or outside the state.[74] The Act requires that the Needs Assessment reflect the different needs and challenges faced by urban, suburban, and rural communities and a variety of different population densities and socioeconomic perspectives.

Additionally, the Act requires that material be sent to a REM in order to be considered recycled. This means that recycling and recovery of materials or the disposal of contaminants must be conducted in a way that benefits the environment and minimizes risks to public health and worker health and safety and benefits the environment. The Act incorporates a malus fee, or a charge imposed by a PRO on a participant producer for a covered material due to the adverse environmental or public health impacts of the material.

As environmental impacts of plastic pollution disproportionately impact disadvantaged or low-income communities and rural areas, the resulting benefits discussed in this SRIA such as reduced pollution, access to reusable and recyclable packaging and collection programs, and other potential health benefits will be proportionately higher in these communities.

CalRecycle anticipates the siting of new facilities due to the Act and the Proposed Regulations might affect disadvantaged, low-income, and rural areas. These impacts can be both negative (e.g., increased traffic, odors, and other emissions) and positive (e.g., increased job opportunities, increased access to recycling infrastructure and programs). Furthermore, the California Environmental Quality Act process will anticipate mitigation needs related to any significant environmental impacts associated with expansion of existing facilities or construction of new facilities through the permitting process.

Macroeconomic Impacts

Methods for Determining Economic Impacts

This section provides an overview of the anticipated overall impact of the Act and the Proposed Regulations on California's economy. The implementation of the Act and the Proposed Regulations is expected to result in incremental cost increases for businesses as they work to comply. These compliance costs result in direct changes in the economy as these costs are passed on to other businesses and individual end-users. Resulting shifts in spending patterns among end-users will subsequently have indirect effects on employment, economic output, and investments within the sectors that furnish goods and services to the affected businesses. A summary of these outcomes can be found in the Summary and Interpretation of the Assessment Results section.

Beyond the direct consequences of the Act and the Proposed Regulations, there will be additional indirect and induced effects, including changes in personal income that will impact consumer spending across various expenditure categories. The total incremental economic impacts of the Act and the Proposed Regulations are assessed relative to a baseline, utilizing cost data detailed in the Direct Costs section of this SRIA. This analysis emphasizes the incremental changes in significant macroeconomic indicators spanning from 2024 to 2034 such as employment, economic output growth, and Gross State Product (GSP). Although implementation of the Act and the Proposed Regulations will be complete at the close of 2031, this analysis extends another 36 months beyond full implementation to identify residual economic effects.

CalRecycle used the Regional Economic Models, Inc. (REMI) Policy Insight Plus Version 2.5.0 model to estimate the macroeconomic impacts of the Act and the Proposed Regulations on California's economy. REMI is a robust economic forecasting and policy analysis model which integrates various methodologies, including input-output, computable general equilibrium, econometric, and economic geography approaches. REMI Policy Insight Plus, in accordance with the stipulations of SB 617 (Calderon and Pavley, Chapter 496, Statutes of 2011) and the California Department of Finance (DOF),[75] calculates annual estimations of the cumulative impacts stemming from the Act and the Proposed Regulations. The analysis is underpinned by the utilization of REMI's single-region model, comprising 160 sectors, with adjustments made to align the model's reference case with the most up-to-date publicly accessible economic and demographic projections from the California Department of Finance.

CalRecycle modified the REMI model's National and Regional Control settings to align with the economic forecasts provided by the DOF. These forecasts encompass a range of factors, including U.S. Real Gross Domestic Product, income levels, and employment figures, in addition to civilian employment data categorized by industry for the state of California. These forecasts were officially released as part of the 2023-2024 Governor's Budget on January 10, 2023. Furthermore, demographic projections for California's

population, last updated in July 2021 by the DOF, were also considered in this analysis. It is worth noting that after the conclusion of DOF's economic forecasts in 2026, CalRecycle assumed that economic variables would continue growing at the same rate as projected in the baseline forecasts provided by REMI.

Inputs and Assumptions of the Assessment

The estimated economic impact is sensitive to modeling assumptions. This section aims to offer a concise overview of the assumptions and data inputs that were employed to define the array of policy variables, which most accurately capture the macroeconomic effects of the Act and the Proposed Regulations. CalRecycle translated the direct expenses, as outlined in the Direct Costs section, and the direct avoided costs, as outlined in the Benefits section, into REMI policy variables. These variables were used as foundational inputs for macroeconomic analysis.[†††]

As previously indicated, the Act requires California to fundamentally change its approach to managing the production and disposal of plastic packaging. It is designed to address plastic pollution through source reduction and by requiring producers of covered material to verify that their products are recycled. As such, CalRecycle projects this shift to more recyclable materials and greater accountability will impact all 39 million Californians and its 13.8 million households. An estimated 559,884 businesses will be impacted compared to the baseline scenario. The affected businesses encompass producers of covered material, retailers, wholesalers, and restaurants. Within this business landscape, CalRecycle estimates that 5,741 may be classified as large producers (fully regulated) of covered material, while 7,874 may be classified as small producers (potentially eligible for an exemption from most of the requirements).

The direct expenses associated with the Act and the Proposed Regulations, elaborated upon in the Direct Costs section, encompass production costs that are essential to meet the source reduction and recycling rates requirements. These production costs are incurred directly by manufacturers, wholesalers, retailers, and food service establishments. These direct production costs are projected to be borne by entities from both California and out-of-state. To isolate the effects specific to California, CalRecycle calculated the portion of production cost that can be attributed to California-based businesses. This calculation is based on California's proportionate share of the total number of entities within each affected industry compared to the national industry total, as shown in Table 21.

[†††] Refer to the Macroeconomic Appendix for a full list of REMI inputs for this analysis

Table 21: Direct Production Costs Attributed to California

REMI Industry	US Total Entities	CA Total Entities	Factor	US Total Estimated Production Cost	CA Total Estimated Production Cost
Food Manufacturing	54,406	10,383	0.19	$389.7 million	$74.4 million
Converted Paper Product Manufacturing	11,148	1,230	0.11	$46.2 million	$5.1 million
Plastics Product Manufacturing	13,336	1,425	0.11	$53.5 million	$5.7 million
Glass and Glass Product Manufacturing	3,832	532	0.14	$20.0 million	$2.8 million
Other Fabricated Metal Product Manufacturing	75,330	8,723	0.12	$327.4 million	$37.9 million
Wholesale Trade	914,139	115,416	0.13	$4.3 billion	$546.9 million
Retail Trade	2,601,569	314,906	0.12	$11.8 billion	$1.4 billion
Food Service Establishments	834,022	107,269	0.13	$4.0 billion	$517.8 million

The mandated source reduction and recycling rate requirements will lead to corresponding changes in the final demand for industries involved in the production of these packaging materials. Specifically, implementation of the Act and the Proposed Regulations will induce a decline in demand for the manufacturing industry of non-recyclable plastic products, while simultaneously stimulating an upsurge in demand for industries engaged in the production of recyclable plastic, paper, metal, and glass products.

Additionally, the increased production costs will result in increases in economic output, or sales, for the “management of companies” and construction industries. Conversely, the waste management and remediation industry will experience a net reduction in economic output due to decreased disposal of covered material, but this is partially balanced by an increase in demand for recycling and recovery services.

There will be minor economic impacts stemming from the reduction in revenue from fewer tipping fees collected, as less material in the waste stream will contribute to

declining disposal rates. CalRecycle modeled this as a decrease in state and local government spending. Further economic effects will be observed due to the distribution and investment of surcharge fees paid by the PRO to support environmental mitigation and justice initiatives, especially in disadvantaged, low-income, and rural communities. This distribution has been accounted for as an increase in state and local spending. Lastly, there will be minor economic effects stemming from the state's need to hire additional staff for administration of the Act. CalRecycle modeled this as an expansion in state government employment.

Implementing the Act requires a significant increase in the recycling of plastic-covered materials and an overall decrease in their production. This diminishes the potential future harm of both existing and new covered materials to society and the environment. CalRecycle quantified these benefits at a total of $53.3 billion, which was integrated into the REMI model as a Non-Pecuniary (Amenity) Aspect. CalRecycle expects this avoidance of costs to boost economic output, employment, GSP, investment, and personal income.

Results of the Assessment

The outcomes from the REMI model provide estimates of how the Act and the Proposed Regulations will influence the California economy. These estimates indicate the yearly incremental shifts resulting from the enactment of the Act and the Proposed Regulations when compared to the baseline scenario. Negative impacts reported here would potentially slow economic growth, while positive impacts would add to economic growth. These results are presented in Tables 22 through 27 for every two-year interval spanning from 2024 to 2034.

California Employment Impacts

An overview of the impact of the Act and the Proposed Regulations on overall employment in California, encompassing all industries is provided in Table 22. Employment estimates include both full-time and part-time positions and are distributed based on the place of work within these industries. Full-time and part-time jobs are considered equally.

This calculation includes employees, sole proprietors, and active partners but excludes unpaid family workers and volunteers. The employment impacts reflect the net change in employment, with positive effects on some industries and negative effects on others.

The Act and the Proposed Regulations are anticipated to yield a favorable employment impact starting in 2024 and continuing until 2034. These findings indicate that the estimated positive employment impact stems primarily from increased demand in the paper, glass, aluminum, steel, other metal, and recyclable plastic product manufacturing sectors. The positive impact on employment was also influenced by the costs avoided

as detailed in the Benefits section. There is no indication that there will be a net elimination of jobs within California.

Further elaboration on these employment changes at the industry level is provided in the subsequent paragraph. Importantly, these shifts in employment do not surpass 0.15 percent of the baseline employment figures for California throughout the entire regulatory timeline.

