![CalRecycle logo]

Current State Report:

An Evaluation of Reuse and Refill Systems and Covered Materials that Utilize Other Source Reduction Strategies

A Plastic Pollution Prevention
and Packaging Producer
Responsibility Act
Needs Assessment
Technical Report

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eunomia

PERPETUAL

InterEthnica

touch

State of California

Gavin Newsom
Governor
California Environmental Protection Agency

Yana Garcia
Secretary

Department of Resources Recycling and Recovery (CalRecycle)

Zoe Heller
Director

Office of Public Affairs
1001 I Street (MS 22-B)
P.O. Box 4025
Sacramento, CA95812-4025
www.calrecycle.ca.gov/Publications/
1-800-RECYCLE (California only) or (916) 341-6300

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Executive Summary

[The Plastic Pollution Prevention and Packaging Producer Responsibility Act](#) (Senate Bill (SB) 54, Allen, Chapter 75, Statutes of 2022) (the Act) established an extended producer responsibility (EPR) program to manage single-use packaging and single-use plastic food service ware (covered material) in California. The Act requires the Department of Resources Recycling and Recovery (CalRecycle) to conduct a statewide needs assessment to aid its implementation. CalRecycle awarded a contract to investigate the actions and investments needed to meet the Act's requirements, specifically to achieve a 25% source reduce single-use plastic packaging and single-use plastic food service ware (plastic covered material) by 2032.

In this report, source reduction means reducing both the total weight of plastic and the number of plastic components for plastic covered materials. The goal is to reduce plastic use through design choices, such as removing unnecessary elements, making packaging lighter, and simplifying components, so less plastic is needed overall. For purposes of the Act, source reduction includes using reusable or refillable items as alternatives to plastic covered materials.

This report evaluates current source reduction strategies in California and identifies opportunities and barriers, focusing on access, participation, costs, and community impacts across the state's diverse regions. The contractor conducted regional assessments by engaging with the public, subject matter experts, and community-based organizations to reflect California's varied socioeconomic contexts and diverse community needs.

Insights from Research and Data Analysis

Data on existing reuse, refill, and other source-reduction strategies were gathered through expert interviews, analysis of reusable food service ware usage in dine-in restaurants, and assessment of retailer options. Contractors evaluated the in-store presence, price, brand selection, and geographic access to reuse, refill, and source-reduced products across retailers. The contractor interviewed 42 experts and conducted community engagement across the state.

Findings indicate that goods in reuse and refill packaging, including certain food service ware solutions, make up only a small fraction of what is available on the market today. Access to in-store reuse and refill options is limited. For example, about 35% of California's urban population lives within 1 mile of a store offering at least one in store dispensing option for goods in reusable containers (e.g., single station to refill coffee beans in a store), but only about 4% live within 1 mile of an all-refill store (i.e., store primarily dedicated to refill), and about 26% live near a store with partial refill options (i.e., stores that offer some refill alongside conventional packaged goods). Access is even more limited in disadvantaged communities. Community members expressed demand for more source-reduced options and highlighted viable reuse, refill, and other source-reduction strategies already operating in the state.

Currently, reusable food service ware is primarily used in dine-in restaurants, while to-go reuse and bring-your-own (BYO) food service ware acceptance remain relatively rare. Business-focused reuse solutions are limited, though many companies use refill via concentrates or large format packaging for cleaning supplies and rely on reusable tertiary packaging. Other source-reduction strategies many businesses practice, such as lightweighting, elimination, or substitution, are common but constrained by cost, technical limits, and safety requirements. Large formats and concentrates are generally more practical and cost-effective.

Scaling reuse and refill requires new systems, while other source-reduction strategies build on existing ones. Three main barriers to reuse and refill are: (1) consumer habits and convenience norms, (2) operational and cost complexity, and (3) the potential for negative perceptions and brand impacts. Opportunities to expand reuse and refill include: (1) starting with closed loop and business-to-business (B2B) reuse, (2) standardizing packaging and food service ware, (3) building capacity through hubs and contract manufacturers and fillers, and (4) enabling public collection through shared infrastructure.

Prefill reuse systems, where producers sell goods in standardized reusable packaging that is then returned, show strong potential for scalability. Reusable food service ware and B2B reuse also appear promising but remain early stage.

Other source-reduction strategies are widespread but face barriers such as: (1) technical limits for lightweighting and material substitution, (2) equipment and processes constraints, (3) consumer acceptance challenges, and (4) gaps in cost and market incentives. Key opportunities include: (1) advancing research and design (R&D) for reformulation and alternative materials, (2) implementing right sizing and lightweighting, and (3) establishing market incentives and cost-sharing mechanisms.

How to Read this Report

The report provides both an overview and detailed insights into reuse, refill, and other source-reduction strategies as alternatives to plastic covered material. The opening section explains data collection methods, followed by findings on consumer and business access to reuse and refill systems. The next section explores barriers and opportunities, highlighting how strategies work today and what is needed to scale them. Appendices provide methods, definitions, and supporting data. Readers may want to review the glossary and abbreviations first.

The framework used throughout distinguishes between reuse – where a producer or a third party provides and retrieves the container, and refill – where a consumer provides their own container. These definitions align with regulations (such as the Packaging and Packaging Waste Regulation in the European Union) and by organizations with relevant expertise (such as the New European Reuse Alliance). Some organizations use different terms to describe these same ideas. For example, the Ellen MacArthur Foundation uses 'return' for packaging that is returned for reuse. It uses 'reuse' as an umbrella term for both return and refill solutions.

Within refill, the report identifies "all-refill" stores (primarily dedicated to refill); "partial refill" stores (offer some refill alongside conventional goods); and "standalone refill" stores (feature a single refill machine or dispenser). The analysis also separates business-to-consumer (B2C) and B2B systems, recognizing that opportunities and barriers differ for consumer-facing versus integrated supply-chain solutions. Reusable food service ware programs are treated as B2C because they serve consumers, even though the contracts governing these arrangements are typically between businesses.

Alongside reuse and refill, the report introduces a taxonomy of other source-reduction strategies to compare incremental and systemic approaches. These strategies include lightweighting, large format packaging, concentration, elimination, material substitution, and reformulation. See Appendix A, Table 27.

By organizing the report around a shared taxonomy of solutions, clear distinctions between B2C and B2B contexts, and attention to both individual and systemic strategies, the goal is to help readers navigate a complex and evolving landscape. Understanding these categories and the reasoning behind them makes it easier to interpret the findings and see how different approaches can work together to reduce plastic covered material.

The contractor placed special emphasis on prefill reuse systems. These systems use reusable containers that producers or service providers collect, wash, and recirculate. Unlike refill, prefill shifts responsibility away from consumers and builds on familiar purchasing habits. The contractor analyzed prefill systems differently in this report because they combine aspects of both packaging design reverse logistics and have operational requirements distinct from other models.

Postconsumer Recycled Content

Postconsumer recycled content (PCR) is an alternative compliance strategy, that does not constitute a source-reduction strategy. Therefore, it was excluded from Appendix A, Table 27. However, PCR is included throughout the report as a pathway for 8% of the plastic covered material to be considered source reduced. This can be accomplished through an alternative compliance formula developed by the Producer Responsibility Organization (PRO) that offers source reduction credit for PCR plastic (Public Resources Code (PRC) section 42057(a)(2)(B)(i)).

1.0 Introduction

This report presents findings from the collection and analysis of data on consumers' and businesses' current access to reuse and refill systems that offer alternatives to plastic covered material. It also covers the current landscape of other source reduction strategies to reduce the weight of plastic covered material and the number of plastic components of plastic covered material sold, offered for sale, or distributed in California. Considering the findings of this needs assessment, the Act requires the PRO to identify the investments needed to meet source reduction requirements; develop reuse and refill infrastructure; ensure convenient consumer access to that infrastructure; and promote the growth and use of reusable and refillable packaging and food service ware. These efforts will inform the PRO strategic investment plan to support producer compliance with the Act.

This report presents findings from the collection and analysis of data on consumers' and businesses' current access to reuse and refill systems that offer alternatives to plastic covered material. It also covers the current landscape of other source reduction strategies to reduce the weight of plastic covered material and number of plastic components of plastic covered material sold, offered for sale, or distributed in California.

The contractor combined desk and field research to collect and evaluate data on reuse and refill systems in California and current source reduction strategies, using the following metrics:

- Consumer proximity to retail locations and reuse/refill systems

- Cost of the products

- Variety of options/brands within product categories

- Availability across retail types

- Socioeconomic status and average income of consumers

- Comparisons to single use and nonsource reduced product counterparts

This required the contractor to ensure that the gathered information is representative of California's diverse communities, including rural, urban, and suburban areas, as well as different socioeconomic perspectives.

This report includes selected data from this process, along with the methodology used and the assumptions made. The final section synthesizes relevant findings on the barriers and opportunities consumers and businesses experience in accessing and using reuse and refill solutions and other source reduction strategies.

2.0 Data Collection and Consolidation

The contractor combined desk and field research to collect and consolidate data on reuse and refill systems that provide alternatives to plastic covered material in California. This consisted of utilizing an existing database of reuse and refill systems and conducting additional data collection, research, and interviews to fill gaps and add data points. Additionally, the contractor compiled a set of reuse and refill solutions operating in California and analyzed them based on various characteristics.

The study approach consisted primarily of:

- **Instances Database**: Creation of a comprehensive, up-to-date database of identified reuse and refill instances across California.

- **Reuse and refill solution characterization dataset:** Creation of a framework to categorize and characterize reuse and refill solutions based on various criteria.

- **Store-level data collection:** Development and implementation of a data collection methodology to obtain metrics on California consumers' and businesses' access to reuse and refill systems and use of source reduction strategies.

- **Dine-in restaurant food service ware sampling**: Collection of data on a random sample of restaurants in California to determine whether they use single use plastic food service ware or reusable food service ware for dine-in.

- **Expert and industry interviews:** Completion of interviews with wide array of impacted interested parties representing large, regional, small, and independent businesses.

- **Community engagement sessions**: Collection of qualitative and quantitative data through events and discussions with community members and leaders.

While conducting these activities, the contractor employed the following set of assumptions:

- A representative sample of diverse geographic and socioeconomic areas would be obtained via field research.

- Accurate and up-to-date data would be provided by interested parties via interviews and surveys.

- Methodologies used in prior similar studies (e.g., deposit return systems) would be consulted, where appropriate.

- Additional desk research and interviews would sufficiently fill data gaps.

In addition to the reuse and refill analysis, the contractor examined other approaches to source reduction focused on reducing the amount of plastic in plastic covered materials. While reuse and refill strategies aim to reduce the overall use of plastic by extending the

life of packaging through multiple uses, other source reduction strategies focus on minimizing the use of plastic in the first place through design and material efficiency. This work drew on desk-based research and secondary sources, including insights from Touch's Vault innovation repository, to identify and describe practical examples of source reduction across packaging and food service ware categories.

The review covered the following recognized approaches to source reduction:

- **Elimination:** Instances where plastic components were removed, such as label-free formats, integrated closures, or alternative structures that remove secondary plastic parts.

- **Concentration:** Instances where product reformulation enabled smaller packaging formats to deliver the same product performance, as seen in concentrated liquids or powders.

- **Right-sizing:** Packaging designs that reduce unnecessary space or excess material, ensuring the amount of packaging aligns closely with the volume of the good.

- **Lightweighting:** Approaches that achieve material reduction through thinner walls or refined geometry, maintaining strength and usability while lowering overall weight of plastic. Also known as downgauging.

- **Large format packaging:** Cases where larger packaging units reduced the total number of smaller packages and amount of plastic needed for equivalent quantities of the good.

- **Material substitution:** Instances where plastic components were replaced with nonplastic materials. Examples include shifting from plastic trays to fiber-based molded pulp formats or switching from plastic bottles to metal alternatives.

In addition to the approaches above, reformulation was also identified as an enabling factor for source reduction approaches. Reformulation is the process of altering a good's composition or processing is altered to allow for compatibility with expanded range of packaging types.

PRC section 42041(aj) defines source reduction for the purposes of the Act. Source reduction does not include replacing a recyclable or compostable covered material with a nonrecyclable or noncompostable covered material or a covered material that is less likely to be recycled or composted.

Description of Data Collected

Instances Database

The Instances Database identifies organizations or brands offering reuse and refill solutions that provide alternatives to plastic covered material. To compile a list of B2C and B2B solutions, the contractor collected data from publicly available websites, social

media pages, and phone calls affiliated with the organization of interest. Every solution listed in this database is physically present in California or can be shipped to the state.

To overcome the challenge presented by limited public information on B2B reuse and refill solutions, the contractor team relied on: a) detectable third-party service providers offering the service; b) voluntary company reporting (e.g., through press releases or case studies); and c) interviews with companies willing to discuss these practices. The complete methodology for the Instances Database is described in Appendix B: Instances Database.

Solutions Characterization Dataset

The Solutions Characterization Dataset describes each variant of reuse and refill, separated into model and submodel (if applicable). A list of models and submodels can be found in the Reuse and Refill section of Appendix A, Table 27. This dataset provides a characterization of each solution model and submodel in addition to other information (e.g., packaging level if applicable, B2B versus B2C applicability, product category applicability). The dataset also includes an analysis of additional aspects of the models and submodels (e.g., Americans with Disabilities Act (ADA) accessibility, additional cost implications for consumers). This analysis was done at the submodel level, and was informed by the Instances Database, as well as by additional desk research and interviews. Each reuse and refill model the contractor assessed was identified as: a) presently available in California, b) available outside of California, c) possible but currently unavailable, or d) not applicable. The complete methodology for the Solution Characterization Dataset is described in Appendix B: Solutions Characterization Dataset.

Store-level Data Collection

The contractor conducted in-person data collection at a representative set of purchasing locations in urban, suburban, and rural areas across California, including covering priority populations where possible, to collect data on:

- Availability of reuse and refill, large format packaging, and concentrate solutions.
- Cost of solutions relative to comparable formats that are not source reduced.
- Selection of brands in relevant solution formats versus all other purchase formats.
- Potential barriers.
- Operational considerations for businesses.
- Other datapoints used in the consideration of accessibility and availability of solutions.

The contractor collected price and packaging size data for white rice, milk, shampoo, dish soap, and surface cleaner in various types of retail stores throughout California. These goods were selected to represent commonly purchased items by people of all income levels in three categories: food and beverage, personal care, and home care. The specific products within these categories (white rice, milk, shampoo, dish soap, and

surface cleaner) were chosen because they are available across multiple retail formats and each has at least one source reduced option.

The approach was to gather data for each brand and packaging format available for each product, including formats that are both source reduced and not source reduced. Source reduced options recorded were large format packaging, concentrated products, and in-store dispensing. Other formats of source reduced packaging were omitted in the store-level data analysis because it was not feasible to assess if, or to what degree, the packaging had been source reduced through visual examination on a store shelf. The contractor gathered and analyzed this data to determine the availability and accessibility of source reduced and nonsource reduced formats across retail types including big box stores, warehouse stores, grocery stores, drugstores, convenience stores, and zero-waste stores. The complete methodology for this data collection and analysis is described in Appendix B: Store-Level Data Collection in California.

Dine-in Restaurant Food Service Ware Sampling

To assess the extent to which restaurants are using single use plastic food service ware for on premises dining, the contractor randomly sampled 247 restaurants (mix of full-service and limited-service) to determine which types of cups, food containers, and utensils were being used. This included sampling from rural, urban, and suburban locations. The complete methodology for this data collection and analysis is described in Appendix B: Dine-in Restaurant Food Service Ware Sampling.

Data from Expert and Infrastructure Engagement

The primary goal of expert and infrastructure engagement was to gather perspectives, information, and data needed on the current state of reuse, refill, and other source reduction strategies directly from the interested parties who are exploring, testing, and implementing these strategies. This engagement ensures the output from this project is grounded in a shared understanding of the current reality.

The contractor conducted 42 interviews with subject matter and infrastructure experts, including but not limited to representatives of the retail sector, product and packaging manufacturers, food service establishments, and reuse service operators from large, regional, and small chains, and independent businesses.

Geographic Information Systems (GIS) Data Analysis

To evaluate access to goods sold in different packaging formats, the contractor calculated the population that lives within 1 mile of a store location. For the purpose of this study, store locations include grocery and refill (dispensing to replace packaging) stores. The contractor selected a 1-mile distance as qualifying for "having access" as this aligns to California's convenience zone standard set for the Beverage Container Recycling Program. While this study measures access to purchase and not return, this serves as a reasonable measure for evaluating how close consumers are to retail outlets offering goods in different packaging formats. The detailed methodology of how the GIS analysis was performed is included in Appendix B: GIS Data Analysis.

Data from Community Engagement

The contractor designed the community engagement track to gather lived experience input from California residents and community-serving organizations about how plastic covered material show up in daily life, and to understand what would make reuse, refill, concentrate, and large format options more practical. These efforts were not symbolic; they were essential to ensuring that communities historically underrepresented in statewide policy conversations could directly influence actionable reuse, refill, and source reduction strategies. The objective was to collect self-reported data on prevalence, feasibility, barriers, and equity considerations by region and population. These inputs inform the findings of this report by grounding the findings in consumer experience, surfacing implementation risks, and identifying the conditions and support needed for adoption. All qualitative public engagement findings in this report are thematic in nature.

The contractor conducted community engagement through several approaches, including:

- Pop up events.

- Small group discussions with Tribal communities, community based organization (CBO) representatives, and the disability community.

- One-on-one interviews with CBO representatives and Tribal community members.

- Focus groups with community members.

- Interviews with local jurisdictions.

- Statewide virtual public workshops.

Pop Up Events

Pop up events were primarily held at farmers' markets, with additional outreach at select community events, to engage with members of the public using interactive methods. The information gathered included a mix of quantitative input and qualitative narrative, focusing on frequency of plastic covered material use in their daily lives and what factors shape their choices/interest in refillable, reusable, or other source reduced options. The contractor consolidated this data into the broader engagement dataset, providing regionally specific inputs to feed into the study.

Small Group Discussions with CBO Leaders and Tribal Communities

The contractor held small group discussions with various groups of CBO leaders and California Native American Tribes (Tribes). Across all sessions, the contractor used a consistent set of key questions (included in Appendix B) to collect qualitative data on:

- Awareness and understanding of the Act and its goals to reduce plastic covered material by 25% by 2032.

- Prevalence of single use plastics in daily lives of communities served by CBOs and Tribal communities.

- Feasibility of alternatives, including reusable, refillable, and concentrate options, as well as large format packaging, and the reasons why they are feasible.

- Barriers and opportunities to shift away from plastic covered material. CBOs provided input on factors such as cost to consumers, convenience, technology suggestions, ADA accessibility, and language access.

- Potential roles for CBOs in education, outreach, and supporting future adoption of reuse and refill systems.

Focus Group Discussions with Community Members

The contractor held small, focused discussions with community members. For each focus group, the contractor gathered qualitative data and designed around a consistent set of goals:

- Understand daily reliance on plastic covered material by asking participants which products they use most often, where alternatives exist, and what makes reuse or refill more or less feasible.

- Gather perspectives on barriers and opportunities such as cost, convenience, accessibility, language, and product availability.

- Explore attitudes toward reuse and refill options, including refill stations, concentrated products, and reusable food service ware.

- Identify community-specific considerations such as geography, cultural norms, and socioeconomic factors that might affect the adoption of alternatives.

Outreach and Engagement with Tribal Communities

The contractor conducted outreach with Tribes through a pop-up at California Native American Day in the Sacramento Valley region and hosted a virtual small group discussion. Small group discussion participants self-reported affiliation with the following Tribal Nations and Indigenous lineages: Wok Tribe; Wiyot; Round Valley Indian Tribes/Lakota; Northern California Aztec Village; Nashville El Dorado Miwok; Mexica/Aztec; Mayo; Caxcán and Hñañu (Otomí); California Valley Miwok Tribe; Apache, Mayo; Towa descendant (New Mexico); Yurok; and Coyote Valley Band of Pomo Indians. This engagement gathered qualitative input on access to reuse and refill options, nonplastic alternatives, barriers and opportunities, and locally relevant considerations.

Interviews with Local Jurisdictions

The contractor conducted two interviews per region with city, county, regional agency, or solid waste district staff responsible for waste management, sustainability, or other environmental focus. These interviews provided qualitative and descriptive insights into

existing ordinances, gaps, and local government perspectives on opportunities and challenges for source reduction.

Methodology for Data Collection and Analysis

For each data collection effort, the contractor developed and implemented a specific approach to data collection, quality assurance, evaluation, and analysis.

For all data gathered, the contractor took steps to ensure the information gathered was representative of diverse communities within California. They utilized the following approaches across the different methods of data collection:

- The contractor gathered data from each of the five California regions (San Francisco Bay Area, Central Valley, Coastal, Mountain, Los Angeles, and San Diego Basins), and from at least one urban, suburban, and rural community in each region.

- For store-level data collection, of the five urban sites visited, the contractor selected at least two census tracts with priority populations. Of the five suburban sites visited, the contractor selected at least two census tracts with priority populations, based on the definition of priority populations (refer to Glossary of Terms for full definition).

- Rural areas were, by definition, considered priority populations, so all five areas visited fit the criteria.

For store-level data analysis, a mix of stores were selected, including:

- Local/regional, as well as national retailers.

- Retailers catering to different price points (discount, mainstream, high end).

- Retailers catering to specific international or cultural cuisines.

- Retailers offering both general and specialized goods.

- Package free shops and/or refilleries.

The detailed methodology for each data collection process is included in Appendix B: Store-level Data Collection in California. The list of all retail locations is included in Appendix B: Store-level Data Collection in California.

Data Delivery

The contractor has included all data and analysis in formats suitable for inclusion in the body and appendices of this report.

The full databases and other outputs from this research that are in formats, such as Excel, that do not lend themselves to being included in a report format, are available as an additional resource associated with the report.

3.0 Findings from Data Analysis

This section provides individual outputs from the various data analyses conducted, as well as relevant quantitative and, where appropriate, qualitative findings from the community engagement. The contractor then further synthesized these outputs with holistic findings from the community and business expert, and infrastructure engagement, which forms the basis for the Discussion of Barriers and Opportunities section.

Findings Related to Consumer Access to Reuse and Refill Systems

B2C Landscape of Reuse and Refill in California Today

Reuse and refill solutions available to consumers include:

- Dispensing to replace packaging (both submodels).
    - Retail context
    - Food service context
- Dispensing to replace single use plastic food service ware.
    - BYO cup or container
- Refill via single use packaging (all three submodels).
    - Refill via large format packaging
    - Refill via concentrate
    - Refill via cartridge, pod, pouch, or container (excludes concentrates and large format)
- Prefill.
    - Prefill at production facility
- Reusable food service ware programs (both submodels).
    - Open-loop food service ware program
    - Closed-loop food service ware program
- Reusable packaging for shipping and logistics.
    - B2C reusable tertiary packaging
- Enabler: Apps and digital rewards.
- Enabler: Collection.

Across all community engagement methods, participants self-reported that plastic bottles and bags emerged as the most commonly used plastic covered material, followed closely by soft plastics, such as chip bags. Tubs and single use plastic food service ware show more situational use yet still represent significant categories.

The landscape of solutions identified and described in the Instances Database provides insights into the geographic, economic, and physical access to B2C reuse and refill systems around California and provides further characterization of these solutions such as materials used, collection method, and product categories served.

The landscape of consumer reuse and refill solutions has grown significantly in the past decade: one-third of the identified solutions operating in California have started since 2015. The contractor identified 144 reuse, 888 refill, and two reuse/refill enabler B2C solutions for packaging and food service ware that are operating in California as of November 2025.

Approximately 79% of all solutions identified in California were in the dispensing to replace packaging model, which refers to in-store refill or through a mobile refillery. Refill in-store is generally found as a section within a larger grocery store, such as Sprouts Farmers Market, or as the only purchase method in package-free shops such as Ethos zero-waste store. Mobile refilleries travel to different locations to offer dispensed goods.

For the refill via single use packaging model, the contractor identified 69 solutions that are representative of the depth and breadth of the available solutions. This model includes three submodels:

- Refill via concentrate (e.g., Clean Cult) refers to systems where the consumer refills a container at home by reconstituting the product from a solid, powder, or liquid concentrate, typically with water.

- Refill via large format packaging (e.g., Swiffer WetJet Multi-Purpose Floor Cleaner) refers to systems where the consumer refills a container they already have at home from a package that contains an amount of product larger than the container that is refilled and that does not have the same functionality as the container, such as a spout or a pump.

- Refill via cartridge or other single use packaging (e.g., Wild), where the product comes in a refill package that is different from the original packaging or where the consumer refills the original package using the refill package (excluding large format and concentrates, which are addressed specifically in the previous bullet points).

Over half of the reuse solutions identified in the Instances Database were reusable food service ware programs. The contractor distinguished reusable food service ware programs as operating either in a closed-loop environment, where the food or beverage is consumed in the same location where it was purchased, such as a cafeteria, stadium, venue, or event, or open-loop environment, where the food or beverage is taken elsewhere for consumption, such as restaurant take-out or purchases from food trucks or convenience stores. Service providers that operate in closed-loop environments like stadiums include r.World and Vytal. Those that operate in open-loop environments include Okapi and Foodware to Go, which enable reusable food service ware for restaurant takeout. The food service ware solutions also include companies that rent reusable food service ware for personal or private events. A sample of 38 companies offering this service is included to illustrate this solution, but this is not a comprehensive list of all companies providing this solution in California.