Table 22: Total California Employment Impacts

Year	California Employment	Percent Change	Change in Total Jobs
2024	25,179,690	0.01%	2,167
2026	25,471,879	0.03%	7,473
2028	25,723,179	0.09%	24,204
2030	26,111,652	0.12%	31,916
2032	26,507,957	0.09%	22,759
2034	26,852,837	0.07%	19,975

A breakdown of employment shifts in industries directly affected by the Act and the Proposed Regulations, is provided in Table 23, while the broader trends in employment changes within major sectors are illustrated in Figure 2..

As the requirements of the Act and the Proposed Regulations take effect, the heightened demand within the paper, glass, aluminum, steel, other metal, and recyclable plastic product manufacturing sectors, will result in increased employment opportunities within these industries. The increased expenditures within these categories play a significant role in shaping the employment impact, as evidenced by the figures for the year 2030. For instance, the paper product manufacturing industry is projected to experience an increase of approximately 915 jobs in 2030, constituting 4.5 percent of baseline employment. Similarly, in 2030 it is anticipated that the construction industry will see a gain of approximately 5,200 jobs, while the glass product manufacturing industry is projected to see an increase of roughly 924 jobs, which represents 13 percent of baseline employment within that sector.

Table 23: Employment Impacts by Primary and Secondary Industries‡‡‡

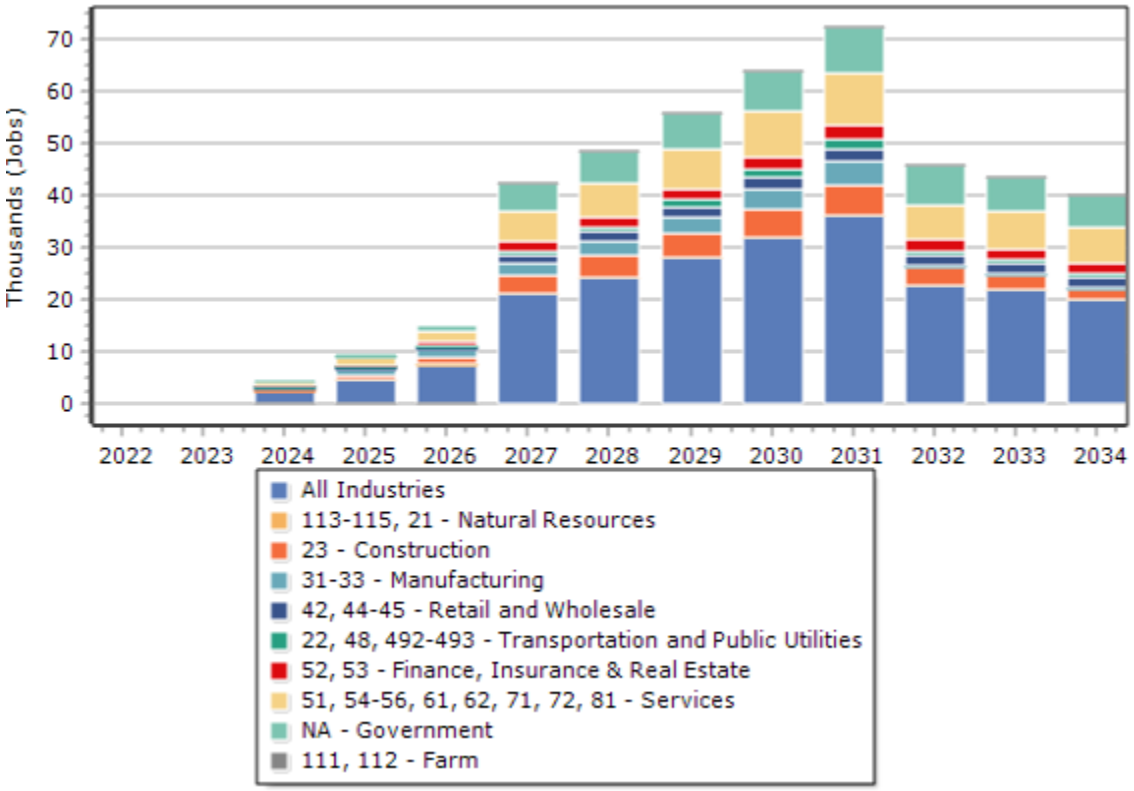
Industry	2024	2026	2028	2030	2032	2034
Food Manufacturing (% Change)	0.00%	0.02%	0.07%	0.10%	0.10%	0.09%

‡‡‡ Parentheses represent negative values

Food Manufacturing (Change in Jobs)	7	32	129	180	185	170
Converted Paper Product Manufacturing (% Change)	0.63%	1.87%	3.08%	4.49%	0.02%	0.03%
Converted Paper Product Manufacturing (Change in Jobs)	133	390	634	915	4	6
Construction (% Change)	0.03%	0.11%	0.32%	0.40%	0.25%	0.14%
Construction (Change in Jobs)	378	1,380	4,046	5,174	3,292	1,843
Glass Product Manufacturing (% Change)	1.98%	5.70%	9.07%	13.06%	(0.07%)	(0.02%)
Glass Product Manufacturing (Change in Jobs)	144	413	648	924	(5)	(1)
Plastics Product Manufacturing (% Change)	0.22%	0.67%	1.11%	1.54%	(0.04%)	(0.04%)
Plastics Product Manufacturing (Change in Jobs)	90	267	440	611	14	14
Steel Product Manufacturing (% Change)	0.92%	2.40%	2.91%	3.78%	(0.03%)	(0.01%)
Steel Product Manufacturing (Change in Jobs)	21	56	67	87	(1)	0
Aluminum Production and Processing (% Change)	0.58%	1.63%	3.26%	4.11%	(0.02%)	(0.01%)
Aluminum Production and Processing	19	54	106	132	(1)	0

(Change in Jobs)						
Other Fabricated Metal Product Manufacturing (% Change)	0.24%	0.74%	1.24%	1.88%	(0.03%)	(0.01%)
Other Fabricated Metal Product Manufacturing (Change in Jobs)	42	131	215	322	(5)	(2)
Wholesale Trade (% Change)	0.01%	0.02%	0.06%	0.08%	0.05%	0.05%
Wholesale Trade (Change in Jobs)	52	165	487	634	383	356
Retail Trade (% Change)	0.00%	0.01%	0.06%	0.07%	0.07%	0.06%
Retail Trade (Change in Jobs)	76	287	1,203	1,549	1,391	1,308
Food Service Establishments (% Change)	0.00%	0.02%	0.08%	0.12%	0.14%	0.12%
Food Service Establishments (Change in Jobs)	59	359	1,243	1,963	2,284	1,950

Figure 2: Employment Impacts by Major Sector



California Business Impacts

Gross output is used as a measure for business impacts because it represents an industry's sales or receipts and tracks the quantity of goods or services produced in a given time period. Output growth is the cumulative output across individual private industries and state and local government sectors that contribute to the state's gross domestic product (GDP). This growth is influenced by changes in production cost and shifts in demand. When production cost rises or demand diminishes, output tends to shrink. Conversely, when production cost decreases or demand surges, output typically expands.

Under the Act and the Proposed Regulations, CalRecycle anticipates an increase in production costs, which is counterbalanced by avoided costs along with increased demand for the recyclable plastic, paper, metal, and glass product industries. The increase in production cost will result in increased economic output (sales) for several industries, specifically the "management of companies" and the construction industries. This will provide additional support in mitigating the effects of the expected rise in production costs, ultimately resulting in an overall boost in output. The pattern of output changes within major sectors is shown in Figure 3. Specifically, there will be an output increase of $589 million in 2024 and a further rise of $8.3 billion in 2030, as demonstrated in Table 24. Similarly, as with employment impacts, industries that are

projected to have an increase in demand or direct output (sales) will experience positive economic impacts.

Figure 3: Change in Output in California by Major Sector

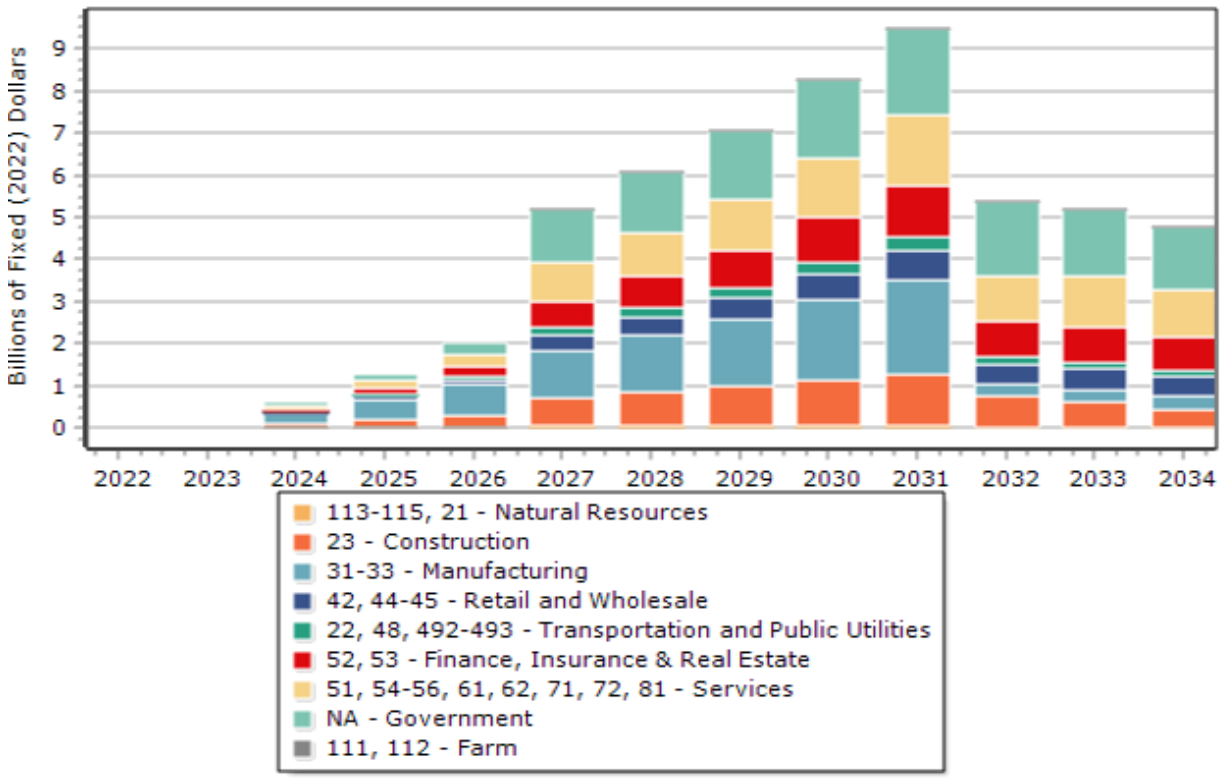


Table 24: Change in California Output Growth by Industry[§§§]