Another solution to purchasing single use plastic food service ware for personal use is to purchase reusable food service ware for use at home or on the go that consumers washed and use again. The contractor did not include this in the Instances Database because the database does not catalog items for purchase.

Reuse and refill enablers are tools or services that facilitate the use of reuse or refill solutions but that do not provide a solution directly. This includes smartphone apps that provide behavioral nudges or incentives for reuse and refill behavior, technical assistance to restaurants to make the switch from single use to reusable or source reduced alternatives, and services that facilitate the collection of reusable food service ware and packaging. Two enablers are included in the Instances Database.

Typically, a business implements a reusable food service ware program, but the contractor has included this as a B2C solution because they are consumer-facing. The product categories that these solutions currently primarily serve are to-go food and beverage, stadium, venue, and cafeteria food and beverage, and personal and private events.

The Instances Database did not collect individual instances of dispensing to replace single use plastic food service ware because the ability to bring your own food service ware to establishments is legally mandated across California under Assembly Bill (AB) 619 (Chiu, 2019) in 2019.[1] Examples of dispensing to replace single use plastic food service ware include bringing your own cup for a beverage and bringing your own takeout container to a restaurant. This row is included in Table 1 for completeness, but the value is Not Applicable, or "N/A"," for this reason.

The contractor also characterized solutions for packaging by level (as defined in PRC section 42041(s)):

- Sales packaging or primary packaging: intended to provide the user or consumer the individual serving or unit of the product and most closely containing the product, food, or beverage.

- Grouped packaging or secondary packaging: intended to bundle, sell in bulk, brand, or display the product.

- Transport packaging or tertiary packaging: intended to protect the product during transport.

Food service ware does not have equivalent packaging levels.

Table 1 summarizes the results of the Instances Database by model, submodel, and packaging level. "N/A", is noted when a solution model or submodel has no equivalent packaging levels.

Table 1: Number of B2C reuse and refill solutions by type, model submodel, and level

Type	Solution Model	Solution Submodel	Packaging Level	Number of Solutions
Refill	Dispensing to replace packaging	Retail context	Primary	819
Refill	Dispensing to replace food service ware	Bring your own cup or container	N/A	Not assessed
Refill	Refill via single use packaging	Refill via large format packaging	Primary	17
Refill	Refill via single use Packaging	Refill via concentrate	Primary	32
Refill	Refill via single use packaging	Refill via cartridge, pod, pouch, or container (excludes concentrates and large format)	Primary	20
Reuse	Prefill	Prefill at production facility	Primary	19
Reuse	Reusable food service ware programs	Open-loop food service ware program	N/A	62
Reuse	Reusable food service ware programs	Closed-loop food service ware program	N/A	55
Reuse	Reusable packaging for shipping and logistics	B2C reusable transport packaging	Tertiary	8
Enablers	Apps and digital rewards	N/A	N/A	1
Enablers	Collection	Curbside collection of reusable packaging and food service ware	N/A	1

Table 2 summarizes which product categories each active and inactive solution applies to in the Instances Database. Solutions can involve more than one product category, for example a package-free shop may sell both personal care and home care products. Not Applicable, or "N/A", is noted when a certain product category is not relevant to that solution type. This table only includes solutions operating in California currently. Solutions serving additional product categories are possible but may not be in operation within California.

Table 2: B2C reuse and refill solutions by product category currently operating in California (excluding enablers)

Product category	Packaging Solutions – Dispensing to replace packaging	Packaging Solutions – Refill via single use packaging	Packaging Solutions – Prefill	Packaging Solutions – Transport packaging	Food Service Ware Solutions – Open-loop	Food Service Ware Solutions – Closed-loop
Packaged food	515	1	7	1	N/A	N/A
Packaged beverage (non CRV)	1	1	12	1	N/A	N/A
Personal care	153	35	7	2	N/A	N/A
Home care	111	29	1	2	N/A	N/A
Stadium/venue/cafeteria food and drinks	N/A	N/A	N/A	N/A	N/A	17
Personal and private events	N/A	N/A	N/A	N/A	N/A	38
To-go food and drinks	N/A	N/A	0	N/A	59	N/A
Pet care	237	2	0	2	N/A	N/A
Office and school supplies	0	4	0	2	N/A	N/A
Apparel, footwear and accessories	N/A	N/A	N/A	5	N/A	N/A

Hygiene and Food Safety

Guidance from Food Codes

For the use of refillable consumer owned containers in the food service context, both federal Food and Drug Administration (FDA) Food Code and California's Retail Food Code now explicitly allow consumer owned containers in lieu of single use food service ware under certain circumstances and with proper procedures, though this is relatively recent. In California, AB 619 (Chiu, Chapter 93, Statutes of 2019) enabled greater use of refill by providing guidance for how clean, consumer owned food service ware could be filled in a hygienic manner, but it does not address the use of reusable food service ware in an open or closed-loop reusable food service ware system. Dispensing to replace packaging is not in scope for the California Retail Food Code.[2]

At the federal level, the 2024 Supplement to the 2022 FDA Food Code provided new guidance for approved methods for BYO or business facilitated filling of packaging. The supplement allows for reusable food service ware, including third party ownership.[3] The Conference for Food Protection (CFP) provided guidance on safe handling measures in all reuse use cases, and it does not limit the types of food that can be served.

The determination by the FDA that the relevant reuse and refill solutions are safe and hygienic when correct procedures are followed indicates that there are no inherent or uncontrollable hygiene or food safety risks associated with reuse and refill.

Local jurisdictions have the authority to interpret these regulations and impose additional requirements, which can be restrictive for reuse and refill solutions. However, an analysis of city and county level codes showed that this is not the case, and most California cities and counties had adopted codes consistent with what is allowed in the federal and California codes.

Community Engagement Insights on Food Safety (Specific to Refill)

Public concerns related to food safety at refill stations primarily focused on scoop style bins, which participants in community engagement activities perceived as the least sanitary, compared with closed systems, such as gravity fed, pull down levers, twist/rotary dispensers, and spout or tap dispensers that minimize direct contact with the good. The practice of individuals placing their hands into containers was the most frequently raised issue, particularly in urban areas where people experiencing homelessness often reside. One participant described putting her hands into containers holding lentils and letting the goods run through her fingers because she enjoyed the tactile experience. Another noted, "I have sampled candy and nuts from the refill station." Such practices reinforced participants' fears about contamination and the potential spread of germs. Several reported discontinuing use of refill stations during the COVID-19 pandemic and stated they had not felt comfortable using bulk bin refill stations since.

By contrast, participants in more rural areas did not express these concerns and reported being comfortable with all types of refill stations.

Standardization, Harmonization, and Pooling

Standardization in packaging refers to developing and using uniform specifications, dimensions, materials, and performance criteria for packaging and its components. This ensures interchangeability, compatibility, and efficiency across products, supply chains, or industries. Harmonization means aligning multiple existing standards or rules, so they work together effectively.

Managed pooling is when standardized packaging is shared among multiple users and owned by a central packaging provider, rather than by individual companies. This type of system decreases sortation, cleaning, and logistics complexity by aggregating packaging and streamlining operational logistics and associated costs. Additionally, well managed pool systems generate a reduction in transport distances as well as production and conversion costs.[4]

While reusable container pool systems can differ in size and other characteristics, successful pool systems typically include a central governance structure and ownership, shared access, and self imposed quality and efficiency standards.

Reuse experts point to well managed pool systems for reusable packaging as a key instrument to make efficient and effective reuse systems work. The benefits experts ascribe to a well managed pool system include:

- Reduction in investment and operating costs

- Lowered individual risks for companies

- Small and medium enterprises (SMEs)' market entry fostered

- Enhanced efficiency

- Increased competition when standards are well defined.

- Accelerated scaling [5]

The Ellen MacArthur Foundation identified packaging standardization and pooling alongside scale and shared infrastructure and high return rates as the three key performance drivers for reuse systems.[6]

The contractor identified 11 B2C organizations currently using one of these methods for packaging or food service ware. The contractor did not identify any examples of standardized or harmonized labels. PR3 is a nonprofit that is leading a process to develop a standard for reuse, with standards drafted for collection points, container design, digital, marking and labeling, system operations and performance, and washing. The PR3 Reuse Standards remain to be finalized.[7]

E-commerce and Local Delivery

Reuse and refill solutions are available through e-commerce and local delivery, but access varies greatly by solution model and location. Consumers can buy 89 solutions (8.6%) online, and 75 solutions (7.5%) offer local delivery of their product or service or

operate as a mobile refillery. Consumers typically cannot order online solutions that require a consumer owned container for refill, while they can order online for systems with return infrastructure like prefill, reusable transport packaging, and reusable food service systems. Grocery and prepared meal delivery services are generally limited to local delivery only.

Collection and Cleaning Methods

The contractor recognized five distinct collection methods and three distinct cleaning models relevant to business owned packaging used in B2C reuse solutions today.

Collection methods for packaging include home pick up by the program operator or a third party, return by mail either from home or post office drop off, retail drop off of reusable packaging (which includes redemption centers), restaurant drop off of reusable food service ware, and on site collection for on premises services utilizing closed-loop reusable food service ware programs. Within home pick up is the curbside collection pilot in Berkeley, California, where reuse service operator Cyclei is collecting reusable packaging and food service ware from multiple programs in a single pouch that residents hang off of their curbside recycling bin for regular pick up, and Cyclei facilitates the return of deposits.

Public collection of reusables, such as through return receptacles placed on streets, in parks, and at schools and public buildings, is not currently available in California, though the Petaluma Reusable Cup Program pilot did implement public collection points during the three months the pilot was underway. Programs that offer public collection infrastructure now exist in Aarhus, Denmark, Monaco, and Lisbon, Portugal, with others planning to launch in the near future. Without convenient collection of consumer-facing reusable packaging and food service ware, the additional burden on the consumer can be a barrier to high rates of collection.

Table 3 summarizes the existing collection methods and details whether they are used for packaging or food service ware. Every solution currently operating in California using business-owned packaging or food service ware utilizes one of these collection methods.

Table 3: Types of collection methods for packaging and food service ware*

Collection Method	Used for Packaging	Used for Food Service Ware
Home Pick Up	3	7
Return by Mail	11	0
Retail Drop Off	7	0
Restaurant Drop Off	0	61
On Site Collection (On Premises Services)	N/A	56

*Consumer-owned packaging (used in solution models dispensing to replace packaging and dispensing to replace single use plastic food service ware) does not require collection because it is not business-owned or managed and is excluded from this table.

Cleaning approaches currently operating in California include wash hubs separate from production or filling locations, washing at the production facility, and washing by the restaurant or food service operator, typically on-site. Mobile washing units are another form of washing reusable food service ware, though the contractor did not find active solutions that would be a relevant fit in the Instances Database. At least two reuse service providers had developed mobile wash facilities to support reusable food service ware use, but they are no longer operating. There are businesses who rent trailers outfitted with dishwashers, but they are typically deployed as a temporary solution for dishwashing (e.g., during restaurant kitchen renovations), not as part of a program to facilitate additional use of reusable food service ware. Availability of mobile washing capacity, or unused washing capacity at existing wash hubs, can be an enabler for increasing the amount of reusable packaging and food service ware to be used.

Part of the cleaning process involves an inspection of the reusable packaging and food service ware to ensure it is safe for consumer use. This inspection is typically done at the washing location. Even seemingly minor damage such as scratches and dents can require that items be taken out of service because these surface degradations can become harbors for pathogens or allergens and are a safety hazard. The pass rate for inspection is recognized by reuse service providers as equally important as the return rate as it impacts the number of uses an item can complete, which is closely tied to both economic and environmental performance.

Table 4 summarizes the existing ways that companies complete the cleaning of their packaging or food service ware. Every solution currently operating in California using business-owned packaging utilizes one of these cleaning methods.

Table 4: Operating models for cleaning for packaging and food service ware*

Cleaning method	Used for packaging	Used for food service ware
Wash hub (separate from production or filling) (not mobile)	5	66
Washing at production facility	16	7
Washing by restaurant/food service operator	N/A	51

*Consumer-owned packaging (used in solution models dispensing to replace packaging and dispensing to replace single use plastic food service ware) does not require cleaning to be provided by a third-party because it is not business-owned and operated and is excluded from this table.

Impact on Jobs

The contractor assessed the potential direct impacts of reuse and refill solutions on jobs, in and outside of California, relative to the current single use plastic status quo. The assessment considered both what has been observed already about job impacts as well as the potential impacts that would be expected as reuse and refill solutions achieve a larger scale. The potential for changes to the number of jobs in California are considered for first order (i.e., direct) impacts, including how each solution type impacts production, package filling, transportation, retail, and, where applicable, collection, washing, and recirculation. Second order job impacts (i.e., indirect) were not considered for this analysis. Second order job impacts include changes to package manufacturing, company overhead expenses (e.g., from changes to how reusable packages appear in financial statements, or to support tracking of containers), material demand, and waste management.

Existing literature for estimating benchmarks for job creation based on system adoption and scale is limited, but the contractor analyzed available data to determine that job creation for reuse and refill systems could be in the range of 100 to 700 net new jobs per 10,000 tons per year of material being reused. If 10% of current plastic covered material in California, calculated at 2.9 million tons per year in the 2023 baseline, were replaced by reuse and refill solutions, this could create from 2,900 to 20,300 new full-time jobs in California based on this analysis.

The analysis indicated that of only of the direct impacts of the eight B2C reuse and refill models, four have the potential to directly create new jobs in California, while three other strategies are estimated have little to no direct impacts on job creation. One strategy, refill via concentrate, will decrease transportation needs for those products because the products are so much smaller and lighter that transportation efficiencies can be realized, which has the potential to decrease jobs associated with transporting the product. The contractor did not expect the two B2C enablers analyzed to directly impact jobs in California as they are very small scale.

The contractor reviewed existing literature and asked interviewees questions about the potential for job creation. Most interviewees had not evaluated the impact of different solutions on jobs and did not speculate. Some reuse service providers were able to provide directional numbers for their staffing levels at different levels of volume, which were in line with Perpetual's modeling that citywide reusable food service ware systems indicates a rule of thumb that the first 5,000 reusable food service ware units moving through the system per day requires five full-time employees (FTEs), and every 1,300 reusable food service ware units per day above that requires one additional FTE. This provides one benchmark to consider.

The most comprehensive and relevant source available is the report, The Job Creation Potential of Zero Waste Solutions, published in 2021 by the Global Alliance for Incinerator Alternatives, an environmental nonprofit group.[8] The report compiled estimates made in other research papers or by individual experts. While these are reuse jobs, these numbers reference situations that do not align exactly with the reuse and refill solutions contemplated in this report (see Table 5). For example, the solutions studied are more focused on facilitating the reuse of durable products, such as operating secondhand shops. The range of FTEs created by reuse per 10,000 tons per year (TPY) was 118 to 750, in contrast to a range of one to six FTEs created by landfill and incineration. The estimate from the contractor's model is within this range for reuse, which may indicate that these numbers are directionally correct. Even subtracting the existing FTEs for landfill and incineration (from the same report) from the range of jobs in Table 5, the estimate of net new jobs from reuse and refill solutions is still 100 to 700 FTEs per 10,000 TPY.

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Table 5: Jobs per 10,000 tons per year (TPY) of material to be recycled and reused

Jobs per 10,000 TPY	Location	Source
118	United States	Institute for Local Self-Reliance (ILSR) (1995). Manufacturing from Recyclables - 24 case studies of successful enterprises.
185	United Kingdom	Friends of the Earth (2010). More Jobs, Less Waste: Potential for job creation through higher rates of recycling in the UK and in the EU.
250	Denmark	Personal communications with Kristina Overgaard Zacho at AVV Waste Management Company
496	Sweden	Personal communications with Sebastian Holstrom at Inrego
625	Belgium	Cools, P., & Oosterlynck, S. (2015). De Kringwinkel: A symbiosis between jobs for the long term unemployed and waste reduction? Poverty Reduction in Europe: Social Policy and Innovation (ImPRovE).
750	Europe	The Reuse and Recycling EU Social Enterprises Network (RREUSE) (2015). Briefing on job creation potential in the re-use sector.

Source: Ribeiro-Broomhead, J. & Tangri, N. ZeroWaste and Economic Recovery: The Job Creation Potential of Zero Waste Solutions. Global Alliance for Incinerator Alternatives. 2021. www.doi.org/10.46556/GFWE6885

Impacts on Jobs for Each Consumer Facing Reuse and Refill Solution Type

Reusable packaging and food service ware systems create formal sector jobs through employing people to wash, transport, inspect, and manage the reuse system, as well as covering administrative and service functions. Consumer facing reuse systems involve collecting used packaging and food service ware to be washed, and the potential to design the system to provide income earning opportunities for informal sector workers as well, for example by providing a redemption fee for the return of lost or abandoned packaging and food service ware. As the nature of reuse is inherently local, these jobs will be predominantly located in California.

The contractor did not detect a direct impact on jobs from in-store dispensing to replace packaging for goods that would otherwise have been packaged or for BYO food service. Retailers are typically able to use existing staff to manage in-store dispensing operations that replace packaging at current levels of participation. However, in interviews, retailers noted that the managing in-store dispensing can be somewhat more labor intensive than simply shelving packaged goods. This is because the containers dispensing the goods must be refilled, cleaned, and maintained by employees, so at larger scale it could provide an incremental increase in retail jobs in California. Because the consumer is responsible for providing their own packaging or food service ware, there are no additional jobs for the circulation of this packaging or food service ware. The other potential impact here would depend on the method for delivering goods to store for stocking in in-store dispensers. If that packaging is single use, which is typical today, then there would be no impact. To maximize the potential single use plastic reduction of a refill-in-store model, producers could adopt reusable packaging to transport goods to retailers for sale via refill-in-store dispensers. In this case, there would be backhauling and cleaning for this reusable packaging, which would add jobs to this system.

Refill via single use packaging model, including refill via concentrate, refill via large format packaging, and refill via cartridge or other single use packaging, operates largely in the same context as single use packaging, and brand and manufacturing jobs would not be expected to be impacted. The contractor expects refill via large format packaging to require less single use plastic per unit of goods, though the order of magnitude of this difference ranges from 8% to 40% of packaging weight depending on the packaging format and how different it is from the original packaging. Refill via single use packaging, excluding concentrate and large format would fall on the lower end of that range.

Ranges were determined leveraging a Eunomia analysis of in-market packaging weights, using a methodology developed by Touch. To calculate the weight savings, Touch identified the lightest available large format for each packaging cluster using European best in class weight data. They then determined how many small packs the large unit would replace by comparing product volumes. The weight of the small pack is multiplied by this replacement ratio, and the resulting total is compared with the weight of the large format. The difference represents the plastic reduction achieved. Using European data for the large formats and typically heavier US data for the small formats provides a realistic view of current market conditions while showing the upper limit of savings achievable.

The impact on the space required to transport each unit could impact transportation efficiencies and resulting labor needed to complete them, but the contractor was unable to generalize based on available data.

For refill via concentrate, the greatly reduced weight and size of the refill product allow for more efficient transport, which could impact transportation jobs as the same quantity of goods could be delivered in fewer trips. The impacted jobs could be in California, or

they could be long-haul trucking or another mode of transportation jobs based out of state.

Prefill models use similar approaches for manufacturing and filling as single use packaging, though these can be slower and more labor intensive. Given that prefilling would ideally happen within the reuse service area, the contractor expects any additional jobs to be located in California. Collection, inspection and sorting for reusable packaging in a prefill system require new labor not currently in the economy, though some collection methods leverage existing labor, such as prefill programs where consumers return packaging by mail. In a scaled system, consumers could return prefill packaging through curbside pick up, similar to residential waste or recycling curbside pick up, with potential synergies with existing services. A collection pilot being run by Cyclei in Berkeley, California, gives consumers bags for their reusable packaging and food service ware, such as prefill glass milk bottles and reusable cups from local open-loop reusable food service ware programs. These bags are then hung on recycling bins and picked up by recycling trucks as part of their normal route. These efficiencies only exist if recycling trucks have extra capacity (and the additional volume or weight will not trigger the need for additional trips) or if reusables are replacing recyclables in the mix of collected packaging, such as that the overall collected volume remains roughly constant.

Consumer-facing reusable tertiary packaging such as reusable mailers and dunnage requires backhauling, inspection, and cleaning of the reusable packaging. If some or all of the backhauling can be done using vehicles that would have been empty, then there is a minimal impact on labor, as these transport legs were required anyway. If backhaul synergies are not available, then more transport labor will be required, and this would result in additional jobs, at least some of which would be in California. Labor for cleaning and inspection is in addition to current status quo and would be directly related to the volume of reusable packaging and dunnage used.

The contractor does not expect reuse enablers such as apps that provide reminders or rewards to consumers to bring reusable bags to have an impact on jobs.

Geographic Access

Access to In-Store Dispensing to Replace Packaging Options

GIS analysis showed that 26% of the California population lives within 1 mile of a store selling a mix of single use packaged products and goods sold through in-store dispensing (partial refill), 4% live within 1 mile of a store that sells mostly or only goods through in store dispensing ("all refill"), and 12% live within 1 mile of a store with just one refill machine or dispenser (standalone refill).

Approximately 35% of California's urban population live within 1 mile of a store with at least some refill in store options. For the GIS analysis, urban was defined using the 2020 Census Bureau's urban-rural classification, where a territory is categorized as an urban area if it encompasses at least 2,000 housing units or have a population of at

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least 5,000 people.[9] Additionally, a spatial dataset was used that assigns areas as low-income or disadvantaged based on criteria detailed in Appendix B: GIS Data Analysis.

The purpose of Figures 1 through 7 is to spatially illustrate the locations of partial, all, and standalone refill stores across five regions in the state. The contractor overlaid a 1-mile buffer on population block data to estimate the population with access to these stores. Figure 1 includes the Southern region, Figure 2 includes Mountain region (northern portion), Figure 3 includes Mountain region (southern portion), Figure 4 includes the Valley region, Figure 5 includes Coastal region (northern portion), Figure 6 includes Coastal region (southern portion), and Figure 7 includes the Bay Area region. The figures below were separated into those specific categories to ensure locations on the map are visibly clearer and more accessible.