Industry	2024	2026	2028	2030	2032	2034
California Economy (Output, Current M$)	5,978,413	6,221,033	6,478,259	6,803,946	7,147,930	7,481,750
California Economy (% Change)	0.01%	0.03%	0.09%	0.12%	0.08%	0.06%
California Economy (Change, Current M$)	589	2,004	6,054	8,258	5,372	4,787
Food Manufacturing (% Change)	0.00%	0.02%	0.07%	0.10%	0.09%	0.08%
Food Manufacturing (Change, Current M$)	3	14	56	80	83	77
Construction (% Change)	0.03%	0.11%	0.32%	0.40%	0.26%	0.15%
Construction (Change, Current M$)	72	269	821	1,085	726	428
Glass and Glass Product Manufacturing (% Change)	1.93%	5.55%	8.86%	12.74%	0.05%	0.06%
Glass and Glass Product Manufacturing (Change, Current M$)	49	142	227	331	1	1
Steel Product Manufacturing (% Change)	0.93%	2.45%	2.99%	3.89%	0.02%	0.02%
Steel Product Manufacturing (Change in Jobs)	11	29	36	49	0	0
Aluminum Production and Processing (% Change)	0.60%	1.67%	3.34%	4.24%	0.03%	0.03%
Aluminum Production and Processing (Change in Jobs)	11	32	65	84	1	1
Other Fabricated Metal Product Manufacturing (% Change)	0.24%	0.75%	1.25%	1.90%	(0.01%)	0.00%
Other Fabricated Metal Product Manufacturing (Change, Current M$)	14	44	74	116	(1)	0

[§§§] Parentheses represent negative values

Converted Paper Product Manufacturing (% Change)	0.65%	1.94%	3.22%	4.76%	0.07%	0.07%
Converted Paper Product Manufacturing (Change, Current M$)	81	241	404	603	9	9
Plastics Product Manufacturing (% Change)	0.22%	0.67%	1.12%	1.59%	0.06%	0.05%
Plastics Product Manufacturing (Change, Current M$)	35	106	180	259	9	8
Wholesale Trade (% Change)	0.01%	0.02%	0.06%	0.08%	0.05%	0.04%
Wholesale Trade (Change, Current M$)	22	74	233	317	200	192
Retail Trade (% Change)	0.00%	0.01%	0.06%	0.07%	0.06%	0.06%
Retail Trade (Change, Current M$)	11	45	201	273	258	255
Management of Companies and Enterprises (% Change)	0.01%	0.03%	0.06%	0.08%	0.05%	0.05%
Management of Companies and Enterprises (Change, Current M$)	12	36	70	100	62	66
Waste Management and Remediation Services (% Change)	0.00%	0.01%	0.09%	0.11%	0.09%	0.07%
Waste Management and Remediation Services (Change, Current M$)	0	2	15	19	16	13
Food Service Establishments (% Change)	0.00%	0.02%	0.08%	0.12%	0.14%	0.11%
Food Service Establishments (Change, Current M$)	5	31	107	173	206	178
State and Local Government (% Change)	0.01%	0.05%	0.27%	0.34%	0.31%	0.26%
State and Local Government (Change, Current M$)	57	263	1,449	1,843	1,757	1,500

Impacts on Investments in California

Private domestic investment consists of purchases of residential and nonresidential structures and of equipment and software by private businesses and nonprofit institutions. It is used as a proxy for impacts on investments in California because it provides an indicator of the future productive capacity of the economy.

The relative changes in private investment growth attributable to the Act and the Proposed Regulations are detailed in Table 25. The data indicate an initial rise in private investment of approximately $49 million in 2024, followed by a positive trajectory, peaking at an increase of $952 million in 2030. It is noteworthy that these shifts in investment do not surpass 0.15 percent of the baseline investment figures throughout the entire regulatory timeline. There is no indication that there will be a net decrease in private investment in the state as a result of the Act or the Proposed Regulations.

Table 25: Change in Gross Domestic Investment Growth

Impact Category	2024	2026	2028	2030	2032	2034
Private Investment (Current M$)	488,889	553,368	597,085	631,447	662,325	690,269
% Change	0.01%	0.04%	0.12%	0.15%	0.12%	0.06%
Change (Current M$)	49	216	710	952	769	420

Impacts on Individuals in California

As depicted in the model, the Act and the Proposed Regulations do not directly impose any cost on individuals in California. However, the expenses incurred by affected entities, coupled with the projected changes in demand, output, employment, and state government spending have a cascading effect throughout the economy, thus impacting individuals.

A key metric for assessing this impact is the change in real personal income. Real personal income encompasses income from various sources, including employee compensation, government disbursements, and business transfers, adjusted to account for inflation. This metric offers a comprehensive statewide evaluation of shifts in personal income, capturing the net outcome of income reductions stemming from job losses in specific industries and income gains generated by job creation in others.

While the Act and the Proposed Regulations are expected to lead to increased production cost, these cost effects are offset by those factors identified previously in this section: heightened industry demands, increased output, avoided costs, and state government spending. Consequently, this leads to net gains in employment, which naturally results in an increase in real personal income, as illustrated in Table 26.

The Act and the Proposed Regulations are anticipated to yield an increase in personal income across all assessment years, with the most significant impact occurring in 2030, amounting to an increase of approximately $3.1 billion.

Table 26: Impacts on Individuals in California

Impact Category	2024	2026	2028	2030	2032	2034
Personal Income (Current M$)	2,912,594	3,025,898	3,171,049	3,337,242	3,507,831	3,675,580
% Change	0.01%	0.02%	0.07%	0.09%	0.08%	0.07%
Change (Current M$)	155	608	2,112	3,083	2,838	2,557
Personal Income per Capita	73,648	75,581	78,418	81,493	84,635	87,624

Impacts on Gross State Product

A measure of economic performance, GSP represents the total market value of all goods and services produced in California and stands as a key indicator of economic growth. It is calculated by summing the dollar value of consumption, investment, net exports, and government spending.

Under the Act and the Proposed Regulations, there is an estimated increase in GSP growth, amounting to approximately $294 million in 2024, peaking in 2030 at $4.5 billion, and culminating in a $2.8 billion increase in 2034, as illustrated in Table 27. This metric serves as a comprehensive summary of the impacts discussed earlier, encompassing consumer spending, investment, and government expenditure. The rise in consumer and government spending along with avoided costs in California outweighs the increase in production cost stemming from the Act and the Proposed Regulations. Importantly, these changes do not exceed 0.15 percent of the baseline GSP.

In general, the Act and the Proposed Regulations have a positive impact on GSP, driven by the favorable influences on consumption and government spending, which effectively offset the decrease in production cost, as explained earlier.

Table 27: Changes in Gross State Product

Impact Category	2024	2026	2028	2030	2032	2034
GSP (Current M$)	3,503,438	3,689,962	3,852,255	4,029,506	4,205,054	4,371,661
% Change	0.01%	0.03%	0.09%	0.11%	0.08%	0.06%
Change (Current M$)	294	1,033	3,339	4,517	3,168	2,820

Creation or Elimination of Businesses

The REMI model does not have the direct capability to estimate the creation or elimination of individual businesses within California. Nevertheless, it can provide insights into potential impacts by analyzing changes in jobs, output, overall cost to directly impacted businesses, and the state of California.

Reductions in output growth, when compared to the baseline, might indicate the potential elimination of businesses. Conversely, increased output within a specific industry may suggest the possibility of new business creation, especially if existing businesses cannot meet all future demands. There is not a specific threshold that definitively identifies the creation or elimination of individual businesses.

Based on the modeling of changes in output and employment, businesses involved in the production of recyclable plastics, paper, glass, metal products, and construction may experience expansions. However, established businesses may be able to accommodate increased demand without necessitating additional business growth.

It's important to note that many of the entities impacted by the Act and the Proposed Regulations are large national corporations, and they are not expected to face business closures. These larger operators are likely to distribute compliance costs across the entire nation. On the other hand, some smaller operators in California may encounter significant rises in compliance-related production costs. If these businesses are unable to pass on these costs to their customers, or if there is a substantial shift in demand, it is conceivable that some of these smaller businesses could face closure.

Incentives for Innovation

The Act and the Proposed Regulations establish material packaging standards, creating an incentive for manufacturers to explore innovative and cost-effective approaches to meet these standards, thereby mitigating compliance expenses. Manufacturers who invest in and gain expertise in technologies that lower compliance cost stand to gain advantages as the market expands. Covered material producers will have increased incentive to develop new products and materials that are compliant with the Act and the

Proposed Regulations and function as well as the packaging and food service ware currently in the market. By innovating, these covered material producers will ensure that companies will continue to buy their packaging and food service ware for their own products, which are required to be packaged with compliant covered material. CalRecycle expects that there will be increased incentive to develop new processes for recycling covered material as well. It may be more cost-effective to develop a recycling process for a material that isn't recyclable currently rather than developing an entirely new material that performs the same function.