Figure 1: Consumer geographic access to in-store dispensing to replace packaging: Southern region

Figure 2: Consumer geographic access to in-store dispensing to replace packaging: Mountain region (northern portion)

Figure 3: Consumer geographic access to in-store dispensing to replace packaging: Mountain region (southern portion)

Figure 4: Consumer geographic access to in-store dispensing to replace packaging: Valley region

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Figure 5: Consumer geographic access to in-store dispensing to replace packaging: Coastal region (southern portion)

Monterey Bay

Isla Vista

Refill Stores (all, partial and standalone)
Urban areas
Coastal (South)

0   48   96 km

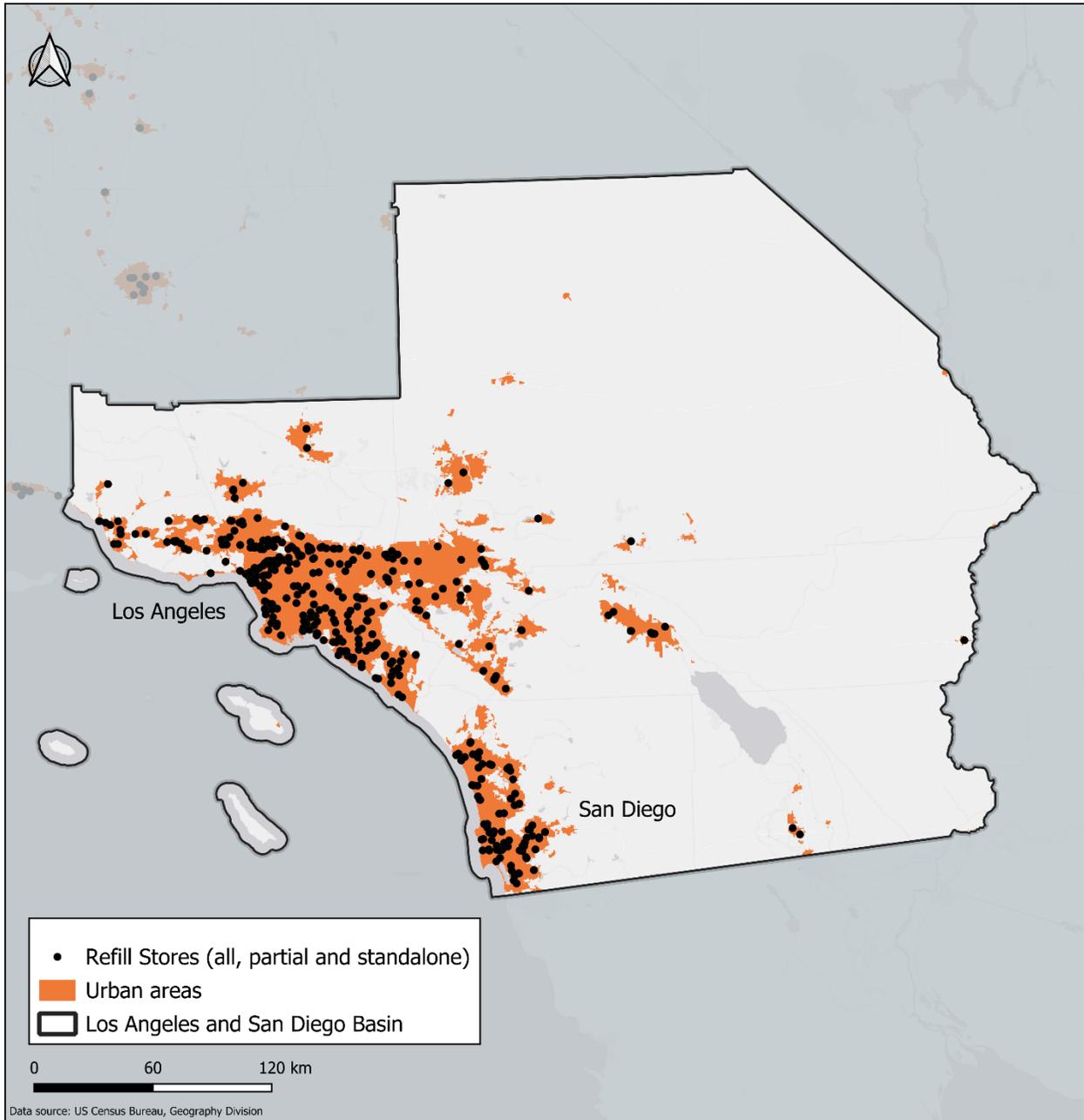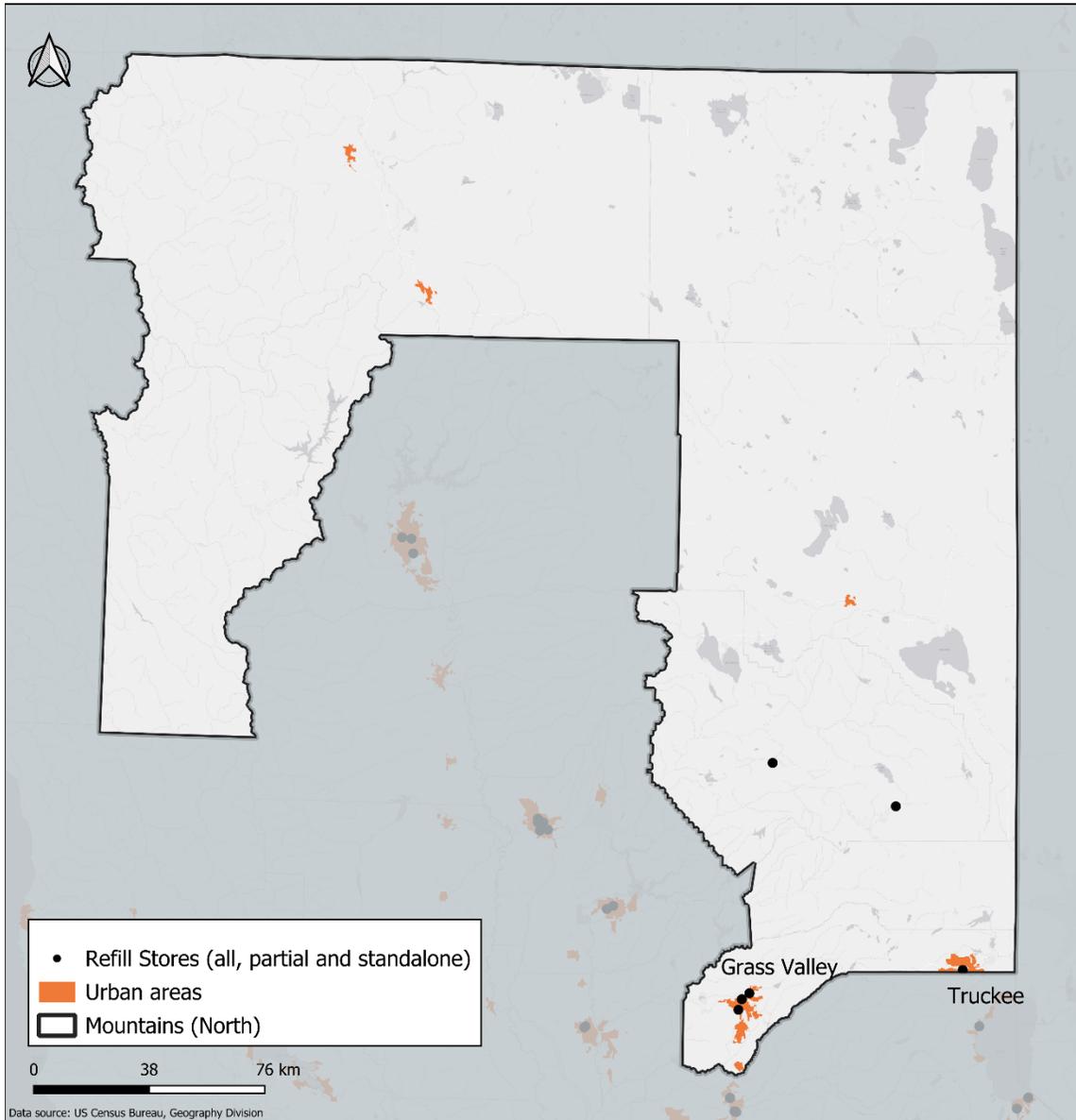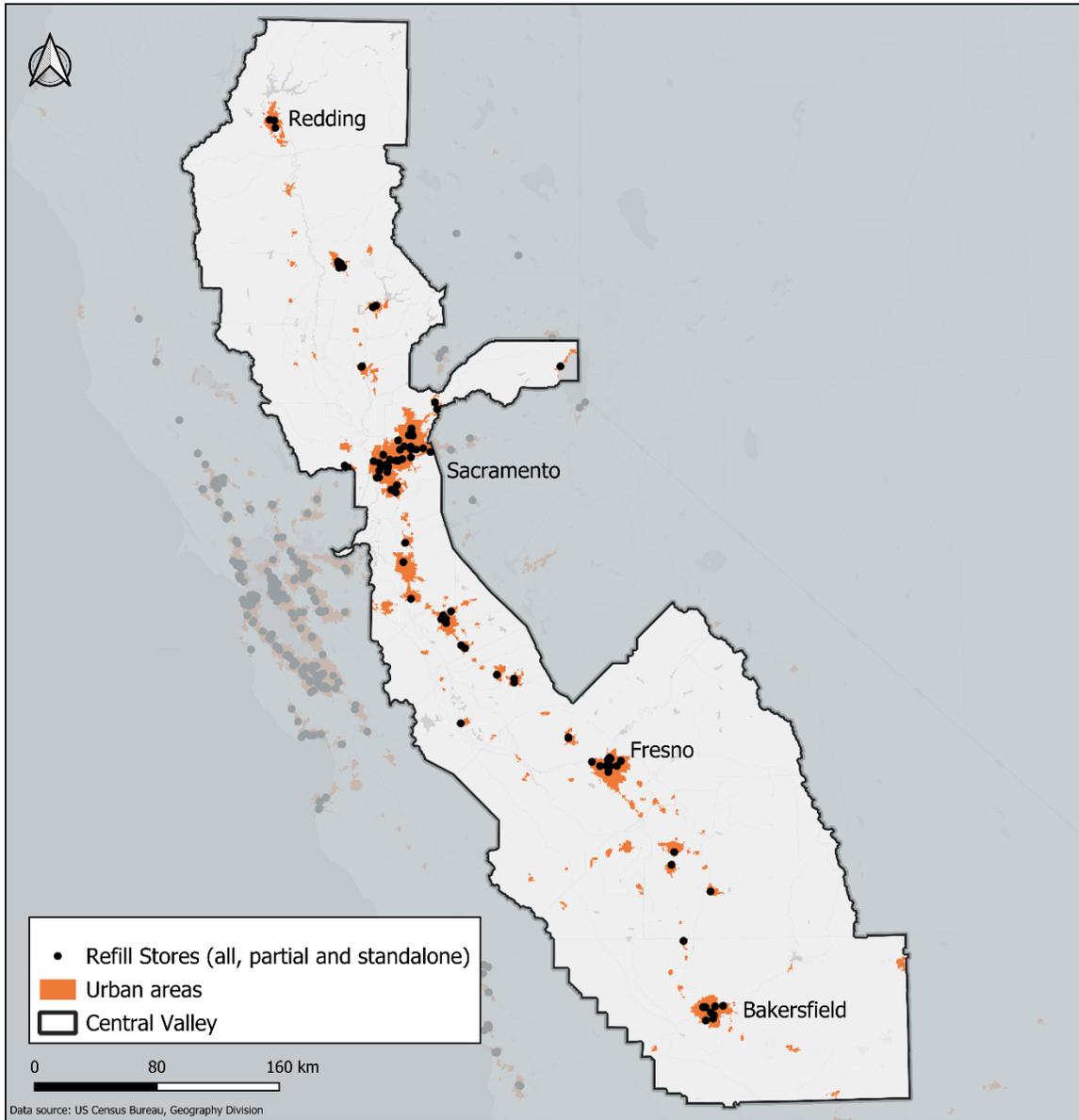Data source: US Census Bureau, Geography Division
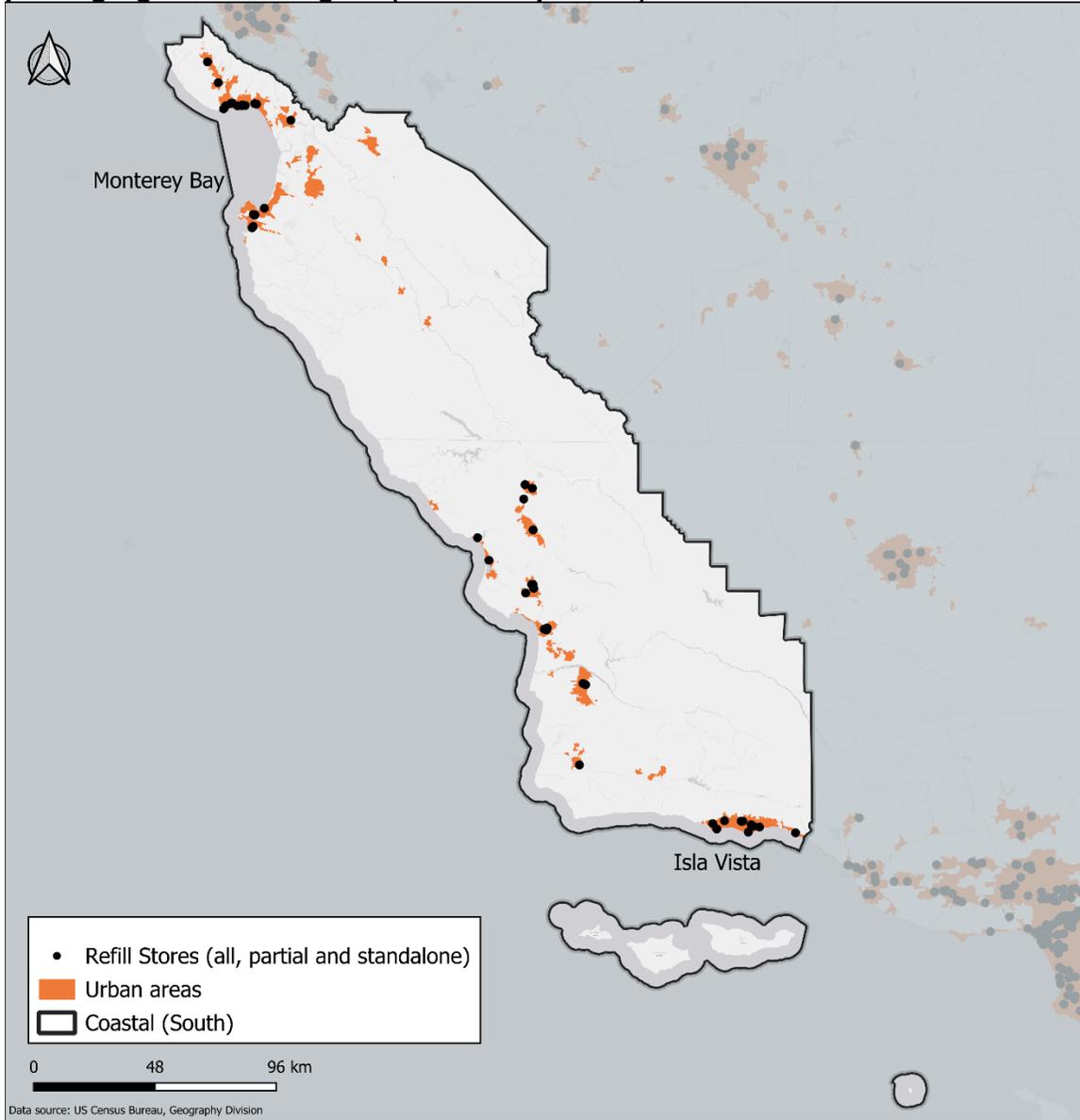
Figure 6: Consumer geographic access to in-store dispensing to replace packaging: Coastal region (northern region)
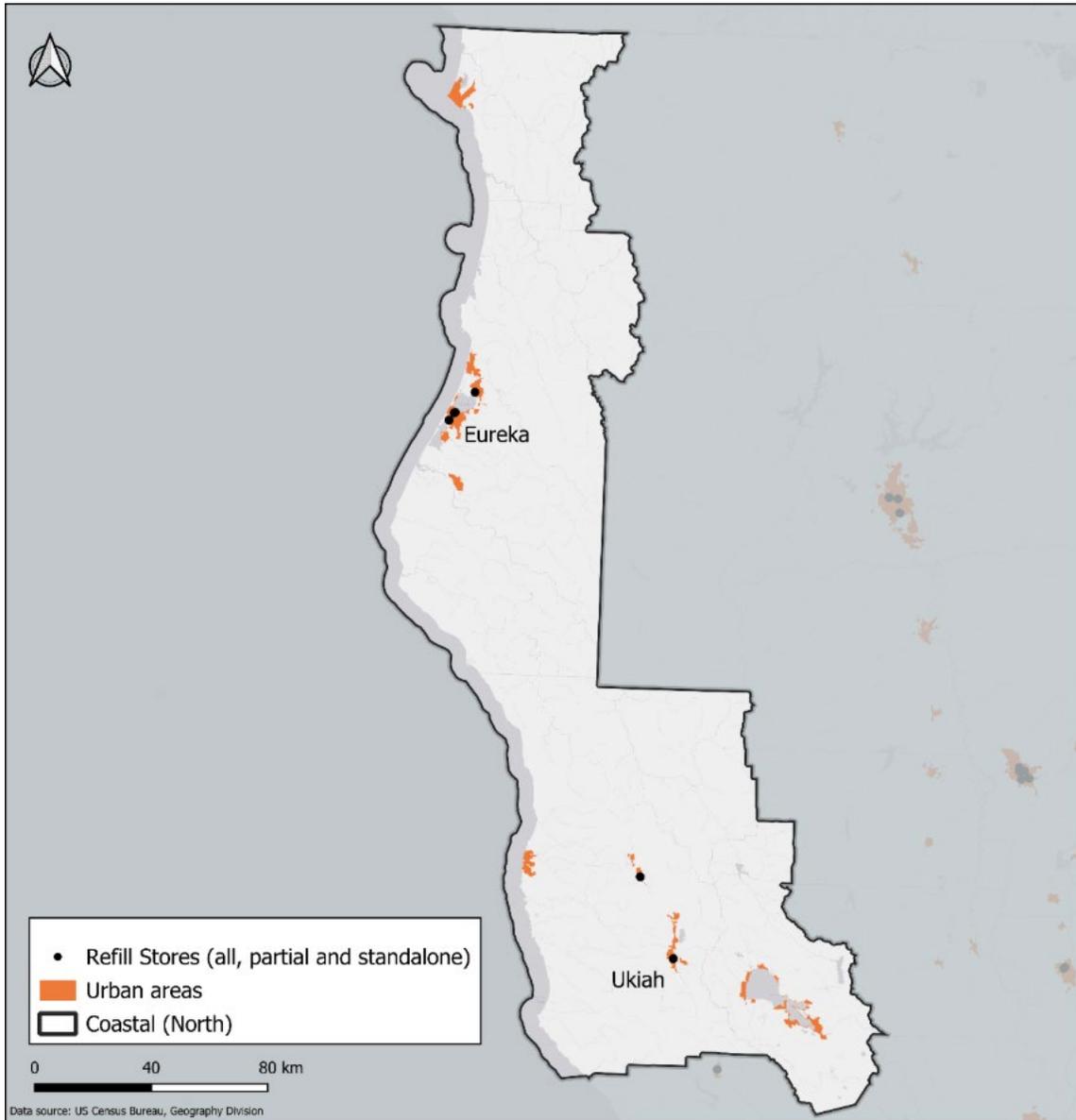
Figure 7: Consumer geographic access to in-store dispensing to replace packaging: Bay Area region
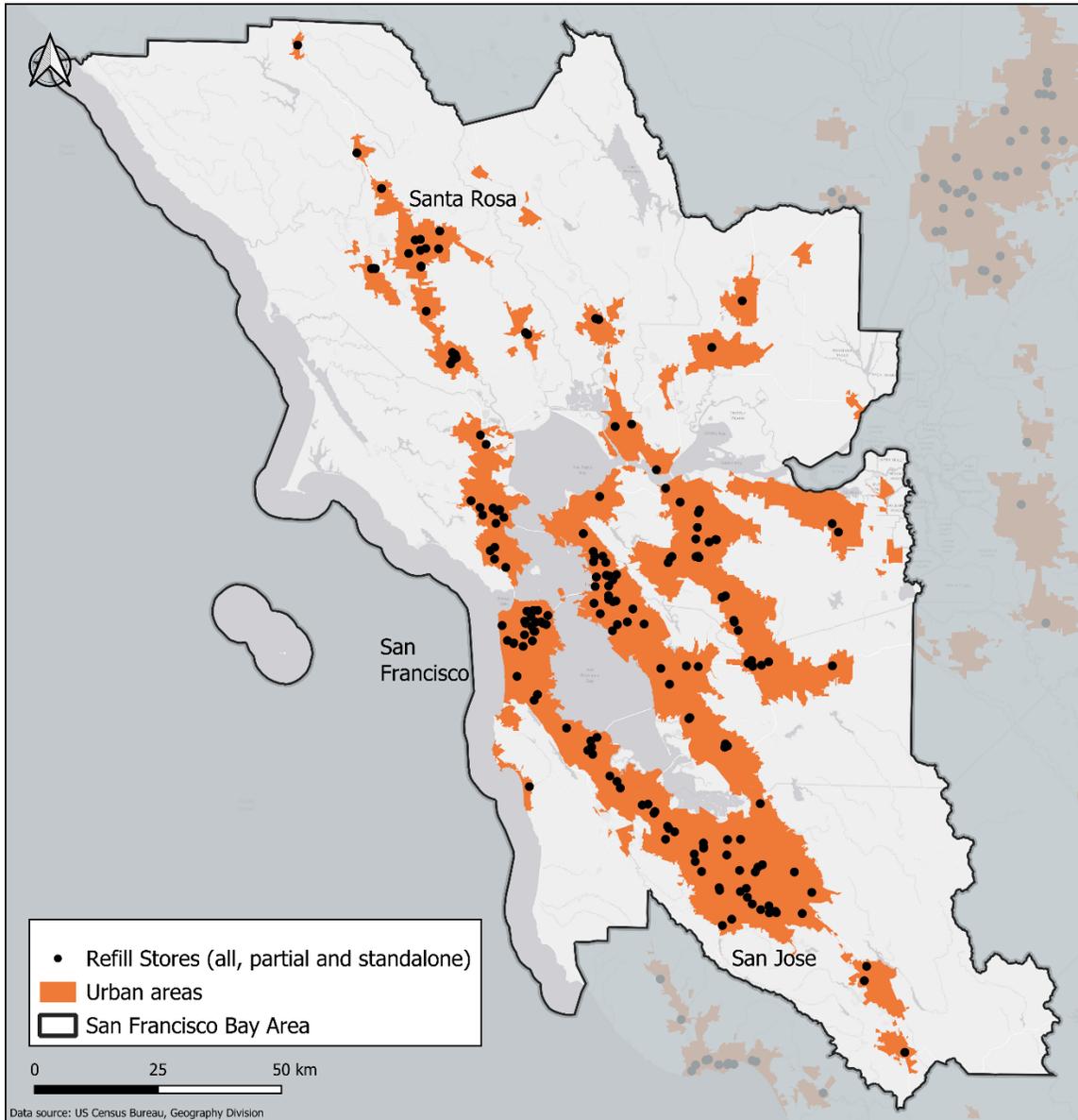
GIS data demonstrates that approximately 62% of California's population lives within communities designated as low-income and disadvantaged. Of this population, only 26% lives within 1 mile of a store selling a mix of single use packaged products and goods sold through in-store dispensing (partial refill), indicating that refill-in-store solutions are not accessible to those in low-income and disadvantaged communities.

As is seen in Figure 8, retail stores, including those with refill-in-store options, tend to align with population clusters, leaving rural or less populated areas underserved.

Figure 8: Consumer geographic access to in-store dispensing to replace packaging overlaid on low-Income and disadvantaged communities: San Francisco Bay Area
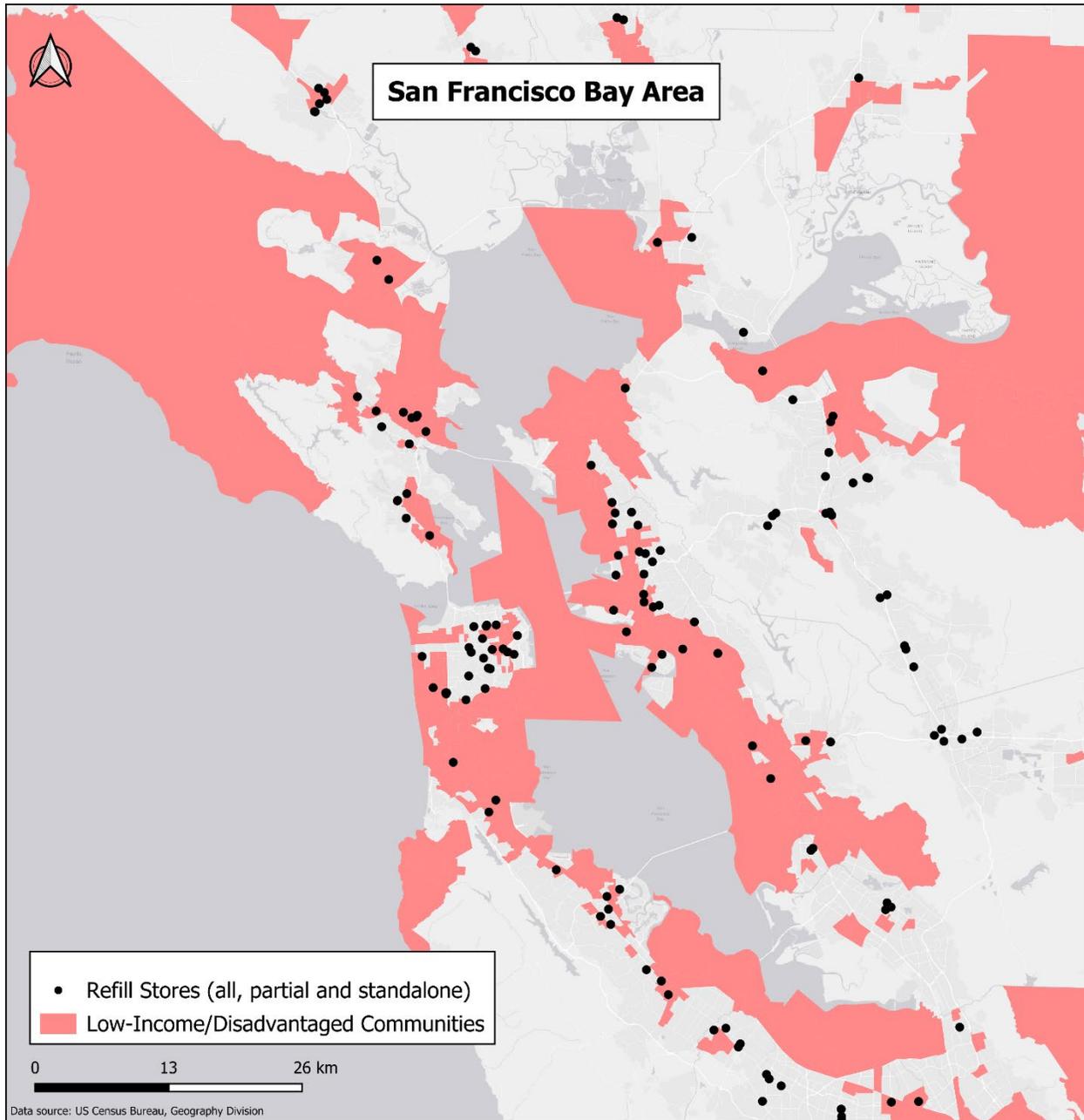
Community Engagement Insights on Geographic Access to Refill solutions

In-person and virtual engagement activities revealed that while people know that refill systems are available, access and usage varied depending on whether participants live in rural, suburban, or urban areas. Nearly all residents and CBO representatives in urban, suburban, and rural areas acknowledged that they knew of markets with

dispensing to replace packaging stations, and some were aware of refill-only stores, but few used them.

In densely populated urban areas, many residents depend on public transportation, walking, or biking to get to their shopping destinations such that carrying glass refill bottles to and from the stores is a major barrier. Some students, immigrant community members, and low-income residents live in food deserts and must travel several miles to get to the nearest market with a dispensing-to-replace packaging station. One respondent said, "I live about three miles to the nearest grocery store with a refill station. I have to walk four blocks to get to my bus stop, wait for the bus, and it takes a 20-minute ride to get to my stop and walk another block to get to the store, so I usually get what I need from the corner store." In some of the more affluent urban neighborhoods, actual refill stores exist, but all use only glass refill containers and are perceived as expensive. Many people living in urban areas have smaller households and live in walkable neighborhoods that contain smaller shops where consumers buy their immediate needs.