Competitive Advantage or Disadvantage

CalRecycle does not foresee substantial direct effects on the overall competitive standing of businesses currently operating in the state. This is because the Act and the Proposed Regulations uniformly impose requirements on all entities operating in California, regardless of whether their parent companies are based within or outside the state. All businesses, regardless of their ownership status (in-state or out-of-state), would be subject to the same set of requirements. Consequently, the Act and the Proposed Regulations are not anticipated to generate competitive advantages or disadvantages for California-based operators.

Summary and Interpretation of the Assessment Results

The findings from the macroeconomic analysis of the Act and the Proposed Regulations are summarized in Table 28. According to CalRecycle's assessment, it appears that the Act and the Proposed Regulations are unlikely to exert a substantial impact on the California economy. In summary, the projected changes in job growth, GSP, and output are expected to remain below a 0.15 percent deviation from the baseline.

The Act and the Proposed Regulations are expected to yield a small demand increase in the recyclable plastic, metal, paper, glass, and construction industries. This will be complemented by an increase in state government expenditure. Simultaneously, minor decreases in demand for the waste management and remediation sector may occur. Collectively, these factors are poised to contribute to marginal increases in real personal income, GSP, output, investment, and employment.

Table 28: Summary of Economic Impacts of the Act and the Proposed Regulations

Indicator	2024	2026	2028	2030	2032	2034
GSP (% Change)	0.01%	0.03%	0.09%	0.11%	0.08%	0.06%
GSP (Change, Current M$)	294	1,033	3,339	4,517	3,168	2,820

Indicator	2024	2026	2028	2030	2032	2034
Personal Income (% Change)	0.01%	0.02%	0.07%	0.09%	0.08%	0.07%
Personal Income (Change, Current M$)	155	608	2,112	3,083	2,838	2,557
Employment (% Change)	0.01%	0.03%	0.09%	0.12%	0.09%	0.07%
Employment (Change, Current M$)	2,167	7,473	24,204	31,196	22,759	19,975
Output (% Change)	0.01%	0.03%	0.09%	0.12%	0.08%	0.06%
Output (Change, Current M$)	589	2,004	6,054	8,258	5,372	4,787
Private Investment (% Change)	0.01%	0.04%	0.12%	0.15%	0.12%	0.06%
Private Investment (Change, Current M$)	49	216	710	952	769	420

Alternatives

CalRecycle has evaluated two alternative scenarios, a lower cost scenario which results in fewer benefits than the Proposed Regulations, and a higher cost scenario which results in similar benefits to the Proposed Regulations. Alternative 1 has less strict requirements for the materials categorized as plastic covered material. This would result in a lower total cost for the implementation since a smaller volume of material would be required to meet the 65 percent recycling rate and 25 percent source reduction rate. Fewer new recovery facilities would be necessary to process the additional materials moving through the system. However, Alternative 1 would result in fewer benefits than the Proposed Regulations, with less reduction of plastic pollution, GHG emissions and landfill volume. Alternative 2 would require producers to make quarterly reports to the PRO as opposed to annual reports under the Proposed Regulations. This would result in a higher total cost for the implementation since producers would have to spend more time compiling data and writing reports. Alternative 2 would not provide greater benefits over the Proposed Regulations as the amount of plastic covered material does not change between the scenarios.

The analyses for both Alternatives are described in the following sections.

Alternative 1: Less Stringent Classification of Plastic Covered Materials

Alternative 1 differs from the Proposed Regulations in that it would allow covered materials composed mostly of paper to contain less than 20% plastic by weight without being categorized as plastic covered material. These materials would be categorized as paper covered materials and would not be subject to source reduction or meeting the plastic recycling rate requirement. These materials would still need to be recyclable by the January 1, 2032, statutory deadline, but they would not be categorized as plastic. This would result in approximately 1,138 tons less material categorized as plastic covered material in Alternative 1 than in the Proposed Regulations. As a result of this material not being categorized as plastic covered material, the amount of material subject to the source reduction and recycling rate requirements would be reduced, which would lower the burden to comply and the associated cost.

Cost

The total direct cost of Alternative 1 is approximately $516 million lower than the cost of the Proposed Regulations. As identified in the DIM, the cost differences between Alternative 1 and the Proposed Regulations for the major expense categories are shown below in Table 29.

Table 29: Cost Difference between the Proposed Regulations and Alternative 1

Category	Cost Difference from Proposed Regulations
Program Administration	$0
Manufacturing and Production	($421,542,379)****
Infrastructure	($94,523,799)
Fees, Surcharges, Assessments	$0
Environmental Mitigation	$0
Total	($516,066,178)

Less material is classified as plastic covered material in Alternative 1. This results in reduced costs for source reduction and material switching. Non-plastic covered materials are not subject to the source reduction and recycling rate requirements and only need to be recyclable by the end of the implementation period. Table 30 shows the reduction in costs to source reduce plastic and meet the plastic recycling rate from 2024 to 2031.

**** Parentheses represent a negative value

Table 30: Reduction in Manufacturing and Production Cost Under Alternative 1

Year	Source Reduction	Recycling Rate
2024	($259,407)****	($48,470,163)
2025	($259,407)	($48,470,163)
2026	($259,407)	($48,470,163)
2027	($191,877)	($48,470,163)
2028	($191,877)	($32,313,442)
2029	($191,877)	($32,313,442)
2030	($56,891)	($80,783,605)
2031	($56,891)	($80,783,605)
Total	($1,467,635)	($420,074,744)

Under Alternative 1, infrastructure cost is also reduced compared to the Proposed Regulations. A smaller volume of plastic covered material will need to be recycled and fewer new collection, sortation, and processing facilities will need to be constructed to responsibly manage the material. The reduction in infrastructure costs for collection, sortation, and processing are shown in Table 31.

Table 31: Reduction in Infrastructure Cost Under Alternative 1

Year	Collection	Sortation	Processing
2024	($628,721)	($3,881,504)	($6,711,719)
2025	($619,221)	($3,822,856)	($6,610,381)
2026	($609,721)	($3,764,209)	($6,509,044)
2027	($600,221)	($3,705,561)	($6,407,707)
2028	($581,934)	($3,592,687)	($6,213,022)
2029	($573,634)	($3,541,448)	($6,124,463)
2030	($848,823)	($5,240,386)	($9,062,507)
2031	($833,261)	($5,144,311)	($8,896,459)
Total	($5,295,535)	($32,692,963)	($56,535,302)

Benefits

CalRecycle calculated the monetary benefits of Alternative 1 using the same methodology as the benefits calculations for the Act and the Proposed Regulations. The total avoided cost for Alternative 1 is approximately $2.5 billion less than the avoided cost for the Proposed Regulations; however, the total benefits for Alternative 1 are still greater than the total direct cost. While GHG emissions would decrease as a result of

increased plastic recycling and the decreased amount of plastic covered material over the Baseline, emissions reductions would be less than for the Proposed Regulations. Greenhouse gas emissions reductions would be approximately 62,000 t CO_2 eq less under Alternative 1 than the Proposed Regulations. Fewer materials would be classified as plastic covered materials, so the decrease in plastic pollution would be lesser than the Proposed Regulations, as only plastic covered materials are subject to the source reduction requirement.

Economic Impacts

Alternative 1 adopts an approach that utilizes less stringent measures compared to the Proposed Regulations, leading to reduced compliance expenses. Furthermore, Alternative 1 will result in a decreased demand for the plastic, paper, metal, and glass product manufacturing industries. This is primarily due to fewer materials being classified as plastic covered material, leading to a reduced need for material switching.

Under Alternative 1, infrastructure cost is also reduced in comparison to the Proposed Regulations. With a smaller volume of plastic covered material requiring recycling, there will be a reduced need for constructing new collection, sortation, and processing facilities. Consequently, this will lead to a decreased level of output within the construction industry relative to what is outlined in the Proposed Regulations.

The reduction in production cost, industry demand, and industry output relative to the Proposed Regulations results in a comparatively lower overall impact on the California economy. However, Alternative 1 reduces GHG emissions less than the Proposed Regulations. The input variables for the REMI analysis are the same variables that were used for the Proposed Regulations as described under “Macroeconomic Impacts.” The data for the Alternative 1 analysis changed in due to the decrease in spending on source reduction and materials switching, and the subsequent decrease in infrastructure improvement cost.

The macroeconomic impact analysis results shown in Table 32 indicate that Alternative 1 would result in similar economic impacts as the Proposed Regulations. Alternative 1 would result in less positive impacts on GSP, personal income, employment, and output when compared to the Proposed Regulations. Under Alternative 1, economic impacts are not estimated to exceed 0.15 percent of the baseline.

Table 32: Summary of Macroeconomic Impacts for Alternative 1

Impact Category	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Employment (% Change)	0.01%	0.02%	0.03%	0.08%	0.09%	0.10%	0.12%	0.13%	0.08	0.08%	0.07%
Employment (Change in Jobs)	2,005	4,336	6,952	20,410	23,301	26,739	30,570	34,430	22,156	21,247	19,564
Output (% Change)	0.01%	0.02%	0.03%	0.08%	0.09%	0.10%	0.12%	0.13%	0.07%	0.07%	0.06%
Output (Change, Current M$)	550	1,178	1,877	5,005	5,831	6,791	7,919	9,065	5,229	5,052	4,690
Personal Income (% Change)	0.00%	0.01%	0.02%	0.06%	0.06%	0.08%	0.09%	0.10%	0.08%	0.08%	0.07%
Personal Income (Change, Current M$)	141	323	562	1,795	2,026	2,471	2,945	3,445	2,751	2,737	2,488
GSP (% Change)	0.01%	0.02%	0.03%	0.07%	0.08%	0.10%	0.11%	0.12%	0.07%	0.07%	0.06%
GSP (Change, Current M$)	273	596	965	2,778	3,218	3,739	4,332	4,924	3,084	2,976	2,762

Cost-Effectiveness

This section evaluates the cost-effectiveness of Alternative 1 in comparison to the Proposed Regulations, utilizing multiple metrics related to implementation cost. The assessment considers the cost per ton of recycled plastic, greenhouse gas reduced, and the material diverted from the landfill.

Alternative 1 presents a cost reduction compared to the Proposed Regulations, with an estimated implementation cost of $20.5 billion to achieve the source reduction and recycling rate goals outlined in the statute. Conversely, the Proposed Regulations entail an estimated cost of $21.0 billion to achieve the same objectives. Alternative 1 results in similar plastic recycling, GHG emissions, and disposal reductions to the Proposed Regulations. A summary of these results, along with their respective cost-effectiveness, is provided in Table 33.

Table 33: Summary of Cost-Effectiveness for Alternative 1††††

Scenario	Recycled Plastic (Cost/Ton)	GHG Reduction (Cost/Ton)	Material Diverted from Landfill (Cost/Ton)
Alternative 1	$13,603	$9,633	$14,694
Proposed Regulations	$14,036	$9,594	$14,283
Difference	($432)	$39	$411

While Alternative 1 benefits from reduced implementation costs, it is important to note that the cost per ton for reducing GHG emissions and diverting material is higher compared to the Proposed Regulations.

Reason for Rejecting

Alternative 1 will not reduce the amount of covered material with small amounts of plastic. In Alternative 1, paper packaging and food service ware with less than 20 percent plastic (mixed materials) are categorized as paper instead of plastic covered material. Mixed materials including laminated paper and multi-layer packaging, composed of paper and plastic, are harder to recycle than non-mixed materials like milk jugs, which are solely composed of plastic. The paper and plastic materials need to be separated to be used as feedstock for new products, and the separation process is not simple. There are already systems in place throughout California to recycle plastic containers such as soft drink bottles and milk jugs. However, robust recycling infrastructure does not exist for packaging such as plastic-lined mailing pouches and bakery boxes with plastic windows. Therefore, not including them in the plastic category exempts them from the source reduction and recycling rate requirements, and it is likely they would be disposed due to how difficult they are to recycle. These materials

†††† Parentheses represent a negative value

contribute considerably to the issues that the Act was intended to address, such as the environmental and human health impacts of plastics, microplastics, and the challenges of managing certain hard-to-recycle plastic materials.

Alternative 2: Higher Frequency of Required Producer Reporting

Alternative 2 differs from the Proposed Regulations in that it requires producers to submit quarterly reports to the PRO as opposed to annual reports. Alternative 2 does not include a change in the amount of material categorized as plastic covered material, nor does it include any change in the source reduction or recycling rate requirements. The increased producer reporting requirements would increase the burden of complying with the Proposed Regulations.

Cost

The total direct cost of Alternative 2 is approximately $218 million more than the cost of the Proposed Regulations. The cost differences between Alternative 2 and the Proposed Regulations for the major expense categories[76] are shown below in Table 34.

Table 34: Cost Difference between Alternative 2 and the Proposed Regulations

Category	Cost Difference from Proposed Regulations
Program Administration	$218,265,875
Manufacturing and Production	$0
Infrastructure	$0
Fees, Surcharges, Assessments	$0
Environmental Mitigation	$0
Total	$218,265,875

Alternative 2 shows a higher cost for producer reporting, under the Program Administration category, due to the increased number of reports producers would be required to make on their operations. The average annual cost to report would be $7,908per large producer under Alternative 2. Table 35 shows the difference in large producer reporting costs between the Proposed Regulations and Alternative 2.

Table 35: Increase in Program Administration Cost Under Alternative 2

Year	Large Producer Reporting Cost
Annual	$31,180,839
Total	$218,265,875

Benefits

Alternative 2 would have approximately the same benefits as the Proposed Regulations. The amount of plastic covered material required to be source reduced and recycled in Alternative 2 is the same as in the Proposed Regulations. For this reason, CalRecycle expects that Alternative 2 will result in the same reductions in both plastic pollution and GHG emissions. The increased producer reporting may result in more accurate estimates of progress toward statutory requirements, but it is not expected to have a major impact on the overall benefits.

Economic Impacts

Alternative 2 adopts a more stringent approach compared to the Proposed Regulations, which leads to increased compliance costs. Output within the “management of companies” industry is expected to be higher compared to the Proposed Regulations in order to manage the increased frequency of reporting.

Stricter reporting measures would lead to an increase in costs for producers. This would in turn decrease the positive impacts on GSP, personal income, employment, and output in comparison to the Proposed Regulations. However, the increased output within the “management of companies” industry will result in an overall slight increase in the factors mentioned above.

The input variables for the REMI analysis are the same variables that were used for the Proposed Regulations, as described under "Macroeconomic Impacts." The adjustments in the Alternative 2 analysis are attributed to the increased production cost, as well as a modification of the output for the “management of companies” industry to account for the additional expenses expected to manage the heightened reporting requirements.

The macroeconomic impact analysis results are shown in Table 36. Alternative 2 would have economic effects to the Proposed Regulations. However, these effects are smaller in magnitude due to the increase in reporting costs. Specifically, Alternative 2 is expected to yield slightly less favorable results concerning GSP, personal income, employment, and output in comparison to the Proposed Regulations. Under Alternative 2, these impacts are projected not to surpass 0.15 percent of the baseline.

Table 36: Summary of Macroeconomic Impacts for Alternative 2

Impact Category	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Employment (% Change)	0.01%	0.02%	0.03%	0.08%	0.09%	0.11%	0.12%	0.13%	0.08%	0.08%	0.07%
Employment (Change in Jobs)	2,106	4,525	7,223	20,754	23,709	27,209	31,129	35,072	22,354	21,485	19,787
Output (% Change)	0.01%	0.02%	0.03%	0.08%	0.09%	0.10%	0.12%	0.13%	0.07%	0.07%	0.06%
Output (Change, Current M$)	577	1,229	1,952	5,102	5,949	6,929	8,068	9,260	5,291	5,124	4,758
Personal Income (% Change)	0.01%	0.01%	0.02%	0.06%	0.06%	0.08%	0.09%	0.10%	0.08%	0.08%	0.07%
Personal Income (Change, Current M$)	148	334	577	1,814	2,049	2,498	2,978	3,484	2,769	2,767	2,515
GSP (% Change)	0.01%	0.02%	0.03%	0.08%	0.09%	0.10%	0.11%	0.12%	0.07%	0.07%	0.06%
GSP (Change, Current M$)	287	624	1,006	2,831	3,282	3,814	4,423	5,029	3,120	3,019	2,802

Cost-Effectiveness

This section evaluates the cost-effectiveness of Alternative 2 in comparison to the Proposed Regulations, utilizing multiple metrics related to implementation cost. The assessment considers the cost per ton of recycled plastic, cost per metric ton of greenhouse gas reduced, and the cost per ton of material diverted from the landfill.

Alternative 2 shows a cost increase compared to the Proposed Regulations, with an implementation cost of $21.2 billion to achieve the goals outlined in the statute. Conversely, the Proposed Regulations entails an estimated cost of $21.0 billion to achieve the same objectives. In terms of the quantity of plastic covered material recycled, the amount of GHG reduction, and the amount of material diverted from the landfill, Alternative 2 and the Proposed Regulations achieve the same results. Alternative 2 requires producers to provide updates to the PRO more frequently, increasing their administrative cost and the overall cost per ton basis for the cost-effectiveness metrics previously mentioned in the Alternative 1 section. A summary of these results, along with their respective cost-effectiveness, is provided in Table 37.

Table 37: Summary of Cost-Effectiveness for Alternative 2

Scenario	Recycled Plastic (Cost/Ton)	GHG Reduction (Cost/Ton)	Material Diverted from Landfill (Cost/Ton)
Alternative 2	$14,182	$9,694	$14,431
Proposed Regulations	$14,036	$9,594	$14,283
Difference	$146	$100	$148

Alternative 2 and the Proposed Regulations achieve the same results but differ in cost because of increased requirements for producers. The costs per ton for recycling plastic, reducing GHG emissions, and diverting material are slightly higher compared to the Proposed Regulations.

Reason for Rejecting

Alternative 2 was rejected because it is more costly than the Proposed Regulations and does not provide any additional benefits that would contribute to the issues that the Act was intended to address. Alternative 2 does not result in decreased emissions or plastic pollution reductions over the Proposed Regulations, as the amount of material subject to the source reduction and recycling rate requirements is the same. Alternative 2 does not provide more money to disadvantaged and low-income communities that are disproportionately affected by the environmental and human health hazards of plastic manufacturing and littering. The amount of money dedicated to serving disadvantaged and low-income communities is set by statute.[77] While the additional producer reporting may give the PRO and CalRecycle more detail on the progress producers are making

toward the required goals, this small benefit does not justify the increased cost over the Proposed Regulations.

Abbreviations and Acronyms

The Act – Senate Bill 54 (Allen, Chapter 75, Statutes of 2022): Plastic Pollution Prevention and Packaging Producer Responsibility Act
AGPA – Associate Governmental Program Analyst
ASD – Administrative Services Division
BCP – Budget Change Proposal
CalEPA – California Environmental Protection Agency
CalRecycle – California Department of Resources, Recycling, and Recovery
CCR – California Code of Regulations
CFC – Chlorofluorocarbon
CTU – Comparative Toxicity Unit
DIM – Direct Impacts Model
DOF – California Department of Finance
EPR – Extended Producer Responsibility
FY – Fiscal Year
GHG – Greenhouse Gas
GSP – Gross State Product
IT – Information Technology
LCA – Lifecycle Analysis
MRF – Materials Recovery Facility
NOx – Nitrous oxides
Oregon DEQ – Oregon Department of Environmental Quality
PFAS – Per- and Polyfluoroalkyl Substances
PFOA – Perfluorooctanoic Acid
PRC – Public Resources Code
PRO – Producer Responsibility Organization
RDRS – CalRecycle's Recycling and Disposal Reporting System
REMI – The Regional Economic Models, Inc. Policy Insight Plus Version 2.5.0 model
SB 1383 – Senate Bill 1383 (Lara, Chapter 355, Statutes of 2015): Short-Lived Climate Pollutants (SLCP) Organic Waste Methane Emissions Reductions
SCC – Social Cost of Carbon
SRB – Source Reduction Baseline Study
SRIA – Standard Regulatory Impact Assessment
SRMG – Sound Resource Management Group
TPY – Tons Per Year
TRACI – Tool for Reduction and Assessment of Chemicals and Other Environmental Impacts
US EPA – United States Environmental Protection Agency
VOC – Volatile Organic Compound
WCS – Waste Characterization Study
WIC – Waste Impact Calculator
WPCMD – Waste Permitting, Compliance and Mitigation Division

Glossary of Terms

Baseline – CalRecycle used the 2021 Waste Characterization Study, 2021 Recycling and Disposal Reporting System data in CalRecycle's material reporting database, and CalRecycle's Source Reduction Baseline Report published in 2024 to estimate a baseline for the covered material generated.