This contrasts greatly with those living in suburban and rural areas, as the majority of participants shared that they drive to large grocery stores and big box stores. Those living in the most rural areas shared that shopping is a planned activity since the distance to the markets is far, and they tend to buy large family-sized products to reduce the number of visits to the market. This community reported that they would need to drive far because they do not have dispensing to replace packaging stations in their local market. Nearly half said they would use them if they were readily available.

Spanish-speaking groups said that reusable options are clustered in higher-cost stores and are intimidating for lower-income shoppers. They called for adoption in mainstream supermarkets and Latino grocery stores and markets.

Access to Reusable Food Service Ware Options

Analysis of accessibility of reusable food service ware showed options were more limited for consumers across both closed-loop and open-loop dining contexts, despite consumers having the legally mandated option to bring their own reusable food service ware for use in place of single use plastic food service ware options. For closed-loop food and beverage consumption, only five stadiums and venues out of an estimate of roughly 2,300 total[10, 11] in California currently offer the option of reusable food service ware at least some of the time.

The contractor analyzed a random sample of 247 restaurants in California to estimate that 29% of limited-service restaurants (i.e., no wait staff; includes fast food chains and independent restaurants in the random sample) offer reusable food service ware options for dine-in, though 96% of full-service restaurants do. The contractor determined even lower availability of reusable cups and utensils for limited-service restaurants, at 23% and 22%, respectively. Table 6 summarizes the percentage of restaurants based on type of service offering reusable food service ware.

Table 6: Percentage of restaurants using reusable food service ware

Type of restaurant	Dishware	Cups/Glasses	Cutlery
Full-service restaurants	96%	95%	93%
Limited-service restaurants	29%	23%	22%

For to-go food and drink, 59 restaurants (out of an estimated 85,000[12]) in California offer reusable food service ware for food or drink, typically working with a reuse service provider or, in one case, through a municipal swap style program.

Consumers also have the option to BYO food service ware, as was explicitly allowed by law (AB 619) in 2019, however, community engagement found that limited education and participation for BYO containers was a barrier to greater use, and some restaurants and cafés still do not allow personal containers for food or drinks. Participants who do BYO are already highly conscious of plastic use and taking multiple actions to reduce waste. Others said they were not aware of where BYO is accepted locally.

Spanish-speaking groups stressed the need for support for small, family-owned restaurants to adopt and sustain BYO. Participants could not name specific family-owned businesses that currently offer BYO. They suggested two kinds of support: clear, Spanish-language guidance and training on how to implement BYO safely and in compliance with regulations, and financial assistance or incentives to cover start-up and ongoing costs.

Affordability and Economic Access Limitations

The contractor assessed economic access considering differences in price per unit and in costs or savings from using reuse and refill solutions. The contractor used findings from consumer engagement to contextualize ability to use assisted payment programs including Supplemental Nutrition Assistance Program (SNAP), Women Infants and Children (WIC), and Electronic Benefit Transfer (EBT).

Price Comparison of Products Available in Reuse/Refill Formats versus Comparable Products in Single Use Formats

The contractor collected data for five products in stores across each California region and across urban, suburban, and rural census tracts: white rice, milk, surface cleaner, dish soap, and shampoo. These five products were selected by creating a list of the most common products purchased by people of all income levels in each product category, and what might be considered staple products. The contractor chose one food product, one beverage product, two home care products, and one personal care product from this list, ensuring that each one had at least one alternative format for comparison and that they were widely available in-store. The types of retail locations surveyed were grocery stores, convenience stores, drugstores, package-free shops, general merchandise stores, and warehouse clubs.

The contractor analyzed this data to understand how cost of goods varied depending on the packaging format. The contractor considered seven packaging formats, though no product was available in all formats. Generally, it was not possible to compare goods of the same brand across packaging types because most brands did not offer multiple in-store options of source reduced and nonsource reduced packaging for their good. In some cases, the contractor found that the product available in the refill or reuse format was not fully comparable to the comparison product in single use plastic packaging. For example, only a more premium version of white rice (such as organic or sushi grade) was available for in-store dispensing (refill format), rather than long-grain, nonorganic white rice which was the product for comparison in single use packaging. Similarly, most prefill milk in reusable glass bottles was organic, while the milk for reference in single use packaging was not. The contractor found that the brand available in the refill or reuse format was not the same produce in single use packaging.

Most, but not all, of the goods surveyed in California were primarily in single use packaging that were predominantly made of plastic. These were the exceptions:

- Evaporated milk was typically sold in metal cans with a plastic lining.

- Powdered milk was sometimes sold in paperboard boxes, with and without a plastic bag inside.

- Shelf-stable and cold milk were sold in coated paper cartons.

- Rice was sometimes sold in paperboard boxes or in cardboard boxes that held multiple single serving plastic containers.

- Dish soap, surface cleaner, and shampoo each had single use concentrated options sold in paperboard boxes, wrapped in paper, or with no packaging at all.

- Some surface cleaners were sold in glass or metal bottles (not returnable to the producer or refillable).

The full methodology for this data collection and description of all packaging/refill/reuse formats is detailed in Appendix B: Store-level Data Collection in California.

Table 7 shows the normalized unit price for each product across the six packaging formats considered. Values in Table 7 were calculated by averaging the price per normalized unit for the set of products in each combination of good and package format. The full methodology for this data collection, description of all packaging/refill/reuse formats, and normalized units for each good are detailed in Appendix B: Store-level Data Collection in California.

For example, because rice is sold in many different sizes, the normalized unit price for rice was dollars per ounce to allow for comparison across package sizes. Additional data tables and information about units and the unit normalization process of each good are detailed in Appendix A: Additional Data Tables for In-Store Data Collection. The results for white rice show that large format versions of rice are almost a quarter of the price of standard on a per unit basis and that refill-in-store rice is 26% more expensive

than standard single use plastic packages of rice. Rice is not available in the other formats that were analyzed.

Table 7: Price comparison of reuse and refill packaging formats versus baseline single use package in dollars per normalized unit

Product	Baseline Single use standard	Refill: Single use	Refill: Large format	Refill: Concentrate	Refill: Dispensing	Reuse: Prefill
White rice	0.19 (0)	N/A	0.00 (0)	N/A	0.24 (++)	None (0)
Milk	0.67 (0)	N/A	N/A	None (0)	None (0)	0.81 (+)
Surface cleaner	0.30 (0)	0.30 (0)	0.20 (--)	0.22 (--)	0.44 (++)	None (0)
Dish soap	0.27 (0)	0.27 (0)	0.15 (--)	None (0)	0.40 (++)	None (0)
Shampoo	0.97 (0)	0.85 (0)	None (0)	None (0)	0.84 (-)	None (0)

"N/A" indicates that this solution does not exist. "None" indicates that this solution does or could exist but was not encountered in the stores visited.

Table 7 Key

Color	Description
Darker Orange "++"	25% or lower than the percent of baseline single use packaging available
Lighter Orange "+"	12.5% lower than the percent of baseline single use packaging available
White "0"	+/-12.5% from percent of baseline single use packaging available
Lighter Blue "-"	12.5% higher than the percent of baseline single use packaging available
Darker Blue "--"	25% higher than the percent of baseline single use packaging available
Gray "N/A"	Not applicable

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Additional costs or savings of use by solution type

For each B2C solution identified in the Instances Database, the cost implication for the consumer to access that solution was captured (see Table 8). The vast majority of solutions (88%) have no cost to consumers. This is due to the large share of dispensing to replace packaging solutions in the data, but this was also true for at least three instances of each model, and for the one enabler.

The most common form of cost was a one-time membership fee, which was required to participate in the reusable food service ware systems operating at 50 locations in California, and in the Collection pilot. The 38 reusable food service ware programs indicating a per-use fee are for the rental of reusable food service ware from an event company, while the per-use fee for the prefill solutions was for prepared meal delivery services using reusable packaging. Twenty-five instances of food service ware programs, as well as five prefill systems use refundable deposits. All prefill systems that were found in California were for milk in reusable bottles.

Table 8: Cost implications of B2C reuse and refill solutions

Solution Model	No cost	One-time member-ship fee	Ongoing subscription	Penalty fee	Per-use fee	Refundable deposit
Apps and digital rewards	1	0	0	0	0	0
Prefill system	7	0	4	0	3	5
Refill via single use packaging	69	0	0	0	0	0
Reusable food service ware programs	3	50	0	1	38	25
Reusable packaging for shipping and logistics	6	0	0	0	1	1
Dispensing to replace packaging	819	0	0	0	0	0
Collection	0	1	0	0	0	0
Total	**905**	**51**	**4**	**1**	**42**	**31**

Use of Assisted Payment Programs

Consumers can access about 40%of reuse and refill solutions using at least one assisted payment program: 411 reuse and refill solutions, both e-commerce and in-store, can be accessed using at least one assisted payment program (e.g., SNAP, WIC, EBT), while 623 reuse and refill programs cannot be accessed or accessibility is unknown (e.g., Boox). Solutions that do not accept assisted payment programs include 130 reuse programs (e.g., prefill systems and reusable food service ware programs) that do not offer one at checkout or have a low starting cost to consumers. For 477 refill solutions (via dispensing or single use packaging), there was no indication that they accept assisted payment programs at checkout on their website.

Insights from Community Engagement - Refill Systems

Community engagement sessions revealed a strong perception that refill systems are not economically accessible for many households. Participants consistently described refill and package-free stores as expensive and targeted at a narrow, higher-income customer base. Participants often characterized these spaces as "bougie," with products and pricing that community members and CBO leaders felt were not designed for everyday families.

Even where participants noted presence of dispensing to replace packaging stations in grocery stores, they reported them as underused, primarily because these products cost more than their single use equivalents. Participants cited common household goods such as detergent, cleaning supplies, and personal care products specifically as "overly priced" in refill formats. For households already under financial pressure, particularly those relying on SNAP, WIC, or EBT, participants emphasized that refill systems remain out of reach if benefits cannot be applied to these purchases.

Participants frequently cited urban areas as localities with visible refill and package-free stores; however, they described these locations as costly niche spaces. Community members and CBO leaders noted that residents perceive refill-only stores as signs of gentrification, with products curated for a narrow consumer profile. This reinforced perceptions regarding who such stores are intended to serve.

Participants highlighted the need for clear, accessible information about dispensing to replace packaging stations and their associated costs. This suggests there remains a lack of familiarity with how refill systems work and their potential long-term cost savings, resulting in concerns about container deposits, how tare weight is measured, and how final prices are calculated. Those already using or interested in dispensing to replace packaging stations identified the uncertainty surrounding the initial cost or deposit on containers as a barrier to adoption. Participants also raised questions about how the weight of refill containers would be measured and how this would affect the final cost of products, particularly for those bringing their own containers rather than using store-supplied ones. As one participant observed, "Stores, like your average grocery store, don't really have these systems in a way people are familiar with."

Insights from Community Engagement - Food Service Ware

On food service ware, participants discussed two approaches: replacing single use plastic with nonplastic single use food service ware such as paper or molded-fiber takeout containers, paper straws, wooden or bamboo cutlery, and fiber lids; and adopting reusable take-out systems that require deposits, returns, and washing. Many viewed both as more expensive than current plastic options and expected restaurants to pass costs on to consumers, reducing affordability for lower-income households. Most comments focused on to-go containers, cups, lids, and cutlery. The only recurring negative experience with nonplastic single use food service ware was paper straws, which participants strongly disliked due to usability concerns.

Brand Choice Access and Availability

The contractor analyzed data collected from retail stores in California to assess the differences between single use and reuse and refill formats in choice of brand, packaging format, and retail location. Across the board, consumers have fewer choices for reuse and refill solutions compared to single use plastic alternatives, and in most cases significantly so.

The choice score is a summary metric calculated by taking the number of brands available in a refill or reuse solution format and dividing it by the total number of brands available for any single use plastic format for that product. For example, there were three unique brands of surface cleaner available in a refill via single use format across all retailers visited, while there were 71 unique brands in the single use plastic package format. We divided three by 71 to calculate the choice score of 0.04. Choice scores less than one indicate fewer options are available in reuse and refill formats compared to single use nonsource reduced. A score of one indicates equal choice, and scores over one indicate more choice for brands of reuse/refill options.

As Table 9 shows, consumers have far fewer brand options for purchasing goods in reuse and refill formats. Additional data tables on product and format choice scores are detailed in Appendix A: Additional Data Tables for In-Store Data Collection.

Table 9: Choice scores for reuse and refill formats compared to single use plastic options

Product	Count of unique brands for single use: All formats	Refill: Single use	Refill: Large format	Refill: Concentrate	Refill: Dispensing	Reuse: Prefill
White rice	42 (0)	N/A	N/A	N/A	0.12 (++)	0 (++)
Milk	56 (0)	N/A	N/A	0 (++)	0 (++)	0.04 (++)
Surface cleaner	71 (0)	0.04 (++)	0.01 (++)	0.11 (++)	0.15 (++)	0 (++)
Dish soap	68 (0)	0.09 (++)	0.37 (++)	0 (++)	0.16 (++)	0 (++)
Shampoo	220 (0)	0.01 (++)	0 (++)	0 (++)	0.06 (++)	0 (++)

N/A is indicated where a solution is not applicable. Zero is used where a solution does or could exist, but it was not encountered in stores during data collection for this analysis.

Key for Table 9

Color	Description
Darker Orange "++"	Choice scores between 0 and 0.5
Lighter Orange "+"	Choice scores between 0.5 and 1
White "0"	Choice scores equal to 1
Lighter Blue "-"	Choice scores between 1 and 1.5
Darker Blue "--"	Choice scores greater than 1.5
Gray "N/A"	Not applicable

Table 10 provides further detail into the presence of brand options across retail locations for the five products surveyed. All refill and reuse formats and products have few options compared to the baseline single use plastic package option. For example, there were only two brand options for milk in a prefill format while there were 40 brands of milk in single use plastic packaging. Additional data tables on brand variety are detailed in Appendix A: Additional Data Tables for In-Store Data Collection.

Table 10: Total count of brands observed across all retail locations (statewide)

Product	Baseline single use standard	Refill: Single use	Refill: Large format	Refill: Concentrate	Refill: Dispensing	Reuse: Prefill
White rice	41	N/A	N/A	N/A	5*	0
Milk	40	N/A	N/A	0	0	2
Surface cleaner	58	3	1	8	11	0
Dish soap	55	6	25	0	11	0
Shampoo	167	3	0	0	13	0

*There are five brands for refill via dispensing of white rice counting generic/unlabeled products as one brand.

Table 11 summarizes the average number of brands at each retail location by product and format. This provides another view of the difference in brand options. Because there are store brands (private label) at many retailers, no single retailer will ever have all of the brand options of another. This table shows the average number of brands per location to provide additional context into the situation in a single retail location. This view still reflects that there are substantially fewer reuse and refill options, but it shows that many retail locations offer at least one, while they may offer three to five brand options in the single use format, with shampoo at 14.7 being an outlier in this product selection.

Table 11: Average brands observed per retail location (statewide)

Product	Baseline single use standard	Refill: Single use	Refill: Large format	Refill: Concentrate	Refill: Dispensing	Reuse: Prefill
White Rice	3.0	N/A	N/A	N/A	1.0	0/A
Milk	3.0	N/A	N/A	0	0	1.1
Surface Cleaner	5.1	1.0	1.0	1.7	1.8	0
Dish Soap	5.6	1.3	3.3	0	2.0	0
Shampoo	14.7	3.0	0	0	2.6	0

Table 12 summarizes the percent of formats available in stores for each product type. Format availability is calculated as the total number of observations per format (out of all stores visited) divided by the number of retail locations where at least one format of the product was observed (meaning, a store that carries that product). This shows that while stores that carry a reuse or refill format will have brand choice, most stores do not carry a reuse or refill format at all. For example, only about one out of ten stores that sells surface cleaner offers it in a refill via concentrate form. Additional data tables on availability are detailed in Appendix A: Additional Data Tables for In-Store Data Collection.

Table 12: Format availability in store by product type

Format	Baseline single use standard	Refill: Single use	Refill: Large format	Refill: Concentrate	Refill: Dispensing	Reuse: Prefill
White rice	88% (0)	N/A	N/A	N/A	18% (++)	0% (++)
Milk	92% (0)	N/A	N/A	0% (++)	0% (++)	23% (++)
Surface cleaner	81% (0)	10% (++)	1% (++)	8% (++)	18% (++)	0% (++)
Dish soap	82% (0)	19% (++)	57% (++)	0% (++)	15% (++)	0% (++)
Shampoo	78% (0)	1% (++)	0% (++)	0% (++)	19% (++)	0% (++)

Note: The numerator is the number of observations per format. The denominator is all retail locations where at least one format of the product was observed.

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Key for Table 12.

Color	Description
Darker Orange "++"	25% or lower than the percent of baseline single use packaging available
Lighter Orange "+"	12.5% lower than the percent of baseline single use packaging available
White "0"	+/-12.5% from percent of baseline single use packaging available
Lighter Blue "-"	12.5% higher than the percent of baseline single use packaging available
Darker Blue "--"	25% higher than the percent of baseline single use packaging available
Gray "N/A"	Not applicable

Insights from Community Engagement (Specific to Refill)

Engagement in the Bay Area highlighted limited brand choice and product availability within refill and reuse systems as significant barriers to adoption. Participants repeatedly emphasized that dispensing to replace packaging stations and package-free shops rarely carry the brands they "know and trust." This concern was especially pronounced for food products, where brand reputation holds both cultural and practical importance.

Community members cited examples such as Goya beans, specific brands of rice, and familiar cereals, noting that these trusted staples are not offered in refill formats. For many households, particularly immigrant and low-income families, these brands represent reliability, cultural familiarity, and consistent quality. Participants stressed that such qualities cannot easily be replaced with boutique or unfamiliar alternatives. They also raised concerns about the origin and sourcing of refill products, inferring a lack of clarity about who manufactures them, where they are made, and whether quality, safety, and labeling standards match the name brand products they trust. Participants described this lack of brand availability and clarity about product origins as a barrier to adoption, reducing willingness to try refill options for staple foods. Participants reported a strong preference for trusted brands to meet their needs and expressed reluctance to purchase generic products in dispensing to replace packaging stations due to uncertainty about unfamiliar brands. Participants did not consider information on ingredients or whether products were organic as sufficient to motivate a switch. Many participants felt that generic products were less effective than branded options, particularly for household cleaning and personal care products. As one participant noted, "I trust the brands I use to meet my needs." A CBO representative emphasized, "It is very important to know the brand. Many of our members are committed to buying only from brands that are committed to their cause."

Other Considerations for Access and Availability

Ease of Use

The contractor assessed ease of use, technology, and accessibility to determine which populations can utilize the reuse and refill landscape today compared to what populations could utilize it if adjustments were made or circumstances changed.

The contractor assessed ease of use based on whether a solution required no instructions, simple instructions, or substantial instructions. The contractor defined these terms in this way:

- No instructions: Only require actions that will be familiar to most people from other common tasks in daily life. For example, purchasing a larger size package to pour into the smaller original package or returning rented items after using them.

- Simple instructions: Requires only one to three basic steps to use. For example, how much water to add to the bottle with the concentrate tablet, how to return a reusable shipping package, or where to return a borrowed reusable cup.

- Substantial instructions: Requires more than three steps and is likely to take more than ten minutes to understand and complete.

The contractor found that a majority, 963 of 1,034, of solutions could be operated based on simple instructions, while 69 refill via single use packaging solutions with a pouch/container or large format, as well as food service ware rentals, did not require any explicit instructions. Only two required substantial instructions – an enabling app and a toner refill-at-home kit.

The contractor assessed dispensing to replace single use plastic packaging as requiring only simple instructions based on in-store assessments of seven different refill in-store dispenser types.

What this assessment did not investigate is the overall consumer requirements of accessing each solution: how easy or hard was it to identify, did it require establishing new behaviors, such as remembering to bring a reusable item to be filled or used later, and the implications of this behavior for people reliant on public transit. These are significant and important considerations to consider, together with other accessibility considerations, in determining how comfortable consumers will feel using reuse and refill solutions.

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Table 13 summarizes the extent of instructions required to use each B2C reuse, refill, and enabling solution in the Instances Database

Table 13: Ease of use requirements by B2C solution type

Type	Model	Submodel	Easy, no instructions required	Operable with simple instructions	Requires substantial instructions
Refill	Dispensing to replace packaging	Dispensing to replace packaging	0	819	0
		Refill via large format packaging	13	4	0
		Refill via cartridge, pod, pouch, or container	15	4	1
		Refill via concentrate	3	29	0
Reuse	Prefill	Prefill at production facility	0	19	0
	Reusable food service ware programs	Open-loop food service ware program	0	62	0
		Closed-loop food service ware program	38	17	0
	Reusable packaging for shipping and logistics	B2C reusable tertiary packaging	0	8	0
Enablers	Apps and digital rewards	N/A	0	0	1
		Total	**69**	**963**	**2**

Community engagement results provided a different perspective. Community engagement findings show that participants viewed refilling reusable containers at a store or dispensing to replace packaging station as the most challenging alternative to single use plastic packaging. While 37% of participants said using a dispensing to replace packaging station would be easy or that they are already doing it, 63% described it as somewhat or very challenging. When asked what would make it easier to reduce single use plastic, only 23% of responses pointed to greater access to dispensing to replace packaging stations, the lowest share among the four options provided.

While there is no way to definitively reconcile these varying conclusions within the scope of this project, the contractor wishes to draw some distinction between the difference in methodologies employed in public engagement versus dispensing to replace packaging station ease of use testing. The contractor members involved in testing dispensing to replace packaging stations for ease of use were primarily interested in the dispenser equipment and in-store user experience, not the overall experience which includes a wide range of consumer habits and responsibilities, like buying, remembering to bring, and washing containers. The contractor members who engaged the public focused on a broader set of habits and experiences. While both methods had their specific purpose and rationale, a future iteration of this work could broaden the testing ease of use for refill to consider the entire ecosystem upon which the solution depends.

Technology Requirements

The contractor assessed technology requirements based on the need for internet access to access a solution. If a solution required the use of a smartphone, the contractor assumed it also required internet access. About 10% of solutions require access to the internet, approximately 5% require the use of a smartphone (and in turn, internet), and the remaining 85% do not require technology to use. This indicates that most active solutions in the Instances Database are widely accessible without the internet.

The contractor marked some refill via concentrate solutions as requiring access to internet because some retailers choose to offer them only via e-commerce, not on the shelf in store. In interviews with businesses, parties explained they are not purchased frequently enough to earn their shelf space. While there may be some retailers that do offer them in-store, access is much less common and is often only a portion of the product line rather than all of the options. As a result, some products do require internet access to be purchased via e-commerce. Additionally, some solutions in the dispensing to replace packaging model require internet because they must be ordered online and then picked up and returned at a set location. Mobile refilleries offer refill in various areas, and the internet can be used to confirm when and where they will be operating. Most open-loop reusable food service ware programs require the use of a smartphone to track rentals and returns through an app or by scanning a quick response (QR) code present at participating locations.

Table 14 summarizes the potential technology needed to access each B2C reuse, refill, and enabling solution in the Instances Database.

Table 14: Technology requirements by solution type, model, and submodel

Type	Model	Submodel	Requires access to internet	Requires use of smartphone	None
Refill	Refill/product delivery via dispensing	Dispensing (replacing packaging)	13	0	830
		Dispensing (replacing single use plastic food service ware)	0	0	0
	Refill via single use packaging	Refill via large format packaging	17	0	0
		Refill via cartridge, pod, pouch, or container (excludes concentrates)	19	0	1
		Refill via concentrate	31	0	1
Reuse	Prefill	Prefill at production facility	13	0	6
	Reusable food service ware programs	Open-loop food service ware program	3	49	10
		Closed-loop food service ware program	9	0	46
	Reusable packaging for shipping and logistics	Reusable tertiary packaging	7	0	1
		Reusable dunnage	0	0	0
Enablers	Apps and digital rewards	N/A	0	1	0

The contractor only included categories with solutions active in California in Table 14.

Americans with Disabilities Act (ADA) Accessibility and Compliance

The contractor assessed all reuse and refill solutions to be equally compliant with ADA accessibility requirements as their single use plastic packaging counterparts, and some solutions even offer potential for greater accessibility options by giving consumers the ability to choose packaging types that work for them. To ensure that reuse and refill solutions achieve their potential to be as or more accessible compared to their single use counterparts, design of these systems need to incorporate ADA accessibility requirements as they further develop and scale.

The contractor evaluated in-store accessibility, physical packaging manipulation, and visual packaging accessibility to detail implications for ADA. In-store accessibility relates to how accessible a product or dispensing to replace packaging station is based on its physical location. Packaging manipulation was evaluated based on users' physical requirements or abilities needed to hold, open, and close the packaging. Visual accessibility was evaluated based on the size, color, and font of words on the packaging, in addition to other elements (e.g., presence of raised symbols). The contractor included evaluation of ADA accessibility for reuse and refill solutions in the in-store data collection and supplemented these activities with interviews with interested parties, desk research, and insights from community engagement. The contractor rated each solution type as never, sometimes, or always accessible based on these criteria and the information gathered. Each solution type was determined to be more, equally, or less accessible than comparable single use options.

The contractor implemented the assessment criteria by estimating how frequently the solution is or can be accessible from an ADA perspective:

- Never accessible: There are inherent characteristics to this type of reuse or refill solution that cannot be reasonably adapted to be made accessible. For example, it will always require two hands to use and will therefore never be accessible.

- Sometimes accessible: This solution's accessibility depends on the specific details of implementation, and there are identified examples of accessible solutions operating today.

- Always accessible: This solution is always accessible by its very nature. For example, when an individual can choose which packaging to fill at a dispenser, they can always choose a package that is accessible, so physical manipulation would always be accessible.

Table 15: Evaluation of ADA accessibility: physical accessibility in store

Model	Physically accessible in store	Physically accessible in store – comparison	Accessibility considerations
Dispensing to replace packaging	Sometimes accessible	Equally accessible	General retail store accessibility; Aisle width for dispenser location; Ability to reach dispenser or scoop container while using an assistive mobility device; Space to set refillable packaging down for opening, during filling, and closing; Physical strength or dexterity required to operate dispenser; Tactile or auditory cues to facilitate use of dispenser by people with visual impairments
Dispensing to replace food service ware	Sometimes accessible	Equally accessible	General retail store/food service operation accessibility; Counter/dispenser height and accessibility for those using assistive devices
Refill via single use packaging: Refill via large format packaging	Sometimes accessible	Equally accessible	General retail store accessibility; Shelf height; Weight of package
Refill via single use packaging: Refill via concentrate	Sometimes accessible	Equally accessible	General retail store accessibility; Shelf height
Refill via single use packaging: Refill via cartridge, pod	Sometimes accessible	Equally accessible	General retail store accessibility; Shelf height
Prefill systems: Prefill at production facility	Sometimes accessible	Equally accessible	General retail store accessibility; Shelf height; Accessibility for relevant mechanism of return (return point, mail drop, return to store, other)

Model	Physically accessible in store	Physically accessible in store – comparison	Accessibility considerations
Prefill systems: Prefill via fractional manufacturing	Sometimes accessible	Equally accessible	General retail store accessibility; Shelf height; Accessibility for relevant mechanism of return (return point, mail drop, return to store, other)
Reusable food service ware programs: Open-loop	Sometimes accessible	Equally accessible	General food service operation accessibility; Height of the opening for return points and physical requirements for depositing an item
Reusable food service ware programs: Closed-loop	Sometimes accessible	Equally accessible	General food service operation accessibility; Height of the opening for return points and physical requirements for depositing an item
B2C reusable transport packaging	N/A	N/A	For solutions requiring return away from home, accessibility for return (return point, mail drop, return to store, other)

Table 16: Evaluation of ADA accessibility: Package accessibility – Physical manipulation

Model	Package accessibility - Physical manipulation	Package accessibility - Physical manipulation comparison	Accessibility considerations
Dispensing to replace packaging	Always accessible	More accessible	Reusable package is chosen by user, so it can meet any accessibility requirements
Dispensing to replace food service ware	Always accessible	More accessible	Reusable food service ware is chosen by user, so it can meet any accessibility requirements
Refill via single use packaging: Refill via large format packaging	Sometimes accessible	Equally accessible	Dexterity or strength required to open package; Weight of package
Refill via single use packaging: Refill via concentrate	Sometimes accessible	Equally accessible	Dexterity or strength required to open refill package
Refill via single use packaging: Refill via cartridge, pod	Sometimes accessible	Equally accessible	Dexterity or strength required to assemble or configure, open and close the refill package
Prefill systems: Prefill at production facility	Sometimes accessible	Equally accessible	Dexterity or strength required to open and close the package
Prefill systems: Prefill via fractional manufacturing	Sometimes accessible	Equally accessible	Dexterity or strength required to open and close the package

Model	Package accessibility - Physical manipulation	Package accessibility - Physical manipulation comparison	Accessibility considerations
Reusable food service ware programs: Open-loop	Sometimes accessible	Equally accessible	Food service ware ability to be easy to grasp and to accommodate straws
Reusable food service ware programs: Closed-loop	Sometimes accessible	Equally accessible	Food service ware ability to be easy to grasp and to accommodate straws
B2C reusable transport packaging	Sometimes accessible	Equally accessible	Dexterity or strength required to open and close the transport package

Table 17: Evaluation of ADA accessibility: Package accessibility – Visual accessibility

Model	Package accessibility - Visually accessible	Package accessibility - Visually accessible comparison	Accessibility considerations
Dispensing to replace packaging	Sometimes accessible	Equally accessible	Size, contrast, and legibility of text on dispenser label; Use of appropriate visual cues to communicate important warnings, such as presence of common allergens; Design for compatibility with assistive devices where possible
Dispensing to replace food service ware	Sometimes accessible	Equally accessible	For digital or tech-enabled food or drink dispensers, legibility of text on screen, design for compatibility with assistive devices where possible
Refill via single use packaging: Refill via large format packaging	Sometimes accessible	Equally accessible	Best practices for visual accessibility for packaging
Refill via single use packaging: Refill via concentrate	Sometimes accessible	Equally accessible	Best practices for visual accessibility for packaging, with special consideration for small format packaging
Refill via single use packaging: Refill via cartridge, pod	Sometimes accessible	Equally accessible	Best practices for visual accessibility for packaging, with special consideration for small format packaging
Prefill systems: Prefill at production facility	Sometimes accessible	Equally accessible	Best practices for visual accessibility for packaging

Model	Package accessibility - Visually accessible	Package accessibility - Visually accessible comparison	Accessibility considerations
Prefill systems: Prefill via fractional manufacturing	Sometimes accessible	Equally accessible	Best practices for visual accessibility for packaging
Reusable food service ware programs: Open-loop	Sometimes accessible	Equally accessible	Size, contrast, and legibility of text providing instructions for deposit/check-out (if applicable) and return, whether on food service ware itself, in other signage or in digital form
Reusable food service ware programs: Closed-loop	Sometimes accessible	Equally accessible	Size, contrast, and legibility of text providing instructions for deposit/check-out (if applicable) and return, whether on food service ware or in other signage or in digital form
B2C reusable transport packaging	Sometimes accessible	Equally accessible	Size, contrast, and legibility of text providing return instructions on package

The in-store accessibility of dispensers varied, with some at table height or below and others on higher shelves. This is comparable to the in-store experience of purchasing single use products with store shelves at variable heights.

Data gathered from in-store testing of dispenser types showed that dispensers in use today commonly require two hands to operate, though small adaptations, such as providing places to rest a container while filling it, would address this. Greater detail on the in-store testing is provided in section, Time and physical requirements to complete the refill process.

Through in-store observations, the contractor found that visual accessibility of products varied as well, with the product name in larger font and the ingredients in smaller font for a typical refill dispenser. The contractor found inconsistent legibility of labels. This is comparable to font sizes and readability, which can be influenced by factors such as distortion of lettering due to a package's nonrigid structure, of most single use packaging types.

While the contractor observed varied levels of accessibility in stores, they found most solution types equally accessible, if not more accessible both physically and visually compared to single use alternatives, as shown in Tables 16, 17, and 18. While reuse and refill solutions in operation today are not always fully accessible, any future growth or expansions of reuse and refill system could ensure that all systems are fully accessible.

The contractor conducted community engagement sessions with people who are differently abled, including those using wheelchairs, walkers, or canes, people with low vision or blindness, persons experiencing hearing loss or deafness, and people who shared that they are neurodivergent. High-level findings from the sessions include:

- Those in wheelchairs shared that overhead dispensing to replace packaging stations cannot be reached, and to use scoop-style stations they need to turn their chairs sideways and access them with two hands, creating barriers. Those who described themselves as being shorter in stature reported difficulty reaching the height of the dispensers.

- Those using walkers and canes expressed difficulty holding their mobility devices while attempting to use a dispensing to replace packaging station, describing the process as difficult and unsafe.

- People with low vision or blindness said they would need to rely on others to let them know that refill options are available and would likely depend on family or community members to assist them. They also emphasized the need for large print and braille labels on containers. One participant, probably in her twenties, at the pop-up in Oakland shared: "I am here with my sister, but I like to do things independently, including my grocery shopping. I shop at the same two grocery stores and because I have memorized the layout of those stores, and in stores I have never been to or don't shop at often, I use my cane and apps like Google Lookout and Be My Eyes. Technology is my friend. I used to have to ask people

to help me find store staff and then wait for staff to have time to help me. Sometimes I had to wait a long time for this help. I would like to use refill stations because I like to be environmentally responsible, and I think it will be possible if you talk to people like me to figure out how to make it work. Thank you for being in my neighborhood and listening to me."

The contractor has included additional findings from engagement with communities living with disabilities in Appendix A: Communities with disabilities.

Time and Physical Requirements to Complete the Refill Process

Based on in-store testing, which is detailed in the Appendix B methodology, the time to complete the refill process for each dispenser type averaged between one to two minutes. This is longer than the single use packaging experience, which generally takes seconds to select the product.

Table 18 summarizes the physical and dexterity requirements associated with each dispenser type as well as the average time required to complete the refill process based on contractor testing. All dispensers required two hands to use, with variations in the level of dexterity required.

Table 18: Time and physical requirements to complete refill process by dispenser type (Photo credit to Perpetual)

Dispenser type	Physical requirements	Dexterity requirements	Time to dispense and weigh product (minutes)
Spigot	1 hand to hold container, 1 to open spigot	Ability to grip and turn small spigot handle	1:40

Dispenser type	Physical requirements	Dexterity requirements	Time to dispense and weigh product (minutes)
Small container scoop	1 hand to hold container, 1 to scoop	Ability to grip a small scoop or spoon handle	1:45
Large container scoop	1 hand to hold container, 1 to scoop	Ability to lean forward to scoop product out of deep container and into a smaller container	1:00

Dispenser type	Physical requirements	Dexterity requirements	Time to dispense and weigh product (minutes)
Pump bottle	1 hand to hold container, 1 to press pump	Ability to flatten hand and push down on top of pump	1:30
Push button	1 hand to hold container, 1 to push button	Ability to use one finger to push start and stop	1:50

Dispenser type	Physical requirements	Dexterity requirements	Time to dispense and weigh product (minutes)
Turn dial	1 hand to hold container, 1 to turn dial	Ability to grip small handle to turn dial and open spout	1:20
Lever	1 hand to hold container, 1 to pull lever	Ability to grip narrow lever handle and pull or push down	1:10

Language Access

The contractor found all websites for reuse and refill solutions in California available only in English. There was no publicly available evidence that reuse service providers offer signage in any language other than English. In retail and grocery stores, packaged formats were the only product type with other languages, including some source reduced options like large format bags of packaged food or concentrated products. Based on store visits conducted by the contractor in California, smaller retailers—such as convenience stores and international markets—were the most likely to carry packaged food, home, and personal care products labeled in one to three languages.

Through the community engagement, Spanish-speaking groups reported very few opportunities to use personal containers or access reusables at restaurants, and they emphasized the need for bilingual promotion in community hubs. Some participants said

they try to refuse straws or utensils but feel embarrassed or overlooked when staff ignore their request. They emphasized that bilingual signage and reminders could make this easier.

Additional insights on accessibility from community engagement

Comments on the Refill Experience

Community engagement participants offered a range of ideas for making dispensing to replace packaging stations more user-friendly and accessible. Suggestions included adding a button or dial instead of the pull-down mechanism to allow users to control the amount of the good dispensed and place dispensing to replace packaging stations in the same aisles where products are typically sold (e.g., cereal with cereal, rice with rice). One participant explained, "When I go into a store for something, I go to the aisle with that product. I don't even think, 'oh, maybe I can find that item at the refill station.'"

Participants discussed the idea of staffing dispensing to replace packaging stations similar to a deli counter, where questions could be answered and container weight could be measured and subtracted from the total weight when filled. As one CBO representative shared, "I love this idea. I think this could inspire people to try refill stations and lead to the creation of new jobs." At the same time, some participants expressed concern that these new approaches could increase both costs and wait times.

Members of more urban communities cited barriers to dispensing to replace packaging stations including distance, weight, higher costs, ADA/disability access, hygiene/food safety, brand choice, convenience, and social exclusion. In comparison, most people living in suburban and rural areas felt that the most prominent barriers were cost, brand choice, breakability of containers, and availability of dispensing to replace packaging stations.

Cultural and Community Relevance for Dispensing to Replace Packaging Systems

Participants frequently expressed feeling "othered" in refill environments, reinforcing perceptions that these systems are not currently designed for, or inclusive of, broader populations CBO representatives noted that low-income communities often have fewer options and, even when available, refill systems are not culturally or economically tailored. As one CBO participant explained, "If you're talking about families in lower-income neighborhoods, it's not realistic. They don't see these as made for them."

Perceptions of what constitutes a dispensing to replace packaging station also varied across groups. Monolingual Chinese (Cantonese and Mandarin-speaking) participants described refill systems as open-air markets where consumers fill bags with herbs, fruits, vegetables, or baked goods. Latino participants reported familiarity with scoop-style dispensing to replace packaging stations in stores such as Sprouts and Rainbow Grocery but said they did not use them. Instead, they described open-top barrels of beans and salsa stations in ethnic markets as their version of refill, relying on store-provided plastic bags or clamshells rather than bringing their own containers.

These perspectives highlight the importance of ensuring that refill systems reflect cultural practices and household needs. As one CBO representative cautioned, "Refill stations will need to, first, contain products we use when cooking, and second, cost less than the packaged versions, otherwise this will not catch on in our communities."

Community Insights for Prefill, or Recirculating Reusable Containers

Participants were less familiar with the prefill and recirculating reusable containers concept than with reusables for takeout or dispensing to replace packaging stations, but once explained, many saw it as a promising and workable solution for reducing single use plastic packaging. Of all the options discussed, this strategy generated the most excitement. Buying products in standardized reusable packaging, using them, then dropping them at a return point to be washed, refilled, and put back into circulation paired with some type of reward felt practical, modern, and appealing. Compared to other strategies, participants raised fewer barriers to adoption and devoted mental energy to describing how such a system could succeed in their communities.

Barriers to Recirculating Reusable Containers

The following were found to be potential barriers to recirculating reusable containers:

- **Technology:** Participants worried that requiring QR codes or mobile applications would exclude older adults, people with low literacy, those with limited English, or people without smartphones. While most agreed many could use technology, they wanted options that do not rely solely on digital tools.

- **Privacy concerns:** Linking containers to individuals to track rewards raised concerns about shopping and return behaviors being monitored. This felt particularly sensitive for undocumented participants, who emphasized the need for an anonymized option.

- **Cost perceptions:** Many assumed goods that come in a packaging that is reusable or refillable (e.g., glass jars) would be more expensive, either through higher shelf prices or deposits that might not be refunded quickly. For families on tight budgets, the upfront price mattered more than longer-term savings.

- **Product choice and availability:** Participants worried these systems would first target higher-cost or specialty goods, like premium body wash or cleaning supplies, making them feel geared toward wealthier or environmentally engaged consumers. They wanted programs to start with everyday staples, like dish soap, canned beans, pantry basics, to make participation relevant for all households. Some said dairy products like milk or yogurt felt less feasible for reuse due to concerns about milk products reacting to metal products, "milk and dairy products are acidic, which can be reactive to metal containers that are not food-grade stainless steel".

- **Awareness and newness:** Almost all participants had never heard of such a system. They said mass education campaigns and visible pilots would be needed to build awareness and avoid confusion.

Opportunities and Desired Features for Recirculating Reusable Containers

The following were found to be opportunities for circulating reusable containers:

- **Convenient and standardized return bins:** Make bins as easy to find as recycling or compost stations, ideally located at major grocery stores and neighborhood hubs.

- **Make drop-off sites where people already go:** Participants wanted bins at everyday locations such as grocery stores, libraries, school pick up zones, and gas stations. Several suggested that CBOs could help manage rewards, since they already serve as trusted educators in their communities.

- **Simple and low-cost deposit models:** Participants viewed deposits or incentives positively but stressed they must be low-barrier and refunded immediately. Participants viewed modest credits or loyalty rewards as motivating.

- **Options for collective rewards:** Some participants preferred collective benefits over individual rewards, suggesting returns could support community projects such as playground equipment, food distribution, or senior lunches.

- **Retailer and producer responsibility:** Participants said large supermarkets, national brands, and online retailers should manage logistics, washing, and redistribution. They cautioned against placing the burden on small businesses or individual consumers. Some also saw potential for new jobs through local pick up and drop-off services.

- **Transparent cleaning practices:** Participants wanted clear information on how containers are sanitized, with suggestions ranging from videos to signage to public campaigns. Demonstrating both health safety and environmental benefits was seen as critical to building trust.

- **Multilingual education:** Participants viewed clear written instructions in Spanish, Traditional and Simplified Chinese, Vietnamese, Tagalog, and English as essential to ensuring participation across California's diverse communities.

Unique Regional or Priority Community Insights Related to Recirculating Reusable Containers

The following are insights by type of area or region:

Urban areas

- Participants expressed concerns about contamination in container-deposit bins, noting that people may place unrelated packaging, food service ware, and trash into them. Participants expressed heightened concerns in areas with high levels of litter, dense urban waste, and the presence of unhoused individuals nearby. They suggested placing bins in trusted or monitored locations such as school campuses, libraries, or CBO facilities.

- Some also pointed to technology solutions, such as bins that only open after scanning, to ensure that only the correct containers are deposited.

Rural areas

- Participants liked the idea but stressed that bins would need to be available at all major grocery stores to work for families who shop infrequently.

- Participants expressed sensitivity to cost; participants said they could not afford higher shelf prices or large deposits.

- Participants found the idea of recirculating reusable containers less feasible for day-to-day shopping in small, dispersed towns where return point access would be limited.

Community Suggestions for Improving Accessibility of Reusable Food Service Ware

- **Bring it, leave it, or borrow it model:** In rural and suburban settings, participants described or imagined programs where cafés provide a "library" of reusable mugs that consumers can take, borrow, bring or return without question. Participants viewed this as a practical solution in smaller, rural, or mountainous communities where trust and familiarity between businesses and consumers is higher. Participants noted that this approach would be more challenging to manage in dense urban environments.

- **Return-from-home options with incentives:** For takeout, people liked the idea of returning containers on their own schedule, with modest discounts or credits for doing so.

San Francisco Bay Area

- Participants referenced local ordinances in Berkeley, San Francisco, and Alameda, and saw stricter regional implementation as realistic; they pointed to local "Skip the Stuff" ordinances as proof that requiring businesses to ask first if the consumer wants the food service ware item makes refusal simple and effective.

- Participants said incentives and education campaigns would likely succeed because communities already have exposure to zero waste initiatives.

Coastal region

- Concerns about marine debris made participants supportive of reducing single use plastic food service ware, and they would like to see the refusal of those items in restaurants framed as an action to directly protect the ocean. They noted that cultural shifts are especially needed in tourist-heavy dining areas.

- Participants flagged food courts and tourist hubs (beach towns, boardwalks) as ideal pilot sites for reuse systems.

Mountain region

- Small towns and dispersed restaurants rarely offered reusable options.

- Participants suggested seasonal tourism areas like ski resorts or campgrounds as places where shared return systems could work.

Central Valley

- Farmworker families and CBOs said single use plastic food service ware is essential during harvest season when time is scarce, primarily for take-out meals and quick cleanup for larger family meals at home.

- Reuse systems would need to be very simple and low-cost to gain traction.

Los Angeles and San Diego Basin

- While the region has many dense urban areas, participants noted the strong driving culture makes it harder to imagine district-wide systems where containers can be dropped off at multiple restaurants.

- Community members and CBOs from Los Angeles and San Diego Basin engagements liked the idea of placing return bins at gas stations, since they are a convenient, frequently visited location to declutter vehicles.

- Participants said refusal was hardest in fast-casual restaurants where single use plastic and nonplastic food service ware are handed out automatically.

Cantonese and Mandarin-speaking participants

- Cantonese and Mandarin-speaking participants noted that many Chinese takeout traditions already use less plastic or plastic-free packaging, such as paper boxes and wood chopsticks, reserving plastic for foods like soups or Xiao long bao (soup dumplings).

“Everyone knows when they see a pink paper box in someone’s hands here in Chinatown, they bought dim sum. We don’t use plastic forks, we use wood chopsticks, we put our noodles and rice in paper boxes, but for hot soup the compostable non-plastic options just don’t work.” - Cantonese-speaking community member from San Francisco

- This user group expressed more skepticism about sanitation of shared containers and stressed the importance of visible, trusted cleaning practices.

Findings Related to Business Access to Reuse and Refill Solutions

This section uses the Instances Database, Solutions Dataset, information from interviews with interested parties, and additional desk research to analyze access to and availability of B2B reuse and refill solutions in California.

B2B Landscape of Reuse and Refill in California Today

Reuse and refill solutions available to businesses in general include:

- Refill via single use packaging (all three submodels).
    - Refill via large format packaging
    - Refill via concentrate
    - Refill via cartridge, pod, pouch, container
- Prefill (both submodels).
    - Prefill at production facility
    - Prefill via fractional manufacturing/co-filling site
- Reusable food service ware programs
    - Closed-loop food service ware program
    - Open-loop food service ware program
- Reusable packaging for shipping and logistics (both submodels)
    - Reusable secondary packaging.
    - B2B reusable tertiary packaging.
- Enabler: Technical assistance for reuse adoption for dine-in for restaurants.

The refill via single use packaging models are available to businesses as they purchase cleaning and hygiene products, personal care products (for hospitality refills), office supplies, and other products. The Instances Database contains a sampling of relevant products, but the available market goes well beyond what has been included.

The contractor identified three active B2B prefill solutions. Two serve back of house food service packaging needs: Dispatch Goods, a reuse service and logistics operator, provides cut produce, brined vegetables (pickles, olives), and other food through a prefill at production facility model; while Eco Refill Solutions delivers cooking oil for food service back of house use in metal containers through a prefill via fractional manufacturing/co-filling model. The third is PACT Group's Circular Garment Hanger service. The contractor considered this prefill because garment hangers qualify as primary packaging (they closely contain the product, and they provide the consumer with an individual unit). Garments are typically put on reusable hangers at the production facility and then shipped. Hangers are recovered from retailers and recirculated for multiple uses.

Reusable food service ware programs are available both in a closed-loop context for businesses like stadiums, venues, event organizers, and cafeterias/office kitchens (one service provider is currently operating in California) and in an open-loop context for restaurants and other businesses selling ready-to-consume food and beverages (zero

service providers are operating in California currently). While these programs are ultimately consumer-facing, the service contract is between the businesses.

Additionally, the contractor found a robust reusable secondary packaging and tertiary packaging sector operating in California, and globally, which sells or facilitates the use of reusable plastic containers (RPCs) used to transport produce, eggs, and meat, and intermediate bulk containers (IBCs) and drums used for liquids and powders.

The B2B reusable transport solutions included in the Instances Database are those where reuse or refill solutions are offered as a service. For businesses that prefer to implement solutions internally and with supply chain partners, they can purchase reusable tertiary packaging such as reusable pallets, IBCs, RPCs, and others. Reuse or refill as a service requires a B2B service agreement with the provider, while implementing solutions internally requires the purchase of reusable packaging.

Table 19 summarizes the types of reusable tertiary packaging that businesses can consider adopting, either through a service model or under their own management. See the Glossary for definitions and further descriptions of each reusable tertiary packaging item.

Table 19: Overview of reusable tertiary packaging solutions

Reusable tertiary packaging item	Single use plastic weight or components reduced	Success stories from businesses
Totes, bins, and crates	• Tape Bands • Waxed boxes • Corrugated plastic boxes • Single use plastic bags	• Ghirardelli Chocolate, Food and Beverage • Food Maxx, Retail
Intermediate bulk containers, drums	• Single use intermediate bulk containers or drums	• America's Best Coffee Roasting Co., Food and Beverage • EMC, Manufacturing
Pallets	• Single use plastic pallets	• Bay Area Newsgroup, Manufacturing • US Foods, Food and Beverage
Pallet wrap, bands	• Single use plastic stretch film	• Straus Family Creamery, Food and Beverage • Finelite, Manufacturing
Dunnage	• Single use inflatable plastic bags • Single use plastic loose fill (e.g., packing peanuts)	• Herman Miller, Manufacturing

Finally, the contractor found the technical assistance provided by ReThink Disposable and Zero Waste Humboldt to help restaurants switch from single use plastic food service ware to reusable food service ware for dine-in to be an enabler relevant in a B2B context.[13]

B2B reuse solutions being used internally and between businesses is not typically publicly accessible information. These solutions and practices can only be identified where (a) third party service providers are offering the service, which can then be identified as available in the marketplace; (b) companies choose to highlight their supply chain practices through press releases or case studies; and (c) through interviews with companies willing to discuss these practices. Most interviews completed by the contractor generated qualitative and directional numbers, but no substantive quantitative data points. This report captures the publicly available information, with recognition that this is not a full accounting of reuse business practices in use today.

The Instances Database catalogs reusable tertiary packaging offered as a service (not reusable transport products offered for sale) and includes nine businesses providing B2B reusable transport solutions in California currently. Seven of these businesses offer multiple formats of reusable tertiary packaging as a service, including IBCs, pallets, and totes: ContainerPAL, Goodpack, CHEP, IFCO, Tosca, and Hoover CS. Startup Returnity offers a program called The Last Box that enables companies to ship products between distribution centers, stores and back in durable reusable shipping boxes.

The other two businesses are in the process of fully coming to market with their reusable pallet wrap service offerings: Green Spider and Pallet Wrapz. The contractor also identified completed pilots of reusable pallet wrap. A summary of findings published in 2022 reported that the reusable alternatives to stretch wrap "were successful when suitable management and return systems are in place to prevent damage and maximize repeated use" and noted that the complexity of some supply chains created challenges for returns, but that when used enough times, the reusable options were environmentally better than the recycled or composted stretch wrap alternative options.[14]

Table 20 summarizes the service businesses included in the Instances Database by model and submodel.