Covered Material – Covered material means both single-use packaging that is usually discarded after its contents have been unpackaged, and plastic single-use food service ware, such as trays, plates, bowls, clamshells, lids, cups, utensils, straws, wrappers, and bags. The definition of covered material is in PRC 42041(e)(1).

t CO_2 eq – Carbon dioxide equivalent or t CO_2 eq means the number of metric tons of CO_2 emissions with the same global warming potential as one metric ton of another greenhouse gas.

Direct Impacts Model – CalRecycle created the Direct Impacts Model to calculate the estimated direct cost of the Act and the Proposed Regulations. The DIM contains over 100 individual sheets with data inputs and separate sub-models for each impact category.

Economic Output – Economic output refers to the total value of goods and services produced within an industry. In this document, CalRecycle has reported economic output estimates for California as a whole and primary and secondary industries that are expected to experience the most impact from the Act and the Proposed Regulations.

Local Jurisdiction – A city, county, city and county, regional agency, or special district that provides solid waste collection services, as defined in PRC 42041(l).

Standard Regulatory Impact Assessment - State agencies are required to conduct a SRIA when it estimates that a proposed regulation has an economic impact exceeding $50 million. The primary purpose of a SRIA is to inform the public, policymakers, and interested parties of economic and fiscal impacts of a new regulation and the tradeoffs the agency promulgating the major regulation is making.

Appendix A
Public Outreach Appendix

Interested Parties Who Attended and Participated in Informal Rulemaking Workshops

Appendix Table 1: List of Public Workshop Attendees

Workshop Attendees
Ag Container Recycling Council
AMERIPEN
Apple Inc.
Association of Plastic Recyclers
Atrium916
BASF
Beyond Plastic, LLC
Big Valley Rancheria Band of Pomo Indians
Biodegradable Products Institute
Blue Harmony Foundation
CA Manufacturers Association
CA Retailers Association
California Compost Coalition
California Product Stewardship Council
Californians Against Waste
CalState Supply
Carma Laboratories
CG Roxane, LLC
Circular Action Alliance
CircularSolar.net
Cisco
City of Oceanside
City of Palo Alto

Workshop Attendees
CJ Biomaterials, Inc.
Closed Loop Partners
Conscious Container
County of San Mateo
Cyclei
Dairy Institute of California
Danimer Scientific
Del Norte Solid Waste Management Authority
Direct Pack, Inc.
Ecology Center
Edgar and Associates
Fastenal
Fearless Advocacy, Inc.
Flowstop
Forma Brands
Freepoint Ecosystems
Global Alliance for Incinerator Alternatives
Green Impact Plastics
Greenberg Traurig
Health Net
HF & H Consultants
House Foods America Corporation
Hurner Government Relations and Advocacy
Ingevity
International Paper
Kamilo
Kahn, Sores & Conway, LLP
KLR Systems Inc.
Knowledge Bank
Lasso Loop
League of California Cities

Workshop Attendees
Madden Quinonez Advocacy
McHugh, Koepke & Associates
Meta Reality Labs
Mojave Desert and Mountain Recycling Authority
National Stewardship Action Council
NatureKool
Newlight Technologies
Niagara Bottling
Novolex
Ocean Conservancy
Once Upon a Farm
One World Resource
Pactiv
PakTech
Physicians for Social Responsibility
Proctor & Gamble
RCD Packaging Innovation
Recycling Partnership
Republic Services
Resource Recovery Coalition
Richard Anthony Associates
RPM Eco
Rural County Representatives of CA
Santa Clara County
Sinclair
Smart Planet
Surfrider South Bay
Sustain You
Tetra Pak
The Allen Company
The Nature Conservancy

Workshop Attendees
The Recycling Partnership
Upstream
Van Rossem Consulting
VandeLay Industries
Waste Connections
Waste Management
White Brenner, LLP
World Centric

Stakeholder Groups Who CalRecycle Engaged with Outside of Public Workshops

Stakeholder Group Meetings:

- State Government Agencies
  - California Coastal Commission
  - California Business Investment Services
  - California Department of Transportation
  - California Environmental Protection Agency
  - California Natural Resources Agency
  - California Office of Legislative and Governmental Affairs
  - California State Lands Commission
  - Department of Fish and Wildlife
  - Department of Food and Agriculture
  - Department of Justice
  - Department of Parks and Recreation
  - Department of Public Health
  - Department of Toxic Substance Control
  - Ocean Protection Council
  - Office of Environmental Health Hazard Assessment
  - State Water Resources Control Board
- Other Government Agencies
  - Alameda County StopWaste
  - Colorado Department of Public Health and Environment
  - Maine Department of Environmental Quality
  - Oregon Department of Environmental Quality
  - Washington State Department of Ecology
- Industry Associations & Nonprofit Organizations
  - Advanced Medical Technology Association
  - American Beverage Association

    - Animal Health Institute
    - Break Free From Plastic
    - Californians Against Waste
    - California Council for Environmental Economic Balance
    - California Manufacturers & Technology Association
    - California Retailers Association
    - Circular Action Alliance
    - Coalition for Protein Packaging
    - Consumer Brands Association
    - Consumer Healthcare Products Association
    - Foodservice Packaging Institute
    - Natural Resources Defense Council
    - Pacific Counsel
    - Product Stewardship Institute
    - Plastics Industry Association
    - The Recycling Partnership
- Companies
    - Allan Company
    - AMERIPEN
    - Atlantic Packaging Corp.
    - CJ Biomaterials
    - Closed Loop Partners
    - Dow Chemical Company
    - Freepoint Eco-Systems
    - Haleon
    - HP
    - Kenvue
    - L'Oreal
    - Litterati
    - Party City
    - Reckitt
    - Republic Services
    - Starbucks
    - Upstream Solutions
    - Tellus Civic Science
    - Waste Management

CalRecycle Educational Presentations

- Cal Cities' Environmental Quality Committee, virtual presentation. 03/16/23
- Agricultural Council of California, 104th Annual Meeting in Monterey. 03/30/23
- Procter & Gamble Personal Health Care Leadership Annual Team Meeting in Del Mar. 05/04/23

- UN Intergovernmental Negotiating Committee on Plastic Pollution, webinar. 05/10/23
- California Ocean Litter Strategy Project, public webinar. 06/13/23
- American Chemistry Council meeting in Sacramento. 07/12/23
- Product Stewardship Institute Inc., 12th U.S. Extended Producer Responsibility Forum, Portland, Ore. 09/12/23
- Southern California Solid Waste Association of North America Conference. 09/21/23
- February 14, 2024: Smithers Sustainability in Packaging Event
- April 19, 2024: INC 4 Plastic Treaty Negotiations Talking Points
- August 20, 2024: CRRA Keynote on the Zero Waste Plan
- September 12, 2024: SWANA Southern California Workshop Keynote
- September 24, 2024: CA Conference of Environmental Health
- October 17, 2024: League of California Cities Annual Conference and Expo "The Path Towards Plastic Pollution Prevention"
- November 7, 2024: SB 54 Presentation at the Air and Waste Management Association West Coast Section conference.
- November 13, 2024: Southern California Waste Management Forum Keynote
- November 20, 2024: Bioresource Alliance Symposium
- February 4, 2024: Panel Discussion on Navigating California's Packaging EPR Law: A 360 Degree Perspective
- March 4, 2024: Zone Works Presentation
- March 18, 2024: Panel on SB 54 at Agricultural Council's 106th annual meeting
- April 1, 2025: Resource Recovery Coalition of CA Annual Convention
- April 10, 2025: SWANA Wrapup Keynote on Zero Waste Plan at Western Regional Symposium
- May 21, 2025: Webinar Keynote with One Step Closer
- June 4, 2025: Chicago Product Stewardship Institute Keynote
- June 12, 2025: Chemical Industry Council of California Annual Meeting
- June 18, 2025: Keynote to Stockton Chamber and Green Team Symposium

Information about SB 54 was also shared in sessions at the following:

- California Resource Recovery Association (09/07/22),
- Public-Private Partnership on Recycling for the National Conference of State Legislatures (12/05/22),
- Zone Works (Recycling Market Development Zone Program) (12/07/22),
- U.S. Composting Council's Annual Conference (01/25/23),
- Techonomy Climate 2023 (03/28/23),
- SWANA's Western Regional Symposium 2023 (04/06/23),

- The Climate Center's annual California Climate Policy Summit (04/11/23), and
- Verde Xchange Conference (05/02/23).