Table 20: Number of B2B reuse and refill solutions identified by type, model, submodel, and level

Type	Model	Submodel	Level	Number of companies providing solutions
Reuse	Prefill systems	Prefill at production facility	Primary	2
		Prefill via fractional manufacturing/co-filling site	Primary	1
	Reusable food service ware programs	Closed-loop food service ware program	n/a	1
		Open-loop food service ware program	n/a	5
	Reusable packaging for shipping and logistics	Reusable secondary packaging	Secondary	4
		Reusable tertiary packaging	Tertiary	7
Enablers	Technical assistance for reuse for dine-in	n/a	n/a	2

Hygiene and Food Safety

Hygiene and food safety was discussed in the Findings From Data Analysis section within the B2C Landscape of Reuse and Refill subsection. Federal food code explicitly allows for the use of reuse and refill solutions when correct procedures are in place, and this is true in the B2B context as well. Refer to the B2C section for details on how food code addresses reuse and refill solutions.

Standardization, Harmonization and Pooling

Of the seven reusable tertiary packaging companies offering solutions today, five are using pooling (with partial or full standardization) and two are using standardization. Pooling is an efficient model for B2B reusable tertiary packaging because it allows consumers to use the nearest available container, potentially allowing for a lower cost of service.

Impact on Jobs

The impact of jobs in the B2B context was assessed using the same approach as for B2C solutions (see Impact on Jobs in the B2C section for additional detail) and considering where these solutions operate differently in a B2B context. See Table 21 for a summary of job impacts.

The contractor assessed the potential direct impacts of reuse and refill solutions on jobs, in and outside of California, relative to the current single use plastic status quo. The assessment considered both what has been observed already about job impacts the potential impacts that would be expected as reuse and refill solutions achieve a larger scale. The potential for changes to the number of jobs in California are considered for first order (i.e., direct) impacts, including how each solution type impacts production, package filling, transportation, retail, and, where applicable, collection, washing, and recirculation. Second order job impacts (i.e., indirect) were not considered for this analysis. Second order impacts include changes to package manufacturing, company overhead expenses (e.g., from changes to how reusable packages appear in financial statements, or to support tracking of containers), material demand, and waste management.

The B2B tertiary packaging for goods sold via refill in store can be either single use or reusable. When this packaging is reusable, it requires backhauling to the production facility or an alternative filling location (e.g., a co-filling or co-manufacturing facility, as in the case of prefill) to be washed and refilled. This additional step requires labor for transportation and cleaning, though the filling is not additive to what would have been done in a single use context unless the refill process for the reusable package is slower.

B2B refill via single use packaging is not materially different in job impacts than B2C, where findings showed no impact for refill via large format and refill via cartridge or pod, but did identify that products sold in concentrated form would result in a decrease in transportation needs, which could potentially decrease jobs in California.

Prefill systems in a B2B context — like for primary packaging for delivery of back of house food service ingredients — increases jobs in California related to co-filling, when goods are transported in intermediate bulk containers for repacking into consumer (food service) packaging, as well as in the collection, washing, and inspection of reusable packaging because this is all new labor that is not accounted for in current costs. The contractor expects reusable food service ware programs to create new jobs in California, as labor is needed to recover, wash, inspect, and redistribute reusable food service ware, whether it is being utilized in a closed or open-loop context. The magnitude of job creation would depend on the volume of reusable food service ware being circulated.

B2B tertiary packaging systems such as pooled pallets and RPCs are promoted as reducing labor costs by the Reusable Packaging Association ("Designed to optimize both manual and mechanical handling (i.e. forklifts), reusable packaging reduces the time needed to perform supply chain activities")[15], though these specific solutions are of less interest in this context as they do not typically displace much single use plastic.

B2B reusable pallet wrap solutions are still maturing as a solution, so there is uncertainty in their potential impact on jobs at different levels of scale. Whether or not reusable pallet wrap adds labor, is labor neutral, or saves labor will depend on the relative time it takes to use it compared to the single use stretch wrap alternative. Network efficiency at the system level will also impact the amount of labor required, as this will determine the percentage of the time that reusable pallet wrap is shipped in use or shipped for use in another location, effectively requiring its own transport labor, which would create jobs where it is in operation.

Technical assistance for dine-in reuse is when restaurants are provided with free or low-cost support to reduce their use of plastic covered material. While providing the support does rely on staff time, which creates temporary jobs as the assistance is being provided, this does not impact jobs long-term. Dine-in restaurants that switch to reusable food service ware can result in more washing of dishes or other food service ware, which has the potential to increase labor, though case studies suggest that most restaurants experience cost savings from these changes, which would indicate no significant increase in labor[16].

Table 21: Summary of job impacts for B2B reuse and refill solutions in California

Model and submodel	No direct impact	Potential to directly create jobs in California	Potential to directly reduce jobs in California	Explanation
Refill via single use packaging: Refill via large format packaging	X			• Comparable in labor intensity to single use plastic packaging models in most ways • Expected to require less single use plastic per unit of goods, which could impact transportation efficiencies and resulting labor, but it is not possible to generalize based on available data
Refill via single use packaging: Refill via concentrate			X	• The greatly reduced weight and size of the refill product allow for more efficient transport, which would be expected to result in fewer trips needed to deliver the same quantity of product, which could reduce transportation jobs • The impacted jobs could be in California, or they could be long-haul trucking or other mode of transportation jobs based out of state
Refill via single use packaging: Refill via cartridge, pod, pouch, container	X			• Same as refill via large format packaging

Model and submodel	No direct impact	Potential to directly create jobs in California	Potential to directly reduce jobs in California	Explanation
Prefill: Prefill at production facility	X	X		• Comparable to single use packaging for manufacturing and filling, though subscale these can be slower and more labor intensive • Inspection and sorting for reusable packaging in a prefill system require new labor • Collection may require new labor, though some collection methods leverage existing labor, such as prefill programs where consumers return packaging by mail. Impact on jobs would correlate with the scale of the system
Prefill: Prefill via fractional manufacturing/co filling site		X		• Findings from prefill at production facility apply here, except where production facility is located out of state which could impact location of jobs • Adds an extra filling step. This process adds labor, and these jobs would be located in California as they would be within the reuse service area

Model and submodel	No direct impact	Potential to directly create jobs in California	Potential to directly reduce jobs in California	Explanation
Reusable food service ware: Open-loop food service ware program		X		• Creates new formal sector jobs through employing people for washing, transport, and inspection, and, where applicable, management of reuse system operations, including administrative and customer service functions • Can also create economic opportunity for informal sector workers if there are financial incentives for facilitating collection
Reusable food service ware: Closed-loop food service ware program		X		• Creates formal sector jobs through employing people for washing, transport, and inspection, and, where applicable, management of reuse system operations, as well as covering administrative and customer service functions
Reusable packaging for shipping and logistics: Reusable secondary packaging		X		• Could be job neutral or add jobs in California, depending on efficiencies of use and logistics

Model and submodel	No direct impact	Potential to directly create jobs in California	Potential to directly reduce jobs in California	Explanation
Reusable packaging for shipping and logistics: B2B reusable transport packaging	X	X		• Could be job neutral or add jobs in California, depending on efficiencies of use and logistics • Tend to provide cost savings to businesses over time, with some savings coming from labor efficiencies. It is unclear how this would net out as systems scale or with other potential labor required
Reusable packaging for shipping and logistics: B2B reusable transport packaging	X	X		• Could be job neutral or add jobs in California, depending on efficiencies of use and logistics. • Tend to provide cost savings to businesses over time, with some savings coming from labor efficiencies. It is unclear how this would net out as systems scale or with other potential labor required.
Reusable packaging for shipping and logistics: B2B reusable tertiary packaging	X	X		• Could be job neutral or add jobs in California, depending on efficiencies of use and logistics • Tend to provide cost savings to businesses over time, with some savings coming from labor efficiencies. It is unclear how this would net out as systems scale or with other potential labor required

Model and submodel	No direct impact	Potential to directly create jobs in California	Potential to directly reduce jobs in California	Explanation
Enabler: Technical assistance for reuse for dine-in	X	X		• Dine-in restaurants that switch to reusable food service ware instead of single use plastic food service ware require more dishwashing labor, though can save labor on managing waste • Case studies suggest that most restaurants experience cost savings from these changes, suggesting that increased labor costs are not substantial and/or are offset by other savings

Findings Related to Use of Other Source Reduction Strategies – Implications for Consumers and Businesses

This section evaluates the range of strategies currently used to achieve source reduction for plastic covered materials. The analysis focuses on practical approaches that reduce both the weight of plastic used and the number of plastic components in plastic covered material.

> PRC section 42041(aj) defines source reduction for the purposes of the Act. Source reduction does not include replacing a recyclable or compostable covered material with a nonrecyclable or noncompostable covered material or a covered material that is less likely to be recycled or composted.

The contractor drew insights from 42 business interviews, in-store data collection, community engagement, and desk-based research supported by Touch's Vault innovation repository, along with wider industry sources. The aim is to describe each strategy, illustrate its application through examples, and discuss key considerations and trade-offs that influence effectiveness in practice.

Lightweighting

Description

Lightweighting involves reducing the weight or thickness of plastic covered material while maintaining the required level of functionality and product protection. It is one of the most widely used source reduction strategies.

Examples

Lightweighting is common in personal care, home care, household, and food products. Examples include thinner wall sections in bottles and closures for cleaning products, reduced resin use in trigger components, and optimized rigid containers for creams, detergents, and surface cleaners. In rigid packaging, material reduction is often achieved through refined bottle geometry, such as optimized base design, reduced neck finishes, and the use of mold details like ribs or contouring to maintain strength while minimizing plastic use. Advances in forming technology and improved material distribution during molding have also supported further weight reduction. In flexible packaging, downgauging and the simplification of lamination structures can deliver further plastic reductions, with some formats achieving up to 20% material savings without compromising performance.[17][18]

Considerations

Many businesses indicated that most feasible lightweighting opportunities, estimated by some at around 90%, have already been achieved within their product portfolios. However, this level of optimization is not universal, and there remains potential for further reduction across other businesses and product categories. The extent to which lightweighting can be applied is strongly influenced by the product type, its physical

properties, and the requirements of the value chain. Packaging's primary role is to protect and contain the product, so factors such as impact resistance, stacking strength, and top-load capacity during transport and storage often limit how far material reduction is possible.

In food and liquid products, the method of filling and preservation also affects what is achievable. Retort processing, which involves heat and pressure, demands a higher level of material strength and stability, while hot-filling can cause distortion as the pack cools, requiring thicker walls or structural reinforcement. These thermal and mechanical stresses can restrict lightweighting potential in some categories.

The economics of implementing lightweighting also vary by format. For flexible packaging, the costs of change are often limited to testing and trialing new structures, making it a relatively accessible strategy. In contrast, rigid formats typically require new molds, revised designs, or line modifications, which can involve significant upfront investment. Many brands also rely on stock rigid packaging formats supplied by converters or resellers. These standardized designs are intentionally specified to serve a wide range of filling and handling conditions, which often means they are overengineered and heavier than necessary for any single application. This can limit the potential for further optimization without bespoke tooling or design adaptation.

Excessive lightweighting can also affect how consumers perceive the product. Packs that feel too light or flexible may be viewed as lower quality or less durable, particularly in food, personal care, and home care categories where tactile cues influence brand experience. Similarly, reducing material too far can increase the likelihood of deformation or leakage, undermining confidence in both the good and its packaging. Successful lightweighting therefore depends on finding an appropriate balance between material efficiency, good protection, manufacturing feasibility, consumer acceptance, and commercial viability.

Elimination

Description

Elimination involves removing unnecessary plastic components or redesigning plastic covered material so that certain plastics components are no longer required. This approach directly reduces plastic and can also simplify packaging systems and potentially lower costs. Importantly, elimination does not introduce another nonplastic component to replace the removed plastic part. The goal is to achieve the same or improved functionality with fewer total components. A manufacturer may achieve elimination through straightforward removal of redundant parts or through consolidation, combining multiple components into a single element that performs multiple functions.

Examples

Common examples include the removal of tamper seals, over-lids, or plastic sleeves from products. Many refrigerated food products, such as yogurts and dips, have moved away from including a separate plastic reseal lid when a heat-sealed film already provides adequate protection. In personal care and home care categories, elimination

often takes the form of component consolidation. For instance, caps may be tethered to tamper bands to avoid separate components, or multi-part pumps and triggers can be re-engineered to integrate functions within fewer plastic pieces, reducing both part count and total weight of material use. Brands have also reduced or eliminated single use accessories such as cutlery, straws, and dosage caps for products like laundry detergents, where consumers are likely to reuse an existing cap from a previous purchase rather than require a new one each time.

Considerations

While elimination can deliver immediate and measurable plastic savings, the results of this engagement suggest its suitability depends on the functional role of each component. Businesses noted elements that support hygiene, tamper evidence, or transport protection cannot always be removed without compromising safety or compliance. In consumer-facing categories, visual cues such as tamper bands or over-lids can also influence perceptions of quality and reassurance, which arose as a key consideration in community engagement. Where consolidation is used, ensuring ease of use and reliable performance is critical, as experts suggest combined parts often face higher mechanical stress or tighter manufacturing tolerances.

From an operational perspective, elimination is often more accessible and cost-effective than redesigning a full pack, since it typically involves design rationalization rather than new tooling. However, consolidating or removing components can still require adjustments to filling, capping, or packing lines to accommodate new configurations, as consulted experts like Touch Design affirm. As with lightweighting, the need for new designs, tooling, or line modifications can represent a significant cost barrier, particularly for lower-margin products or smaller producers. Success therefore depends on collaboration between design, engineering, and production teams to confirm that packaging maintains its functional, aesthetic, and regulatory requirements while remaining commercially viable.

Concentration

Description

Concentration refers to reformulating a good so that it can deliver the same performance or benefit using a smaller quantity of good, thereby requiring less packaging per use. By reducing good volume or weight, concentration enables smaller, lighter, or simpler packaging, directly reducing the amount of plastic used. In some cases, product concentration can also enable the elimination of plastic packaging altogether, as the reformulated product may no longer require the same level of moisture or barrier protection. Brands have applied concentration widely across food, home care, and personal care categories. Concentration is a source reduction strategy that is sometimes coupled with reuse/refill.

Examples

Examples include concentrated formats of detergents, soaps, and cleaning products, where liquids are reformulated to be more potent and require less packaging per dose.

In food categories, concentration is applied in products such as bouillon, sauces, condiments, and ice cream mixes, where reducing water content allows smaller pack sizes or powdered formats. Experts consulted, like Touch Design, affirm concentration can also fundamentally change the packaging type required. For example, liquid shampoo reformulated into a solid bar can be packed in a paper container rather than a plastic bottle. Concentrated cleaning products in powder form can be packed in a paper-based sachet instead of a rigid plastic bottle, and laundry liquids reformulated into dissolvable solid sheets can be packed in a paper carton. These examples demonstrate how concentration not only reduces the amount of plastic packaging but can also open opportunities for alternative, lower-impact formats.

Considerations

Concentration is an effective source reduction strategy because it reduces both good and packaging weight, but its success depends on product chemistry, consumer behavior, and production infrastructure. Reformulating products often requires investment in research and development, testing, and line modifications to ensure product stability and consistent performance at higher concentrations.

Concentrated products may also require behavioral change from consumers, particularly when the product needs to be diluted or reconstituted as part of a refill system or new usage ritual. For example, concentrated surface cleaners often require the user to add water at home, which can create barriers if the process is unclear or inconvenient. Behavior change can be especially steep when transitioning from familiar formats such as liquid shampoo to solid bars, or from standard laundry liquids to super-concentrated variants, as community engagement suggested. In these cases, consumers may need to adjust to new dosage sizes and develop confidence that the product is equally effective despite its smaller volume.

Shelf presentation also plays an important role in perception. Smaller or lighter packs can appear to offer poor value for money compared with full-sized alternatives, particularly when pricing does not clearly communicate the concentrated nature of the product. If not well signposted, concentrated products risk being overlooked at the point of sale. As the research activities have shown, clear labeling, consistent messaging, and effective shelf communication are essential to help consumers understand the equivalence of concentrated formats and support their long-term adoption.

Health and safety considerations also place limits on how far concentration can be utilized. Certain products, such as cleaning or disinfecting agenda, can lead to formulations that are hazardous to handle or store safely in consumer environments, research in this engagement suggested.

Economically, concentrated formats can reduce packaging costs per use but may require substantial up-front development and retooling investment. The activities of this engagement revealed that this is especially relevant when there is a change in product form, such as from liquid to solid, which demands new packaging and filling technologies. When successfully implemented, findings from this engagement suggest concentration can deliver substantial reductions in packaging material use, logistics

impacts, and overall plastic dependency, while also supporting the transition toward nonplastic packaging to meet the source reduction requirements.

Large format packaging

Description

Large format packaging reduces the overall amount of packaging material used per unit of good by increasing the size, volume, or number of uses per pack. By distributing the packaging weight and surface area across more product units, this approach lowers plastic intensity and can achieve measurable source reduction benefits. The findings from this engagement suggest large format packaging is most effective in categories where consumers or businesses can store, portion, or dispense the product conveniently over time. Large format packaging is a source reduction strategy that is sometimes coupled with reuse/refill.

Examples

Large-format packaging is commonly used across home care, personal care, pet care and food categories. Examples include bulk laundry detergent bottles and large household cleaning products, where a single 100-ounce or 1-gallon container replaces several smaller bottles. In food categories, this approach can be seen in family-size condiments, bulk 10-pound bags of rice or cereal, and large multi-serve snack packs that replace individually wrapped portions within a multipack. By increasing the amount of good relative to the packaging, these formats reduce plastic use per serving of good sold.

Considerations

Large format packaging can reduce plastic use across the supply chain, but experts like Touch Design suggest it requires careful consideration of consumer habits, retail logistics, and product protection. Larger packs can be heavy and less convenient for consumers to handle or store, which may limit uptake outside of certain household types or usage occasions. They can also create challenges for retailers in terms of shelf space, weight handling, and replenishment frequency.

For liquid products, larger pack sizes increase the mechanical and stacking demands placed on the packaging, sometimes requiring thicker walls or stronger handles to maintain integrity during filling and transport. According to the analysis undertaken, this can partly offset the material savings if not optimized carefully through design or resin efficiency. As with lightweighting, changes to pack geometry, mold design, and production lines can involve additional investment and testing.

Behavioral and perception factors are also important. Some consumers may associate larger packs with reduced freshness or perceive them as poor value if pricing focuses on the total cost rather than cost per use. The higher upfront cost of purchasing a large pack can also be a barrier, as consumers are accustomed to spreading spending across smaller, more frequent purchases. In smaller households, large packs can also lead to overconsumption or waste if contents expire before being used. Clear labeling, appropriate pack sizing, and careful communication of value are key to supporting

adoption while maintaining consumer trust. Consultation with experts like Touch Design confirm that, when applied appropriately, large format packaging can reduce overall plastic use while maintaining product protection and convenience, particularly in categories where larger pack sizes align naturally with consumer behavior and product usage patterns.

Right-sizing

Description

Right-sizing involves optimizing the dimensions, proportions, and design of plastic packaging so that it uses only the amount of material necessary to protect, contain, and present the product. The goal is to remove excess space or volume within the primary packaging or between primary and secondary packaging while maintaining product protection, performance, and usability. This approach can be applied to bottles, tubs, pouches, trays, and flexible films across a wide range of categories.

Examples

Liquid bottle formats often include more headspace than is strictly required for filling or handling, particularly in cleaning and laundry products. According to packaging experts, Touch Design, reducing unnecessary headspace can lower the total amount of plastic used while maintaining filling efficiency and user convenience. Flexible packaging used for particulate products, such as powders or granules, can also include excess headspace, meaning the amount of plastic film used can be reduced without affecting protection or usability. However, it is important to recognize that headspace often exists for good reasons. In liquid products, it accommodates foaming during filling or variations in fill level caused by machine tolerances. In particulate products, it allows for natural product settlement over time. When initially filled, the product sits higher in the pack but gradually settles, leaving apparently empty space. Some of this can be minimized by using vibration tables or conveyors during filling to compact the contents and reduce air gaps. Right-sizing also applies to the relationship between primary and secondary plastic packaging. In snack categories, for example, individual flexible packs are often enclosed within secondary wraps or bags that contain excess void space. Reducing this gap between inner and outer packaging can decrease total plastic film use while maintaining shelf stability and presentation quality.

Considerations

Headspace and packaging dimensions are also influenced by manufacturing efficiency and SKU management. Many brands use a single bottle design across multiple product volumes to simplify tooling, inventory, and production. This can result in excess headspace for certain SKUs where the same container is used for a smaller fill level. While operationally efficient, this practice increases material use and can be addressed through design differentiation or modular tooling. When executed with precision, right-sizing offers measurable plastic savings without altering the overall product experience. It is often one of the most straightforward and effective steps toward packaging optimization, as it can usually be implemented within existing material systems and production capabilities.

Material substitution

Description

Material substitution involves replacing plastic components or plastic covered material formats with nonplastic components or formats. The aim is to reduce total plastic use by switching to materials such as paper/fiber, metal, or glass, while maintaining the same functional purpose. This approach can deliver measurable source reduction when the new material replaces plastic outright rather than adding additional layers or components.

Examples

Examples include replacing plastic bottles with aluminum alternatives for personal care or cleaning products, switching plastic jars or bottles to glass in food categories such as sauces, condiments, or spreads, and using molded fiber or aluminum trays instead of rigid plastic for prepared foods. Flexible plastic films can also be replaced with paper-based laminates or coated papers, particularly for dry goods or products with moderate barrier requirements. These laminates may include thin barrier coatings of plastic, but when the coating represents a small fraction of the total structure, it may not interfere with recyclability within paper recycling streams.[19] Replacement can also extend to secondary and protective packaging. Plastic stretch film used to stabilize pallets during shipping can be substituted with reinforced paper-based wraps that provide similar containment strength. Likewise, impact-resistant plastic packaging used for durable goods and appliances is increasingly being replaced with molded fiber or corrugate-based inserts that offer cushioning and structural protection while avoiding the use of plastic foams or rigid shells.

Considerations

Material substitution strategies can reduce plastic use but are often limited by technical performance, cost, and material availability. Alternative materials such as paper and fiber generally provide less moisture and grease resistance than plastic, which can restrict their use for high-moisture or oily products unless barrier coatings or additional layers are applied. These additions may affect recyclability, so the choice of materials and coatings must be carefully balanced between functionality and end-of-life recovery. The cost of research and development to explore, test, and validate new materials should not be underestimated. Extensive testing is typically required to assess strength, barrier performance, product safety, and migration before commercial implementation. In addition, the availability of newer materials such as barrier paper films or advanced fiber-based laminates remains limited, and supply at scale can be a barrier to wider adoption.

While substituting plastic with nonplastic elements reduces plastic use and their associated environmental and human health impacts, other environmental and operational impacts should also be considered. Some alternative materials may have increased transport weight or lower production efficiency compared to some plastics.

Economic and operational factors also play a key role. Retooling production lines to accommodate different forming or sealing requirements can represent a substantial investment, particularly for rigid formats. Switching to materials such as glass or metal often requires entirely new production lines, as these materials have very different handling, filling, and sealing requirements compared to plastics. In contrast, switching to paper-based flexible packaging can often be achieved more rapidly and at lower cost, since it typically involves fewer mechanical changes. The most effective strategies are those that balance plastic reduction with performance, recyclability, production efficiency, and commercial effectiveness.

Summary

Together, these strategies demonstrate the diverse ways that reduction of plastic covered material can be achieved across product categories. The effectiveness of each depends on product characteristics, supply chain capabilities, and consumer acceptance.

Implications for Consumers

The store-level data collection analysis showed that source reduced packaging was generally available to consumers, with variation in which brands and formats were available in which retail contexts. All five products studied offered a large format packaging option, and these options all cost less per unit, ranging from 41% to 77% lower compared to the unit price for the nonsource reduced package, however consumers had less than half the number of brand options for a large format package compared to the number of brands offering a standard nonsource reduced size. Concentrated products were available for four of the five products, though only one was lower cost, two were higher cost, and one was comparable. Milk and surface cleaner had at least half as many brand options as the nonsource reduced format, but the other three products each had less than half, with dish soap only having seven compared to 55 brands to choose from for nonsource reduced packaging formats.

Geographic Access

To assess geographic access to source reduced package formats, the contractor gathered in-store data to determine availability of source reduced options across six types of retailers:

- Supermarkets and other grocery retailers (NAICS Code 445110).

- Convenience stores (NAICS Code 445120).

- Warehouse clubs and supercenters (NAICS Code 455211).

- All other general merchandise retailers (NAICS Code 455219).

- Pharmacies and drug retailers (NAICS Code 456110).

- Cosmetics, beauty supplies, and perfume stores (NAICS Code 446120).

Table 22 shows the availability of source reduced packaging options, by product type as a percentage. In this percentage calculation, the numerator is the number of stores in which the format of the product type was observed, and the denominator is all retail locations where the contractor observed at least one format of that product type.

To take an example using the data in Table 22, this means that for dish soap, the baseline single use product was available at 82% of stores that sell any dish soap, while large format dish soap was available at 64% of stores that sell any dish soap and dish soap concentrate was available at 8%of stores that sell any dish soap.

The GIS analysis showed that 80% of the California population lives within 1 mile of a grocery store. This analysis includes data from six retail types. Availability by retail type, including just for grocery, is found later in this section in Table 26: Availability of source reduced packaging options by product type and retailer type.

Table 22: Availability of source reduced packaging options by product type

Product	Baseline single use standard	Source reduced: Large format	Source reduced: Concentrate
White rice	88% (0)	33% (++)	N/A
Milk	92% (0)	6% (++)	78% (+)
Surface cleaner	81% (0)	3% (++)	81% (0)
Dish soap	82% (0)	64% (+)	8% (++)
Shampoo	78% (0)	85% (-)	27% (++)

The numerator is the number of observations for the relevant good + package format combination. The denominator is all retail locations where at least one version of the good was observed for sale.

Table 22 Key

Color	Description
Darker Orange "++"	25% or lower than the percent of baseline single use packaging available
Lighter Orange "+"	>12.5% and <25% lower than the percent of baseline single use packaging available
White "0"	+/-12.5% from percent of baseline single use packaging available
Lighter Blue "-"	>12.5% and <25% higher than the percent of baseline single use packaging available
Darker Blue "--"	2 5% higher than the percent of baseline single use packaging available
Gray "N/A"	Not applicable

Economic Access

Based on in-store data collection, a price comparison was conducted to compare the cost per unit of products available in concentrated or large format options to comparable products in standard single use formats, which can be seen in Table 23. The cost of source reduced large format products was between 48% and 75% lower than the unit price for the comparable product in a baseline single use package. For the four source=reduced concentrated products assessed, only one was lower cost, two were higher cost, and one was comparable. Additional data tables and information about units and the unit normalization process of each product are detailed in Appendix A: Additional Data Tables for In-Store Data Collection.

Table 23: Price of concentrated and large format packaging compared to single use standard counterpart in collars (average cost in $ per unit)

Product	Baseline single use standard	Source reduced: Large format	Source reduced: Concentrate
White rice	0.19 (0)	0.05 (--)	N/A
Milk	0.67 (0)	0.25 (--)	1.00 (++)
Surface cleaner	0.30 (0)	0.07 (--)	0.03 (--)
Dish soap	0.27 (0)	0.16 (--)	0.33 (+)
Shampoo	0.97 (0)	0.45 (--)	0.92 (0)

Table 23 Key:

Color	Description
Darker Orange "++"	25% higher than the baseline single use standard package unit price
Lighter Orange "+"	>12.5% and <25% higher than the baseline single use standard package unit price
White "0"	+/-12.5% from baseline single use standard package unit price
Lighter Blue "-"	>12.5% and <25% lower than the baseline single use standard package unit price
Darker Blue "--"	25% or lower than the baseline single use standard package unit price
Gray "N/A"	Not applicable

Most concentrate and large format options sold in store and online do not have an additional cost of participation or cost-saving opportunities, other than the discounted cost per unit, though some warehouse clubs or supercenters where large format products are sold have membership fees. Desk research on acceptance of assisted payment programs confirmed that concentrate and large format packaging options are also covered by using assisted payment programs for goods that are eligible (white rice and milk), though WIC explicitly excludes milk in glass bottles (prefill)[20] and SNAP prohibits the use of SNAP funds to pay manufacturer-imposed deposits (e.g., the deposit for Straus milk bottles, which is not required by state law).[21] Eligible food items are allowed by assisted payment programs to be purchased using dispensing to replace packaging.[44] While demographic purchasing patterns could not be assessed, price differences disproportionately impacting people of different socioeconomic levels were observed.

Brand Choice Access and Availability

The contractor used data collected in-store to assess brand availability between products available in concentrated or large format options and comparable products in standard single use formats. Consumers had from 2 to 43% of the number of brand options for a large format package compared to the number of brands offering a standard single use size across all five products, and for concentrates they had from 13 to 70% of the brand choice as was available for the standard single use size format. This meant that, for example, rice consumers had 41 different brands to choose from in a standard single use package across all retail locations sampled but only 12 for large format packaging. Table 24 summarizes the number of brands available within each product by format across all retailers. Additional data tables on brand variety are detailed in Appendix A: Additional Data Tables for In-Store Data Collection.

Table 24: Number of brand options by package format across all retailers

Product	Baseline single use standard	Source reduced: Large format	Source reduced: Concentrate
White rice	41 (0)	12 (++)	N/A
Milk	40 (0)	2 (++)	N/A
Surface cleaner	58 (0)	1 (++)	33 (+)
Dish soap	55 (0)	19 (++)	7 (++)
Shampoo	167 (0)	71 (++)	31 (++)

Table 24 Key:

Color	Description
Darker Orange "++"	25% or less than the baseline single use value
Lighter Orange "+"	37.5% or >12.5% and <25% less than the baseline single use value
White "0"	+/-12.5% from baseline single use value
Lighter Blue "-"	>12.5% and<25% higher than the baseline single use value
Darker Blue "--"	25% higher or more from the baseline single use value
Gray "N/A"	Not applicable

Table 25 summarizes the average number of brands at each retail location by product and format.

Table 25: Average brands observed per retail location

Product	Baseline single use standard	Source reduced: Large format	Source reduced: Concentrate
White rice	3.0 (0)	1.8 (+)	N/A
Milk	3.0 (0)	1.3 (++)	2.0 (+)
Surface cleaner	5.1 (0)	1.0 (++)	3.8 (+)
Dish soap	5.6 (0)	2.6 (++)	1.7 (++)
Shampoo	14.7 (0)	6.9 (++)	3.7 (++)

Table 25 key is the same as for Table 24.

In terms of availability by retail type, the contractor found source reduced large format items were most available at warehouse clubs/supercenters and grocery stores and least available at convenience stores, while concentrated products were consistently available across most retail types with the exception of concentrated dish soap, which was only available at two of the six retail types (see Implications for Consumers: Geographic Access for the list of the six retail types with NAICS codes). Availability was assessed by dividing the number of locations with the source reduced format by the total number of locations offering that product.

Table 26: Availability of source reduced packaging options by product type and retailer type

Product	Packaging format	Supermarkets and other grocery retailers (n=50)	Convenience stores (n=1)	Warehouse clubs and supercenters (n=10)	All other general merchandise retailers (n=7)	Pharmacies and drug retailers (n=10)	Cosmetics, beauty supplies, and perfume stores (n=5)
White rice	**Total retail locations with white rice**	**45**	**0**	**8**	**6**	**6**	**0**
White rice	Standard	96%	N/A	100%	100%	100%	N/A
White rice	Large format	40%	N/A	63%	17%	0%	N/A
White rice	Concentrate	N/A	N/A	N/A	N/A	N/A	N/A
Milk	**Total retail locations with milk**	**43**	**1**	**8**	**6**	**6**	**0**
Milk	Standard	98%	100%	50%	100%	100%	N/A
Milk	Large format	0%	0%	50%	0%	0%	N/A
Milk	Concentrate	84%	0%	63%	83%	67%	N/A
Surface Cleaner	**Total retail locations with surface cleaner**	**45**	**1**	**8**	**6**	**7**	**5**
Surface cleaner	Standard	91%	100%	38%	83%	100%	20%
Surface cleaner	Large format	0%	0%	25%	0%	0%	0%

Product	Packaging format	Supermarkets and other grocery retailers (n=50)	Convenience stores (n=1)	Warehouse clubs and supercenters (n=10)	All other general merchandise retailers (n=7)	Pharmacies and drug retailers (n=10)	Cosmetics, beauty supplies, and perfume stores (n=5)
Surface cleaner	Concentrate	87%	100%	100%	100%	57%	0%
Dish Soap	**Total retail locations with dish soap**	**47**	**1**	**8**	**6**	**7**	**5**
Dish soap	Standard	94%	100%	38%	100%	100%	0%
Dish soap	Large format	64%	0%	63%	83%	100%	0%
Dish soap	Concentrate	9%	0%	0%	0%	0%	40%
Shampoo	**Total retail locations with shampoo**	**45**	**1**	**8**	**6**	**8**	**5**
Shampoo	Standard	89%	100%	25%	100%	100%	0%
Shampoo	Large format	87%	100%	100%	100%	100%	0%
Shampoo	Concentrate	36%	0%	0%	0%	13%	60%

Impact on Jobs

A description of the methodology used to assess impact on jobs for all solution models and source reduction strategies is described in the section B2C Landscape of Reuse and Refill in California under a subheading Impact on Jobs, and additional information is included in Appendix B: Assessment of Impact on Jobs.

Similar to the findings in section B2C Landscape of Reuse and Refill in California, concentration is expected to decrease the need for long-haul trucking and other transportation. For products sold in concentrated form, the greatly reduced weight and size of the product allow for more efficient transport, which could impact transportation jobs as fewer trips are needed to deliver the same quantity of product, but will also reduce greenhouse gas emissions from transportation.

Source reduction through large format packaging is not expected to have a direct impact on jobs in California because it is handled similarly to formats that are not source reduced.

Insights from Community Engagement

The contractor engaged community members across all of California via pop-up events, focus groups, small group discussions with CBOs and Tribes, one-on-one interviews, interviews with local jurisdictions, and two statewide multilingual virtual public workshops. Quantitative summaries below draw on 673 engagement activity responses, supplemented by qualitative input from discussions and interviews. All findings reflect consumer self-reported engagement data, not sales or inventory data.

Large Format and Concentrate Options for Consumers

Seventy percent of participants reported that buying large format products or concentrates would be easy or is already something they do, making it the most favored plastic reduction strategy overall. Only 17% found it somewhat challenging and just 13% very challenging. This points to strong alignment between existing consumer habits and opportunities to expand the use of larger package sizes and concentrated products such as cleaning tablets, powdered drinks, or bulk staples. Despite the favorability, cost, storage and access were cited as barriers to use.

Buying Goods in Paper, Glass or Metal Packaging

Fifty-seven of participants said buying items packaged in paper, glass, or metal is easy or something they already do. Similarly, when asked what would make reducing plastic easier, the top statewide responses were "products available in plastic-free packaging" cited in 32% of all responses, and "more affordable options" cited in 31% of responses. Participants described this approach as both familiar and desirable: people already purchase products in glass jars, metal cans, and cardboard boxes, and they want to see more products available in those formats.

Buying Goods with No Packaging

Buying goods without packaging is something participants said they had not thought about often, but the idea received strong support once discussed. 60% of participants said it would be easy or is something they already do, with only 14% saying it would be very challenging. This suggests openness to shifting away from packaging altogether, particularly for produce and other goods that can be sold loose or in reusable packaging.

Convenience and established norms

Results of community engagement reinforce that the convenience of single use food service ware is hard to compete with: it is quick and requires no washing, making it the default choice for workplaces, meetings, gatherings, and busy households. According to several parties interviewed, extra steps, time, or changes to established routines are a deterrent to adoption, particularly in food service and retail settings.

Going against established norms has other challenges as well, highlighting the need to normalize behaviors related to source reduction and reuse. Some community engagement participants felt out of place pulling out their own containers or utensils in public, describing it as an uncomfortable social act given that it is not a common behavior. Participants said staff often provide straws, utensils, and cups automatically, making it awkward to refuse. Some felt embarrassed when their request to decline single use plastic and nonplastic food service ware was ignored, especially in fast-casual dining or café settings.

Implications for Businesses

Businesses are significantly affected by changes in format and packaging; however, there is limited publicly available data or insight into the resulting impacts. After conducting more than 40 interviews across relevant sectors, the contractor was able to substantiate some hypotheses related to source reduction strategies and their implications for consumers and businesses:

- Industrial efficiency and the potential for cost savings have driven much of the material reduction to date. Many companies interviewed expressed concern about the feasibility of the source reduction targets, with some expressing that it would be difficult if they had to meet the targets individually.

- Material substitution requires changes to equipment as well as packaging and good formulation (for product format shifts), and testing new packaging takes time to assess factors such as shelf life.

- Material substitution can also pose tradeoffs between plastic reduction, cost, consumer acceptance, and other environmental and human health impacts.

Food safety and quality risk for food and beverages packaging (including that which has been source reduced) is addressed through FDA's labeling requirements for

manufacturers. Companies are also responsible for their own safety and quality testing for their goods and packaging.

The following food safety and quality risk perceptions were raised in interviews with businesses, however, as described in the Hygiene and Food Safety section, it was found that there are no inherent or uncontrollable hygiene or food safety risks associated with reuse and refill:

- Perceived trade-off between reducing packaging versus keeping food safe and secure.

- Simpler goods with fewer handling requirements (e.g., dry goods) are easier to implement safely, while more complex food categories carry higher safety risks.

- Concern over packaging performance, especially for products with high liquid content. Perception that fiber-based containers are not adequate. Inferiority of nonplastic alternatives, seen through:

  o Common breakage of cutlery made from alternative nonplastic single use materials.

  o Lack of oxygen barriers in fiber-based products, leading to reduced shelf life, spoilage or reduced quality (e.g., bad taste) for certain products where freshness matters, like coffee.

- Risk of food safety, spoilage prevention, or consumer usability may result in unwillingness to explore packaging reduction as a strategy.

4.0 Discussion of Opportunities and Barriers

This section synthesizes the contractor's findings from community, expert, and infrastructure engagement with the findings from the data analysis to provide holistic insight into this research.

This discussion considers opportunities, and their associated barriers, and does so for reuse and refill solutions and other source reduction strategies separately. This bifurcated analysis mirrors the structure of activities which informed this report and the important distinctions between the two topics. The interview results consistently reflected that whereas reuse/refill solutions require design and implementation of new systems, source reduction strategies mostly involve adjustments to existing systems.

Overarching Findings for Understanding Reuse and Refill Barriers and Opportunities

Reuse Over Refill (Dispensing to Replace Packaging)

For consumer-facing solutions, the contractor found that consumers and businesses are much more enthusiastic about reuse models such as prefill and reusable food service ware compared to the dispensing to replace single use plastic packaging model (i.e., refill in store) and dispensing to replace single use plastic food service ware as solutions for most products. While reuse systems require infrastructure investment and are more complex to implement, they better align with existing consumption patterns they alleviate fears about safety and brand integrity.

Most reuse solutions, especially prefill, have a negligible presence in California as of November 2025 and will require significant upfront investment to scale. Reusable food service ware systems have made visible progress statewide, especially in settings like stadiums and universities. However, there still remains a lot of potential to switch out single use plastic food service ware for reusable food service ware, across all types of closed-loop contexts such as K-12 schools, company or university campus cafeterias, and additional stadiums and venues.

The dispensing to replace packaging and dispensing to replace food service ware models, in which the consumer brings the container, by contrast, are more widespread today, but suffer from operational and consumer culture challenges, as reported in public and expert engagement. Consumers and businesses alike suggest that it may be easier to adopt reusable food service ware than rely on uptake by consumers of the BYO dispensing to replace single use plastic food service ware. Many participants noted that dispensing to replace single use plastic packaging stations in grocery stores and package-free shops often lack familiar brands or only offer premium items (e.g., organic), and they perceive them as expensive, and catering to a narrow, higher-income customer base. In practice, carrying refillable containers, especially in urban areas where residents rely on public transit or walking, may create burdens on consumers and barriers for refill when contrasted to the relative accessibility and convenience of conventional single use options.

A further challenge with refill models, as this and other research identified, perceptions abound that consumers view dispensing to replace single use plastic packaging and dispensing to replace single use plastic food service ware options as a tradeoff with hygiene, while companies worry, about liability and operational risks, there is also strong evidence that these concerns are unfounded when proper systems are in place.

"Unpacked", a report sharing insights from UK grocery retailer Waitrose on their in-store dispensing to replace packaging pilot, reported that some consumers expressed health concerns: "Hygiene considerations were called out by some consumers such as how clean other people's reusable containers were, however, for the majority, it did not present a barrier to shopping in this way."[22]

The presence of reuse models and practical solutions implemented for consumer hygiene considerations in other settings indicates these concerns may be less significant than is currently perceived by some companies. This is exemplified by food service operators such as Just Salad[23] and Starbucks,[24] which each developed Standard Operating Procedures to minimize the risk of contamination when filling consumer-owned containers.

Official guidance also supports the safety of these solutions: the most recent federal food code update (the FDA Food Code 2024 Supplement, see Bibliography for details) now explicitly allows for drinking cups and containers to be reused by self-service consumers if refilling is done without contact between the pouring mechanism and the lip-contact area of the cup or container, and for personal take-out beverage and food containers to be refilled by employees or the consumer through a contamination-free process.

Companies also expressed concerns that dispensing to replace packaging models present challenges for ensuring product freshness, introduce the potential for issues with quality or consumer experience (e.g., using a container that has a residual fragrance that clashes with the fragrance in the new product), and controlling brand integrity (potential for brand mislabeling or misidentification in a dispensing to replace packaging context). Several parties interviewed expressed concern over the potential for dispensing to replace packaging to generate product losses (e.g., due to sampling or product spoilage) or an undesirable store environment (e.g., due to spills). Additionally, there is potential for negative consumer associations if reused packaging is perceived as undesirable or unsanitary.

Refill via single use packaging solutions, as home and beauty products (e.g., pod or concentrate) partially overcome consumer behavior and perception frictions by prioritizing ease of use and removing the friction of dispensing to replace packaging. This solution is also attractive to businesses, as reported, because it can be easily integrated into existing production and retail systems and does not alter well-established modes of consumer convenience. Market analysis suggests these solutions will continue to develop on their own as there are minimal obstacles. However, this solution cannot work for every product, therefore their widespread scaling potential is inherently limited. For example, one cannot sell rice in a concentrated tablet. Therefore, their widespread scaling potential is inherently limited. Further, many refill via single use

packaging solutions often use flexible plastics as the refill packaging format, which were not deemed recyclable or eligible to be labeled compostable as of the December 31, 2024, covered material category list. PRC section 42041(aj) notes that source reduction does not include replacing a recyclable or compostable covered material with a nonrecyclable or noncompostable covered material or a covered material that is less likely to be recycled or composted. At this time, switching to a flexible plastic would not qualify as source reduction in California under the Act.

Research and engagement suggest reuse solutions, specifically prefill reuse systems, reusable food service ware, and B2B reusable tertiary packaging, hold greater promise for mainstream adoption and transformation of the packaging landscape than refill solutions. Behavioral and operational limits to adoption constrain many refill solutions. Some parties interviewed thought that the professional washing of containers was a critical element. Prefill solutions may be able to overcome consumer hygiene concerns with refill systems because, even though the package is being reused, the product is still packed in a professional facility, and reusable food service ware programs operate under strict washing standards to ensure consumer safety.

The optimism for the potential for these solutions is based in part on the fact that the goods are consumed in the same fashion as consumers are used to, which in turn facilitates consumer trust and acceptance. Consumers consistently indicated greater openness to solutions that align with existing shopping patterns, such as larger package sizes, alternative materials, or products designed to reduce packaging altogether. Also, businesses cite reusable food service ware as delivering an elevated user experience.

Additionally, by essentially requiring the same operational considerations in terms of storage and shelf placement, both engaged members of the public and interviewed businesses cited reusable food service ware and prefill solutions as better positioned than dispensing to replace single use plastic packaging and dispensing to replace single use plastic food service ware solutions to gain retailer acceptance. Additionally, while this solution requires additional labor for sortation, transport, and washing, as explained in the section on jobs, those are unlikely to be direct cost factors for retailers, making them more attractive to retailers than dispensing to replace single use plastic packaging, which can incur direct additional cost on site. Cost implications for producers are discussed in Opportunity 3.

Although still nascent in California as well as the United States in general, prefill is not without precedent. In France, the PRO, CITEO, is required to dedicate at least 5% of its annual operating budget – or roughly 50 million euros per year – to a Solidarity Reuse Fund to develop reuse systems, in order to meet the national goal of 10% reusable packaging by 2027, as well as a 20% single use packaging reduction requirement by 2025, half of which must be achieved through reuse. This fund has enabled two large-scale initiatives currently underway:

CITEO's ReUse project:[25, 26]

- Launched in June 2025 across 370 stores covering a region of 16 million residents, with 750 stores anticipated by end of 2025.

- Features 50 participating brands and 150 unique prefill products, with 200 expected by end of 2025.

- Covers 25 million packaged units per year.

Loop[27]

- Present in 345 stores across France, with a goal of 800 stores by end of 2025.

- Includes 50 participating brand partners and product design collaboration with more than 200 brands.

- Deployment of 370 unique prefill products.

Creating a Cost-effective, Geographically-based Ecosystem for Reuse

Businesses raised the concern that reusable packaging will be more expensive than single use options, based in part on the need for new infrastructure.

The distribution networks and logistics systems of today were developed over the past fifty years to minimize the cost of single use packaging for consumer goods, often while creating negative environmental impacts. Data from systems outside the United States in published reports show the potential for pooled, reusable packaging systems to deliver cost-savings. This is true when they operate under certain conditions and typically requires upfront investment. For example, a recent analysis for a regional reusable system in Germany found that a six million bottle per year system would generate a return on investment (ROI) within five years, and a 16.4% ROI within ten years.[28]

The opportunities presented here reflect the assumption that a new system will have to be created and implemented to support reuse. That system will be bound by geographic considerations. Instead of figuring out how to ship a reusable product cost-effectively across the country, prefill systems will depend both on new, local production capacity, and expanded activity by existing enabling actors like co-manufacturers and logistics companies. In its most basic iteration, this reuse system will follow a "hub and spoke" system design, wherein a centralized hub (like a washing site) serves different spokes (like retailers, restaurants, manufacturing sites), redistributing reusables to where they need to go once cleaned. Reuse service areas can vary in size and based on insights from life cycle assessments referenced in interviews, could be as large as 300 miles in diameter. The density of metropolitan areas is an enabler for successful reuse systems, with higher density increasing potential efficiencies, but this does not mean that rural communities cannot also participate in the reuse and refill solutions. Locating infrastructure strategically and establishing efficient logistics and strategic partnerships can expand the reach of service areas into rural areas as well. This service area idea has formed an underlying assumption in key reuse reports to date, including Ellen MacArthur Foundation's "Unlocking a reuse revolution: scaling returnable packaging"[29] and the Story of Stuff's "Bring back refill"[30] report.

Solutions that Work for All

Both physical infrastructure as well as cultural, linguistic, and economic factors shape access to reuse and refill systems. Public engagement revealed that some consumers perceive dispensing to replace packaging stations and package-free stores as expensive, limited in brand choice, and oriented toward higher-income households. These dynamics create a sense among engaged participants that reuse and refill options are niche rather than mainstream.

Consumer engagement participants emphasized that trusted, culturally relevant brands and affordable goods are essential for wider adoption. At the same time, public engagement revealed that barriers such as the weight of refill containers, lack of ADA accessibility, and reliance on public transit make dispensing to replace packaging solutions especially burdensome for many consumers. Equity therefore requires intentional investment to expand geographic coverage and ensure systems are designed with cultural, economic, and linguistic inclusion in mind. Also, while the prospect of new jobs from these systems holds certain appeal, the activities of this engagement undermine how important it is that new jobs generated are not just limited to educated or highly skilled members of the workforce. As reuse is fundamentally a service industry, requiring washing, inspecting, and transportation, there is likely to be good alignment of needs and opportunities.

The synthesized opportunities and associated barriers aim to frame reuse through an equity lens, to create a system built for everyone, rather than only offering a specialty option, to build durable and equitable change. Early investments that make sustainable choices accessible within existing shopping patterns, and leveraging inclusive design processes, combined with long-term infrastructure that reduces costs and increases convenience, can ensure reuse and refill systems work for all communities.

Reuse and Refill Solutions: Opportunities with Accompanying Barriers

Opportunity 1: Standardize Packaging and Food Service Ware

Based on the results of this engagement, standardizing packaging designs and harmonizing operational systems could offer a critical way to reduce complexity, simplify logistics, and enable economies of scale. Interview subjects voiced a need to overcome the current proliferation of highly customized packaging formats. Relevant parties interviewed affirmed that when packaging is interoperable across businesses and venues, it can provide a number of benefits that address barriers associated by lowering costs, building consistency, and improving consumer understanding, making reuse more accessible and efficient. Multi-retailer pilots and the parties queried on this matter suggested that industry-wide standards can further streamline operations and demonstrate what is possible when multiple interested parties align.

The results of this engagement suggest that prefill models, where manufacturers package goods in reusable containers that are sold through retail channels, are an avenue for packaging standardization. Liquid products, which are conducive to

standardized washing/filling equipment, may be a natural first place to test prefill, as suggested by the current solutions deployed and cited in the Instances Database. Furthermore, the consumer experience with prefill products in standardized packaging closely mirrors that of conventional packaged products, which interviewed businesses suggested makes adoption more intuitive and subjects retail operations to fewer operational disruptions.

Many of the reusable food service ware systems operating across the US and in Europe, and all the ones identified operating in California, leverage standardization within their own operations and across their consumers to take advantage of operational efficiencies, though standardization across service providers today is limited.

The reuse standards being developed by PR3 are intended to facilitate further standardization across the reuse industry. Many interviewees said that realizing this opportunity will require pre-competitive collaboration and coordination, and they also acknowledged that there are practical challenges inherent in coordination, particularly among competing companies. Loss of brand visibility and broader reputational hazards also arose as a concern of some parties interviewed. One party interviewed said that in retail settings, branded bags are seen as a marketing and visibility tool, which has made them unwilling to phase them out as a plastic reduction strategy.