Media Coverage

CalRecycle's Office of Public Affairs has pushed out media advisories to both industry associations and news media from across California to further draw attention to the SB 54 public workshops held in the spring and summer of 2023. All advisories are also posted to CalRecycle's website. The resulting media pickup included stories by:
KCRA 3 News, Sacramento: Aired on the evening news and published to KCRA's website:
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- KCRA 3 News, Sacramento: Aired on the evening news and published on KCRA's website.
    - CA business leaders hold workshop for ways to cut plastic pollution
    - KCRA News tweet with link to "CA business leaders..." article (267,000 followers)
- KCBS All-News Radio, San Francisco (106.9FM and 740AM): Aired during commute hours. KCBS has about 216,000 weekly listeners.
- Sustainable Packaging News: Story posted to its website and on social media:
    - CalRecycle seeks input on packaging, plastic pollution rules
    - Sustainable Packaging News LinkedIn post about "CalRecycle seeks input on packaging..." article
    - Sustainable Packaging News tweet about "CalRecycle seeks input on packaging..." article

Other media coverage has included stories by both traditional media and various trade publications, such as:

- Bloomberg Law, published to website and social media:
    - Landmark California Plastic Law's Anniversary Brings Progress
    - Christine Zhu tweet about "Landmark California Plastic Law's Anniversary..." article
- Sacramento News & Review alternative weekly newspaper, in print and social media.
    - Rachel Machi Wagoner of CalRecycle discusses the benefits of a circular economy in California
    - Sacramento News & Review tweet about Part 2 of conversation with Rachel Machi Wagoner
    - Interview with Director Heller, who talked about the basics of SB 54, the timeline, and what to expect.
- Resource Recycling
    - Deadline for California de facto EPS ban nears

    - SB 54 draft rules spark debate over rates, review
- Politico Pro
    - POLITICO Pro | Article | CalRecycle issues second round of draft plastic recycling rules
- Politico, published to website and social media
    - Sacramento's sausage-making comes for plastics
- Packaging Digest
    - Why I'm Against a Packaging Tax
- Recycling Today
    - CalRecycle releases SB 54 updates as new year begins - Recycling Today
- LA Times
    - CalRecycle introduces revised landmark waste law regulations - Los Angeles Times
- Packaging Dive
    - Newsom sends California back to the drawing board on EPR implementation | Packaging Dive
    - California confirms EPS food service ware ban | Packaging Dive
    - CalRecycle unveils new SB 54 text; Wagoner out as CAA's California lead | Packaging Dive
- Waste Dive
    - Navigating next steps on EPR in California and beyond | Waste Dive
    - California packaging EPR implementation moves ahead amid regulatory redo | Waste Dive
- Capitol Public Radio
    - CalRecycle begins enforcement on plastic foam foodware ban - capradio.org
-

Social Media

CalRecycle's Office of Public Affairs has amplified earned media and other news coverage, and promoted SB 54 job openings, on its multiple social media channels. Some of the posts and videos resulting from this coverage were also shared by CalRecycle at its public meetings. Some examples include:

- CalRecycle tweet of a clip from Rachel Machi Wagoner conversation at Techonomy Climate
- CalRecycle tweet of Sacramento News and Review interview with Rachel Machi Wagoner
- CalRecycle tweet soliciting feedback on regulatory concepts with video of Rachel Machi Wagoner interview with KCRA News

Appendix B
Macroeconomic Appendix

Appendix Table 2: Macroeconomic Modeling Inputs

REMI Policy Variable	REMI Industry/ Spending Category	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Production Cost	Food Manufacturing	N/A	N/A	2,067	4,104	6,109	8,084	10,000	11,889	14,684	17,428	N/A	N/A	N/A
Production Cost	Converted Paper Product Manufacturing	N/A	N/A	142	281	418	554	685	814	1,006	1,194	N/A	N/A	N/A
Production Cost	Plastics Product Manufacturing	N/A	N/A	159	315	469	621	768	914	1,128	1,339	N/A	N/A	N/A
Production Cost	Glass and Glass Product Manufacturing	N/A	N/A	77	153	228	301	373	443	547	650	N/A	N/A	N/A
Production Cost	Other Fabricated Metal Product Manufacturing	N/A	N/A	1,054	2,092	3,114	4,121	5,098	6,061	7,485	8,884	N/A	N/A	N/A
Production Cost	Wholesale Trade	N/A	N/A	15,204	30,180	44,929	59,449	73,540	87,432	107,986	128,167	N/A	N/A	N/A
Production Cost	Retail Trade	N/A	N/A	39,771	78,946	117,525	155,508	192,368	228,705	282,472	335,261	N/A	N/A	N/A
Production Cost	Food Service Establishments	N/A	N/A	14,395	28,574	42,538	56,285	69,627	82,779	102,240	121,346	N/A	N/A	N/A
Exogenous Final Demand	Plastics Product Manufacturing	N/A	N/A	(62,285)‡‡‡‡	(123,637)	(184,055)	(243,540)	(301,266)	(358,175)	(442,379)	(525,050)	N/A	N/A	N/A

‡‡‡‡ Parentheses represent a negative value

REMI Policy Variable	REMI Industry/ Spending Category	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Exogenous Final Demand	Plastics Product Manufacturing	N/A	N/A	137,358	272,657	405,899	537,082	664,386	789,886	975,583	1,157,899	N/A	N/A	N/A
Exogenous Final Demand	Converted Paper Product Manufacturing	N/A	N/A	197,776	392,588	584,437	773,322	956,622	1,137,325	1,404,703	1,667,212	N/A	N/A	N/A
Exogenous Final Demand	Other Fabricated Metal Product Manufacturing	N/A	N/A	98,256	195,039	290,350	384,189	475,253	565,027	697,861	828,277	N/A	N/A	N/A
Exogenous Final Demand	Glass and Glass Product Manufacturing	N/A	N/A	92,776	184,161	274,156	362,761	448,746	533,513	658,938	782,079	N/A	N/A	N/A
Output	Management of Companies and Enterprises	N/A	N/A	8,148	16,174	24,078	31,860	39,411	46,856	57,872	68,687	41,869	41,869	41,869
Output	Waste Management and Remediation Services	N/A	N/A	4,303	8,541	12,715	16,825	20,813	24,744	30,561	36,272	22,111	22,111	22,111
Output	Waste Management and Remediation Services	N/A	N/A	(5,594)	(11,103)	(16,529)	(21,871)	(27,055)	(32,166)	(39,728)	(47,152)	(28,743)	(28,743)	(28,743)
Output	Construction	N/A	N/A	26,384	52,373	77,966	103,164	127,617	151,724	187,393	222,413	N/A	N/A	N/A
State & Local Government Spending	Include Amenity: State Government	N/A	N/A	N/A	N/A	N/A	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000
State & Local Government Spending	State Government	N/A	N/A	(57)	(114)	(169)	(224)	(277)	(329)	(407)	(483)	(294)	(294)	(294)
State & Local Government Employment	State Government	34	23	N/A	N/A	1	4	N/A	N/A	N/A	N/A	N/A	N/A	N/A

REMI Policy Variable	REMI Industry/ Spending Category	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Non-Pecuniary (Amenity) Aspects	Total	N/A	N/A	1,482,851	2,943,483	4,381,895	5,798,088	7,172,403	8,527,250	10,531,949	12,500,147	N/A	N/A	N/A

Bibliography

Austin, David, “Pricing Freight Transport to Account for External Costs,” Congressional Budget Office, March 2015.

Bose, Satyajit, “Economic impacts to consumers from extended producer responsibility (EPR) regulation in the consumer packaged goods sector,” The Earth Institute, June 2022.

Burman, Aaron, "Plastic IQ Methodology Document," 2021.

California Air Resources Board, "Final Short-Lived Climate Pollutant Reduction Strategy," March 2017, <https://ww2.arb.ca.gov/resources/documents/slcp-strategy-final>.

CalRecycle, “2021 Disposal Facility-Based Waste Characterization Study,“ November 2022.

———, “25% of what Californians trash is packaging. California is leading the way…,” LinkedIn, September 18, 2023, <https://www.linkedin.com/posts/calrecycle_25-of-what-californians-trash-is-packaging-activity-7103428888709513216-2cUv>.

———, Budget Change Proposal DF-46, 2022.

———, “Extended Producer Responsibility,” 2023, <https://calrecycle.ca.gov/epr/>

———, Recycling and Disposal Reporting System (RDRS) Database, 2021.

———, “Source Reduction Baseline Technical Report,” December 2024.

———, SRIA Direct Impacts Model, 2025.

ChemSec, “The top 12 PFAS producers in the world and the staggering societal costs of PFAS pollution,” May 25, 2023, <https://chemsec.org/reports/the-top-12-pfas-producers-in-the-world-and-the-staggering-societal-costs-of-pfas-pollution/>.

City of San Diego, Sukut Construction, LLC. “Proposal Documents for Organics Processing Facility,” April 2022, <https://www.sandiego.gov/sites/default/files/k-22-2049-db1-3-c.pdf>.

Coelho, Patricia Megale, Corona, Blanca, ten Klooster, Roland, and Worrell, Ernst, "Sustainability of reusable packaging - Current situation and trends," *Resources, Conservation & Recycling*, 2020.

Donaghy, Timothy Q., Healy, Noel, Jiang, Charles Y., and Battle, Colette Pichon, "Fossil fuel racism in the United States: How phasing out coal, oil, and gas can protect communities." *Energy Research & Social Science*, 2023.

Ellen MacArthur Foundation, SystemIQ, Eunomia, “Unlocking a reuse revolution: scaling returnable packaging,” 2023.

HDR Consultants, Metro Waste Authority, "Materials Recovery Facility (MRF) Feasibility Study," 2018.

Mahmoudi, Monireh and Parviziomran, Irandokht, “Reusable packaging in supply chains: A review of environmental and economic impacts, logistics system designs, and operations management,” *International Journal of Production Economics*, 2020.

Monroe, Leila, “Waste in Our Waterways: Unveiling the Hidden Costs to Californians of Litter Clean-Up,” 2013, <https://www.nrdc.org/resources/waste-our-waterways-unveiling-hidden-costs-californians-litter-clean>.

Morris, Jeffrey, “Economic Damage Costs for Nine Human Health and Environmental Impacts,” Sound Resource Management Group, Inc., 2020.
Oregon Department of Environmental Quality, “Waste Impact Calculator,” 2023, <https://www.oregon.gov/deq/mm/pages/waste-impact-calculator.aspx/>.
———, “wic-base,” 2023, <https://github.com/OR-Dept-Environmental-Quality/wic-base/tree/main/impactFactors/source/current>.
Oregon Department of Environmental Quality, Cascadia Consulting Group, Bell & Associates, Circular Matters, “Overview of Scenario Modeling: Oregon Plastic Pollution and Recycling Modernization Act,” 2023.
Powell, Jerry, “Sortation by the Numbers,” October 3, 2018, <https://resource-recycling.com/recycling/2018/10/01/sortation-by-the-numbers/>.
Recycling Markets Ltd, “Secondary Materials Pricing (SMP),” September 15, 2023, <https://www.recyclingmarkets.net/secondarymaterials/>.
Schirber, Michael, “The Chemistry of Life: The Plastic in Cars,” Live Science, May 2009, <https://www.livescience.com/5449-chemistry-life-plastic-cars.html>.
Siddiqua, Ayesha, N., Hahladakis, John, and Al-Attiya, K A Wadha, "An overview of the environmental pollution and health effects associated with waste landfilling and open dumping," *Environmental Science and Pollution Research*, 2022, pp. 58514-58536.
Singapore Packaging Agreement, “Packaging Benchmarking Database,” January 2020.
State of California Department of Finance, SB 617 Rulemaking Documents, <https://dof.ca.gov/forecasting/economics/major-regulations/sb-617-rulemaking-documents/>.
United States Environmental Protection Agency, “Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI),” 2024, <https://www.epa.gov/chemical-research/tool-reduction-and-assessment-chemicals-and-other-environmental-impacts-traci>.
———, “Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances,” Washington, D.C., 2022.

Source Reference Notes

[1] *CalRecycle, "2021 Disposal Facility-Based Waste Characterization Study," November 2022.*

[2] *CalRecycle, SB 54 SRIA Direct Impacts Model, 2025.*

[3] *California Code of Regulations (CCR) section 2000.*

[4] *Public Resources Code (PRC) section 42064.*

[5] *SB 1383, Lara, Chapter 395, Statutes of 2016.*

[6] *CalRecycle, "2021 Disposal Facility-Based Waste Characterization Study," November 2022.*

[7] *CalRecycle, Recycling and Disposal Reporting System (RDRS) database, 2021.*

[8] *CalRecycle, "Source Reduction Baseline Technical Report," December 2024.*

[9] *PRC section 42057(b).*

[10] *CalRecycle, "Source Reduction Baseline Technical Report," December 2024.*

[11] *CalRecycle, "25% of what Californians trash is packaging. California is leading the way…," LinkedIn, September 18, 2023, <https://www.linkedin.com/posts/calrecycle_25-of-what-californians-trash-is-packaging-activity-7103428888709513216-2cUv>.*

[12] *Oregon Department of Environmental Quality, "Waste Impact Calculator," 2023, <https://www.oregon.gov/deq/mm/pages/waste-impact-calculator.aspx/>.*

[13] *United States Environmental Protection Agency, "Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI)," 2024, <https://www.epa.gov/chemical-research/tool-reduction-and-assessment-chemicals-and-other-environmental-impacts-traci>.*

[14] *ChemSec, "The top 12 PFAS producers in the world and the staggering societal costs of PFAS pollution," May 25, 2023, https://chemsec.org/reports/the-top-12-pfas-producers-in-the-world-and-the-staggering-societal-costs-of-pfas-pollution/>.*

[15] *Leila Monroe, "Waste in Our Waterways: Unveiling the Hidden Costs to Californians of Litter Clean-Up," 2013, <https://www.nrdc.org/resources/waste-our-waterways-unveiling-hidden-costs-californians-litter-clean>.*

[16] *CalRecycle, SB 54 SRIA Direct Impacts Model, 2025.*

[17] *United States Environmental Protection Agency, "Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances," Washington, D.C., 2022.*

[18] *Oregon Department of Environmental Quality, "Waste Impact Calculator," 2023, <https://www.oregon.gov/deq/mm/pages/waste-impact-calculator.aspx/>.*

[19] *Oregon Department of Environmental Quality, "wic-base," 2023, <https://github.com/OR-Dept-Environmental-Quality/wic-base/tree/main/impactFactors/source/current>.*

[20] *Jeffrey Morris, "Economic Damage Costs for Nine Human Health and Environmental Impacts," Sound Resource Management Group, Inc., 2020.*

[21] *Ibid. pp. 14.*
[22] *Ibid.*
[23] *Ibid. pp.6.*
[24] *Ibid.*
[25] *Ibid.*
[26] *Ibid. pp. 14.*
[27] *Ibid. pp. 6.*
[28] *Ibid.*
[29] *Ayesha Siddiqua, John N. Hahladakis, and K A Wadha Al-Attiya, "An overview of the environmental pollution and health effects associated with waste landfilling and open dumping," Environmental Science and Pollution Research, 2022, pp. 58514-58536.*
[30] *Ibid.*
[31] *CalRecycle, SB54 SRIA Direct Impacts Model, 2025, CM Summary worksheet, Cell C14.*
[32] *Aaron Burman, "Plastic IQ Methodology Document," 2021.*
[33] *Michael Shirber, "The Chemistry of Life: The Plastic in Cars," Live Science, May 26, 2009, <https://www.livescience.com/5449-chemistry-life-plastic-cars.html>.*
[34] *CalRecycle, "Extended Producer Responsibility," 2023, <https://calrecycle.ca.gov/epr/>.*
[35] *PRC section 42060(a)(5)(A).*
[36] *PRC section 42064.*
[37] *CalRecycle, Budget Change Proposal DF-46, 2022.*
[38] *CalRecycle, SB54 SRIA Direct Impacts Model, 2025, Circular Economy Fund worksheet, Cell O8.*
[39] *PRC section 42067.*
[40] *PRC section 42050.*
[41] *PRC section 42057(b).*
[42] *Singapore Packaging Agreement, "Packaging Benchmarking Database," January 2020, < https://www.packaging-partnership.org.sg/resources/packaging-benchmarking-database>.*
[43] *PRC section 42057(a)(2)(A).*
[44] *PRC section 42067(e)(3)(C).*
[45] *Ellen MacArthur Foundation, SystemIQ, Eunomia, "Unlocking a reuse revolution: scaling returnable packaging" 2023.*
[46] *Monireh Mahmoudi and Irandokht Parviziomran, "Reusable packaging in supply chains: A review of environmental and economic impacts, logistics system designs, and operations management," International Journal of Production Economics, 2020.*
[47] *Aaron Burman, "Plastic IQ Methodology Document," 2021.*
[48] *CalRecycle, SB54 SRIA Direct Impacts Model, 2025, Source Reduction Summary worksheet, Cell R19.*

[49] *Singapore Packaging Agreement, "Packaging Benchmarking Database," January 2020, < https://www.packaging-partnership.org.sg/resources/packaging-benchmarking-database>.*

[50] *Ibid.*

[51] *Aaron Burman, "Plastic IQ Methodology Document," 2021.*

[52] *CalRecycle, SB54 SRIA Direct Impacts Model, 2025, CM Summary worksheet, Cells C14 through G14.*

[53] *Aaron Burman, "Plastic IQ Methodology Document," 2021.*

[54] *Oregon Department of Environmental Quality, Cascadia Consulting Group, Bell & Associates, Circular Matters, "Overview of Scenario Modeling: Oregon Plastic Pollution and Recycling Modernization Act," 2023.*

[55] *Ibid.*

[56] *HDR Consultants, Metro Waste Authority, "Materials Recovery Facility (MRF) Feasibility Study," 2018.*

[57] *Ibid.*

[58] *Jerry Powell, "Sortation by the Numbers," Resource Recycling, October 2018, <https://resource-recycling.com/recycling/2018/10/01/sortation-by-the-numbers/>.*

[59] *City of San Diego, Sukut Construction, LLC, "Proposal Documents for Organics Processing Facility," April 2022, <https://www.sandiego.gov/sites/default/files/k-22-2049-db1-3-c.pdf>.*

[60] *California Air Resources Board, "Final Short-Lived Climate Pollutant Reduction Strategy," March 2017, <https://ww2.arb.ca.gov/resources/documents/slcp-strategy-final>.*

[61] *Recycling Markets Ltd, "Secondary Materials Pricing (SMP)," September 15, 2023, < https://www.recyclingmarkets.net/secondarymaterials/>.*

[62] *Aaron Burman, "Plastic IQ Methodology Document," 2021.*

[63] *Ibid.*

[64] *Austin, David, "Pricing Freight Transport to Account for External Costs," Congressional Budget Office, March 2015.*

[65] *Satyajit Bose, "Economic impacts to consumers from extended producer responsibility (EPR) regulation in the consumer packaged goods sector," The Earth Institute, June 2022.*

[66] *Ibid., pp. 10.*

[67] *PRC section 42060.5.*

[68] *PRC section 42051.1(j)(1)(B).*

[69] *Timothy Q. Donaghy, et al. "Fossil fuel racism in the United States: How phasing out coal, oil, and gas can protect communities." Energy Research & Social Science, 2023.*

[70] *Ibid.*

[71] *PRC section 42064(j).*

[72] *PRC section 42064(k).*

[73] *PRC section 42070.*

[74] *PRC section 42051.1(j)(1)(G).*

[75] *State of California Department of Finance, "SB 617 Rulemaking Documents," <https://dof.ca.gov/forecasting/economics/major-regulations/sb-617-rulemaking-documents/>.*

[76] *CalRecycle, SB54 SRIA Direct Impacts Model, 2025, Combined Overview worksheet.*

[77] *PRC section 42064(e)(1).*