Standardization can further support the transition to reuse systems by making solutions more recognizable and increasing awareness. Consumers being unaware of, uncomfortable with, or unclear about use of reuse and refill solutions, can lead to low adoption and return rates. This is supported by the fact that many refill via single use packaging products, such as refill via concentrate, are reportedly sold by large retailers only via e-commerce due to low in-store sales, as cited earlier in the findings section of this report. In community engagement, many consumers said they were unaware of available reuse options that were available in their community, though they expressed interest in them when informed. As community engagement cited a lack of education in this area, the contractor concluded that as additional jobs are created to support the reuse economy, it is crucial to include roles dedicated to consumer education, which is facilitated by having standardized packaging formats to reference.

Opportunity 2: Enable Collection Through Shared Infrastructure

Collection and return logistics consistently emerged in the activities of this engagement as one of the most challenging aspects of reuse system design. A key opportunity uncovered in this analysis lies in developing a shared collection system. Without a culture of returning packaging, low return rates can drive higher costs for reuse systems. Losing reusable packaging and food service ware to nonreturns or failed inspection due to damage also contributes to higher costs. In addition, branded or high-quality items are sometimes kept as souvenirs, raising loss rates, supporting the recommendation for standardization (see Opportunity 1).

Most consumer-facing reuse and refill systems operating today introduce added costs and operational requirements compared to existing single use systems (though they also reduce costs associated with disposal, as well as pollution and other externalities,

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though these are borne by different interested parties), especially at small scale. Added operational costs and complexity, interviewed parties reported, stem from labor, staff training, managing returns and reverse logistics, increased storage, sanitation and safety requirements, and, where relevant, establishing and maintaining dual or alternative inventories. Businesses report that while they may be willing to trial reusable packaging, they struggle with how to manage the collection process, whether through limited store space, staff burden, or lack of efficient return infrastructure.

Operational constraints were also noted in settings such as retail stores and event venues, which were typically not designed to accommodate return, cleaning, or refill systems. B2B solutions, like reusable vessels in a back-of-house food service setting, may be an outlier in this regard, as they can often be more seamlessly introduced into existing operations, though storage of empty items until they can be picked up was noted as a potential constraint. Without clear and convenient collection points, reuse systems tend to experience low return rates, high loss of packaging, and rising costs.

Publicly-accessible return points, community bins, or collection hubs could reduce the burden on individual businesses while normalizing reuse behavior for consumers. One possibility would be integration with infrastructure associated with California's Beverage Container Recycling Program (Bottle Bill), like redemption sites and mobile redemption units, which multiple parties interviewed recommended. This could expand opportunities for the informal waste sector specifically, as well as generating additional jobs related to collection and sortation more generally.

Several interested parties interviewed that had piloted reusable food service ware solutions cited low participation and return rates that they believed to be a result of insufficient supporting infrastructure. In one reported incident, an interviewed party stated that an open-loop reusable food service ware pilot showed return rates of only 50%, despite a big marketing effort and strategies to maximize convenience and ease of use. This program did not offer any form of return incentive, which likely contributed to the low return rate. However, engaged parties pointed out that even when policies, penalties, or financial incentives are in place, discounts and mandates have limited effectiveness in shifting behavior when the reuse or refill solution does not align sufficiently to consumer demands. The results of pilots and programs across the US demonstrate voluntary adoption of and successful participation in open-loop reusable food service ware programs is likely to remain limited in the absence of a full system solution supported by infrastructure.

Deploying shared infrastructure would allow collection to be integrated into daily routines rather than requiring special trips to participating businesses. Through consultation with experts and literature referenced in the bibliography of this report, the contractor concluded that reducing logistical barriers and providing a visible, standardized return system, public or alternative collection could enable broader adoption of reuse, lower costs through shared responsibility, and create the conditions for more durable and scalable systems.

Opportunity 3: Building Capacity Through Hubs and Contract Manufacturers and Fillers

Scaling reuse systems require more than just packaging design and collection, as reinforced throughout the activities of this engagement, it depends on building robust infrastructure for washing, sanitization, and reverse logistics. Some interviewees attested that some of the associated washing and logistics costs are surmountable by utilizing in-store implementation (including washing and return) and limiting disruption to the user experience, such as prepared foods in supermarkets. But these solutions will not work in all contexts; systemic solutions are needed.

Shared infrastructure, whether developed through public-private partnerships or by independent third-parties, was consistently described in interviews as critical for reducing costs, ensuring quality, and making reuse accessible to a wider range of companies. Across interviews, the lack of sufficient washing and logistics capacity was identified as a primary bottleneck. The idea of reuse service areas, or hubs, as described earlier in this discussion or barriers and opportunities, is a critical frame for a strategic investment plan for shared infrastructure. As noted throughout this report, density, volume, and a full supporting ecosystem shaping consumer behavior are critical enablers for success. The implication is that the development of infrastructure and capacity must be targeted to serve a specific geographic area, rather than be spread piecemeal across the state.

As uncovered in the contractor's analysis, including interviews with businesses, notable opportunities lie in leveraging co-packers and contract manufacturers, who already operate at scale and have the expertise, equipment, and regulatory compliance systems necessary to handle food-grade packaging. The contractor's engagement allowed them to conclude that, by building washing and logistics into their existing operations, these entities can become central enablers of reuse adoption. They can provide professional cleaning, standardization, and logistical reach that individual brands or small businesses cannot achieve alone, as interviewed businesses attested. This strategy can also overcome the concern expressed by businesses of needing to make significant investment on their own. Interviewees pointed out that co-packers and contract manufacturers are well-positioned to lead capacity building. While brand owners noted that contract manufacturing can be associated with higher per unit costs for custom products or packaging, building capacity to fill standardized containers across brands has the potential to lower costs. Supporting their role through investment and other incentives would accelerate the transition toward durable, scalable reuse systems.

Many of those interviewed affirmed that one reuse deployment area which can drive the demand needed for centralized, shared washing, and other infrastructure is adoption of reusable food service ware programs, particularly in controlled, closed-loop environments with predictable consumption patterns, centralized logistics, and strong operational control. Members of the public and businesses engaged supported the idea that large festivals and event venues, which have captive audiences, high-volume throughput, and potential for rapid adoption and high return rates, are well positioned to benefit from shared infrastructure, as their on-site washing capacity is often limited and

off-site logistics will reduce operational complexity. Likewise, universities and hospitals may present similar advantages, with concentrated consumption and opportunities for public-private partnerships to share infrastructure costs and reduce risk according to this analysis. Finally, large and especially high-profile global events can also help demonstrate system viability at scale, attract investment, and leave behind legacy infrastructure that continues to support reuse in the long term, as offered by expert engagement. Literature referenced and engagement suggest that anchor sites like this, which build engagement and provide visibility to reuse solutions, can act as catalysts for broader adoption. At the same time, this strategy could create new jobs, by essentially kickstarting an entirely new sub-industry (and building capacity where the industry activities already exist).

Participants in public engagement activities also saw additional opportunities in neighborhood or district-wide reuse programs. In dense corridors, participants envisioned coffee and meal containers that could be returned to any participating location. They noted this model would not work in rural areas but could succeed in cities and high-traffic districts.

"I can really see this working in places like our strip where tourists walk around here, or in Santa Barbara where there's a lot of restaurants around a courtyard or strip, but where my parents are from in Stockton, this isn't feasible at all." - Community member from Santa Maria

Opportunity 4: Start by Scaling Reuse and Other Source Reduction Through Closed-loop Food Service Ware and B2B

Based on the engagement activities and analysis, closed-loop food service ware programs and B2B prefill and tertiary packaging solutions offer strong opportunities for advancing reuse and source reduction because the dynamics differ significantly from consumer-facing models. These models also have the advantage of not requiring consumer collection infrastructure, reducing the amount of funding needed to realize near-term impacts while building other aspects of infrastructure — such as washing and logistics — that will also be critical enablers of consumer-facing reuse systems.
In B2B contexts, as several relevant parties interviewed attested, packaging is often standardized, managed in closed systems, and cycled between a limited number of partners. This reduces the complexity of behavior change and creates more predictable flows of materials for collection and return. The contractor analysis suggests that high-volume shipments, institutional procurement, and established logistics networks make B2B channels particularly well-suited for reusable transport packaging, intermediate products and raw materials delivery, and other B2B prefill — such as personal care products for hospitality and food and cleaning products for food service back of house. Interviewees noted that B2B channels also reduce risk for participating companies. Relationships between manufacturers, distributors, and co-packers are already structured around efficiency, and adding reuse requirements can be integrated into existing contracts and supply chains. Examples offered and pulled from the contractor's

knowledge base include returnable containers in food service supply chains, dispensers for beverages, and dispensing to replace packaging systems for cleaning products in institutional settings. The activities of this engagement suggest that, by focusing on B2B, companies can achieve significant material reductions with fewer behavioral hurdles, build scale faster, and demonstrate proof of concept for reuse systems before expanding into consumer markets.

Many of the interviewed parties speculated that deploying reusable food service ware in closed-loop systems, and with careful consideration of incentives and penalties, may help overcome challenges to adopt reusable food service ware. In a quick service setting, durable reusable food service ware can enhance consumer experience and reinforce a positive image of quality and sustainability, interviewed parties suggested. Community engagement insights reinforced that there is a readiness for reusable food service ware programs in closed-loop environments. Participants in these activities viewed airports, malls, and college campuses as ideal sites for shared reusable systems. Consumers could receive meals in standardized reusables and drop them at convenient stations near compost or trash bins, some said, while vendors would handle washing and redistribution.

"When I go to a Warriors or Giants game or eat on campus here at UC Berkeley, I'm not really wanting to bring the food with me outside of the area I get it. It would make a lot of sense to have everything that comes with that food reusable...especially at stadiums where people have to clean up so much after anyway" - UC Berkeley Student, Bay Area Community Participant

To provide an illustration of potential impact from a reusable food service ware program, the contractor estimated the weight and unit amounts of single use plastic food service ware and used in closed-loop contexts. The Green Sports Alliance published the "Reuse Playbook" to highlight the opportunity for reuse in sports and entertainment venues in 2024, and it estimates that a venue that hosts 300 events annually uses about 5.4 million single use cups, and if they are polyethylene terephthalate (PET) then this translates to 64 tons.[31] As one source indicates, kindergarten through 12th grade schools also use large volumes of single use food service ware. California had about 5.8 million children in public schools in California for the 2024-2025 school year for 180 school days. Considering many schools serve breakfast and lunch, even if only half of those students' meals are served on single use plastic food service ware, it is a significant opportunity to shift to reusable food service ware, while generating new jobs to support these activities in the process.[32]

Source Reduction Strategies: Opportunities with Accompanying Barriers

Opportunity 1: Invest in R&D for Reformulation and Alternative Materials

The results of this engagement suggest investment in R&D is central to achieving meaningful source reduction. Efforts to reduce packaging through material substitution

or lightweighting face various technical challenges, as many interviewed attested. At this time, some alternative materials (with paper most commonly cited) are often unable to meet operational requirements, such as scanning compatibility, durability, or performance in existing conveyor and distribution systems, said many interviewed parties.

Changing the use of packaging materials, whether switching to paper, or lightweighting, can require significant adjustments to production systems. Retrofitting or replacing filling lines and logistics systems involves high upfront costs and technical complexity, making transitions resource intensive, said many interviewed. The results of this analysis suggest new primary packaging has implications throughout the supply chain and can impact the required secondary and tertiary packaging, the number of products per pallet, headroom, and other aspects of logistics that can drive cost and operational complexity.

Even where new or adapted materials can use the same equipment, it can influence operational efficiency, according to engaged businesses. For example, one interviewed party said certain papers can be run on the same equipment as plastic, but only at one third the speed, which has implications for labor costs and overall productivity. Logistical inefficiencies can also result, said some. One party cited that different packaging creates different stacking/weight profiles, thereby creating ripple effects in transport, storage, and distribution. Because equipment and systems are not always designed for alternative materials, said some interviewed, using them in this way can create risks of slower production, product damage, or other inefficiencies.

Existing solutions may fail to meet consumer expectations of product performance or lose consumer trust, some interviewees argued. As an example, community engagement participants said some nonplastic options feel inadequate for everyday use. Even after discussing a range of alternatives, participants felt that some takeout foods (especially soups, sauces, dips, saucy dishes, and other foods with liquid) were nearly impossible to imagine being enjoyed from a package without single use plastic. This reinforced a perception that plastic is unavoidable in specific food contexts.

"Cardboard plates without plastic lining can get soggy with wet foods, wood forks and spoons splinter, and the paper straws are just gross." – Rural community member

Environmental tradeoffs should also be considered when substituting material. For instance, switching from plastic to paper can, in some cases, increase weight, cost, and carbon emissions.[33] Other interviewed parties cited the concern that source reduced packaging would fail to sufficiently protect the product from damage or spoilage, constituting an unfavorable tradeoff. This is supported by the fact that reducing the oxygen barrier properties of packaging has been found to shorten the goods' shelf life in some instances.[34] Careful consideration of functional, technical, and environmental requirements and impacts was highlighted as an important topic through engagement.

Single use plastic food service ware (especially utensils and containers) is among the most promising intervention areas, due to the number of plastic components in these categories as previously described. This includes eliminating unnecessary plastic layers

or components, simplifying multi-part packaging, and validating new design solutions that require less resin to achieve the same function.

R&D enables the technical progress needed to turn these opportunities into practical solutions. As some of the businesses interviewed attested, advances in materials, forming technologies, and design methods can help reduce plastic use without compromising durability, safety, or shelf life. Experts consulted suggest improvements in structural design, molding precision, and material distribution can produce lighter, less plastic intensive packaging. Reformulating products, such as converting liquids to concentrated, powdered, or sheet formats, can also reduce packaging needs by minimizing water content and overall volume. The contractor concluded from their analysis that these approaches can directly lower plastic demand and often bring additional benefits in production, transport, and storage efficiency.

The contractor's interviews with relevant parties suggest developing and scaling these solutions relies on close collaboration led by R&D teams across the packaging value chain. Material suppliers, converters, and product manufacturers need to work together to ensure that new designs and formulations are technically viable, compatible with existing filling and sealing operations, and meet performance and safety standards. This kind of coordination enables new product formats to emerge that significantly reduce packaging needs. Concentrated and reformulated products are a good example, as experts consulted in this project believe they can deliver wide-ranging benefits beyond plastic packaging reduction. Interviewed parties suggested the potential for savings not only in material use but also in logistics and environmental impacts, with concentrated formats allowing multiple truckloads of diluted product to be condensed into a single pallet. These efficiencies can cascade through the supply chain, potentially reducing warehousing space, lowering transport emissions, and improving overall distribution economics, as interviewed subjects attested.

The findings of this engagement suggest R&D plays a coordinating and enabling role across all of these activities. It connects product reformulation, material innovation, and manufacturing capability to ensure that source reduction opportunities are both technically achievable and commercially scalable. By bridging research, design, and implementation, R&D helps align innovation efforts across the value chain and provides the foundation for continuous improvement in material efficiency and long-term reduction in plastic dependency.

Opportunity 2: Right-sizing and Lightweighting

The analysis from this engagement suggests that other source reduction strategies, such as right-sizing and lightweighting, hold the potential to deliver sizeable weight-based reductions on plastic. These solutions were broadly viewed by many of the subjects interviewed as practical, incremental pathways toward source reduction, particularly when reuse systems remain nascent. These changes also have the potential to drive cost savings and lower transport emissions through lower material use, many interviewed said.

Maintaining performance remains vital, and several parties noted that additional reductions risk compromising product quality or food safety. Lightweighting was viewed by those interviewed as most feasible where packaging lines can be retooled without major capital expense, and where consumer experience is unaffected. Overall, the findings suggest measured progress through material efficiency offers near-term compliance and sustainability benefits while longer-term reuse and refill systems mature, with reductions in pallet wrap and e-commerce envelopes showing particular promise given that many opportunities to lightweight in other areas, like food packaging, have already been captured.

Opportunity 3: Support Market Incentives and Cost-sharing Mechanisms

The results of this analysis suggest that transitioning to new packaging formats can result in incurring upfront costs. Therefore, market incentives and cost sharing are important mechanisms to increase adoption. Interviewed parties recommended clearer incentive structures to help level the playing field between large and small companies, overcome consumer price sensitivity, and accelerate investment in infrastructure and R&D that would not have occurred otherwise.

Recycled content and alternative packaging materials often carry higher costs, and without cost-sharing mechanisms or industry-wide commitments, businesses engaged expressed reluctance to absorb these expenses unilaterally, which is especially challenging for small- and medium-sized companies. Businesses pointed out that incentives such as eco-modulated fees, subsidies, and tax credits could help to accelerate specific source reduction options.

Engaged parties suggested using collective investment mechanisms to spread costs more fairly, reduce financial risk, and encourage broader participation in source reduction strategies.

5.0 Abbreviations and Acronyms

AB – Assembly Bill

ADA - Americans with Disabilities Act

API - Application Programming Interface

B2B - Business-to-Business

B2C - Business-to-Consumer

BYO - Bring Your Own

CBO - Community Based Organization

CCPA - California Consumer Privacy Act

CRV - California Redemption Value

CSV - Comma Separated Values

EBT - Electronic Benefit Transfer

EPA - Environmental Protection Agency

EPR - Extended Producer Responsibility

FDA – Food and Drug Administration

FSR - Full-Service Restaurant

FTE - Full-Time Equivalent

GDPR - General Data Protection Regulation

GIS - Geographic Information Systems

HDPE - High Density Polyethylene

LDPE - Low Density Polyethylene

LSR - Limited-Service Restaurant

NAICS – North American Industry Classification System

PET - Polyethylene Terephthalate

PHA - Polyhydroxyalkanoate

PHB – Polyhydroxybutyrate

PP - Polypropylene

PS - Polystyrene

PCR - Postconsumer Recycled Content

PVC - Polyvinyl Chloride

QR - Quick Response

R&D - Research and Design

RFP - Request for Proposal

RPC - Reusable Plastic Container

RUCA - Rural-Urban Commuting Area

SME – Small and Medium Enterprise

SNAP - Supplemental Nutrition Assistance Program

SUP - Single Use Plastic

TPY – Tons per Year

USC - University of Southern California

USDA - United States Department of Agriculture

WIC - Women Infants and Children

6.0 Glossary of Terms

The terminology used in this report is consistent with the definitions found in the glossary and is only intended for this report. Terminology used in this report may differ from the definitions used by other organizations or as outlined in the Plastic Pollution Prevention and Packaging Producer Responsibility Act (SB 54, Allen, Chapter 75, Statutes of 2022, the Act). The terminology used in this report does not represent or affect the interpretation, implementation, or enforcement of the Act. Specifically, this report considers the current and needed state of reuse and refill materials and infrastructure and does not endorse any products or materials as satisfying the criteria for "reusable" or "refillable" as defined in the Act.

Backhauling: The process of a vehicle or vessel picking up a load on its return trip after a primary delivery.

Band (reusable tertiary packaging): A durable, long-life strap or large elastic band, often made from natural rubber, polyester, or composite materials, specifically designed to be used repeatedly within a supply chain to secure, bundle, and stabilize goods during movement and storage.

Beverage Container Recycling Program (BCRP): CalRecycle administers the California Beverage Container Recycling & Litter Reduction Program (BCRP) in which consumers pay a refundable deposit every time they purchase an included beverage and then receive – California Refund Value (CRV) – when they return the empty container to a certified recycling center, registered dealer cooperative, or participating retail location. Californians may instead choose to forfeit their deposit by donating beverage containers to certified community service programs or giving them to a registered curbside or certified drop-off or collection program for recycling.

Bin (reusable tertiary packaging): Tertiary packaging or storage containers typically with a hopper front (a design to dispense bulk materials), allowing easy visual identification and access to the contents without needing to move the bin from a shelf or rack.

Bottle Bill: See definition for Beverage Container Recycling Program.

Business-to-Business (B2B): Commercial transactions and interactions between two companies, rather than between a company and an individual consumer. This can involve one business providing raw materials, services, or finished goods to another business, which might then use them in its own operations or resell them.

Business-to-Business Enabler (B2B Enabler): Refers to a tool, service, or role that indirectly supports and facilitates the transactions and processes between two businesses.

Business-to-consumer (B2C): The business model of selling products directly to consumers.

Bulk: Material that is often sold in large quantities.

Closed-Loop or Closed Network: A reuse system where the consumption and purchase happen in the same location, and the reusable packaging or food service ware item does not typically or cannot leave the premises.

Concentrate/Concentration: Reduction in the amount of packaging needed for a product by reformulating the product to allow for smaller quantities of the product to be used for the same purpose as the previous, larger quantity (PRC section 42041(d)).

California Redemption Value (CRV): See definition for Beverage Container Recycling Program.

Co-packing/Co-filling: Entities which hygienically repack finished products into smaller packaging on behalf of brands for local resale, return, washing and reuse; these entities can pack or fill for multiple brands and could do so using reusable packaging at regional facilities.

Covered Material Category: A covered material category is one that includes covered material of a similar type and form, as determined by CalRecycle (PRC section 42041(f)).

Crate (reusable): Refers to durable large containers designed for heavy-duty shipping and protective storage, commonly used for food and retail products; typically, stackable.

Disadvantaged community: An area defined by The California Environmental Protection Agency (CalEPA) as (PRC section 42041(i)):

- The top 25% of census tracts experiencing disproportionate amounts of pollution, environmental degradation, and socioeconomic and public health conditions according to the Office of Environmental Health Hazard Assessment's CalEnviroScreen 4.0 tool.
- Census tracts lacking overall scores in CalEnviroScreen 4.0 due to data gaps but receiving the highest 5% of CalEnviroScreen 4.0 Pollution Burden composite scores.
- Census tracts identified in 2017 as disadvantaged, regardless of their scores in CalEnviroScreen 4.0.
- Lands under the control of federally recognized Tribes.

Downgauging: A form of lightweighting typically used in reference to flexibles.

Drum (reusable packaging): Durable, cylindrical industrial containers made of materials such as steel or high-density plastic specifically engineered to be used for multiple trips in a supply chain. These drums are designed for longevity, repeated recovery, inspection, and reconditioning for subsequent use in the same or a similar application.

Dunnage: Material used to secure, support, or protect cargo and products during shipping.

Elimination: The removal of a plastic component from a covered material without replacing that component with a nonplastic component, with respect to source reduction (PRC section 42041(j)).

Enabler: A tool or service that facilitates the use of reuse or refill solutions but that does not provide a solution directly.

Fractional Manufacturing: Process of producing a product from start to finish on behalf of brands as a subset of their production, often in the case where regional product, or packaging, differentiation is required; these entities can produce for multiple brands and could do so using reusable packaging at regional facilities.

Good: Refers to the item sold, excluding the packaging or food service ware used to contain it.

Intermediate Bulk Container (IBC): Reusable, industrial-grade container for storing and transporting bulk liquids and powders, typically as raw materials or unfinished products. IBC types include: Composite IBCs, a large plastic bottle inside a steel cage; Rigid IBCs, made entirely of plastic or metal, with no outer cage and which may be used with a plastic liner; and Flexible IBCs (FIBCs), also known as bulk bags, which are made of woven fabric and are designed for dry, flowable products like sand or fertilizer.

Large Format Packaging: Packaging for a large amount of a product in a large packaging, thereby offsetting the need for multiple smaller packaging units for the same amount of product (PRC section 42041(b)).

Lightweighting: Reducing the weight or amount of material used in a specific packaging or single use plastic food service ware without functionally changing the packaging or food service ware. Lightweighting does not include changes that result in a recyclable or compostable covered material becoming nonrecyclable or non-compostable or less likely to be recycled or composted (PRC section 42041(l)).

Low-income community: An area identified by California AB 1550 (Gomez, 2016) defined as census tracts with median household incomes at or below 80% of the statewide median income (PRC section 42041(n)).

Material Design: Refers to the design of materials, particularly features that achieve source reduction or enhance the ability to reuse and refill packaging or food service ware. Material design may include features such as form, composition, and labeling; may also refer to a material's ability to be recycled or composted.

Material Substitution: Replacing a plastic material with a different material, such as paper, metal or glass, resulting in an overall reduction of plastic use.

Open-Loop or Open Network: A reuse system where the goods purchased in a reusable package are consumed in a different location from where they were purchased.

Optimize/Optimization: Limiting the amount of covered material used in packaging by meeting product or packaging needs with minimal material. This includes, but is not

limited to, eliminating unnecessary components, right-sizing, concentrating, and using bulk or large format packaging (PRC section 42041(r)).

Package-Free Shop: Shops that sell goods to consumers using the consumer's dispensers to deliver products into consumer-owned packaging or use no packaging.

Packaging: Any separable and distinct material component used for the containment, protection, handling, delivery, or presentation of goods by the producer for the user or consumer, ranging from raw materials to processed goods. Packaging includes, but is not limited to, all of the following (PRC section 42041(s)):

1) Sales packaging or primary packaging intended to provide the user or consumer the individual serving or unit of the product and most closely containing the product, food, or beverage (PRC section 42041(s)(1)).

2) Grouped packaging or secondary packaging intended to bundle, sell in bulk, brand, or display the product (PRC section 42041(s)(2)).

3) Transport packaging or tertiary packaging intended to protect the product during transport (PRC section 42041(s)(3)).

4) Packaging components and ancillary elements integrated into packaging, including ancillary elements directly hung onto or attached to a product and that perform a packaging function, except both of the following (PRC section 42041(s)(4)):

   a) An element of the packaging or food service ware with a de minimis weight or volume, which is not an independent plastic component, as determined by the department (PRC section 42041 (s)(4)(A)).

   b) A component or element that is an integral part of the product, if all components or elements of the product are intended to be consumed or disposed of together (PRC section 42041 (s)(4)(A)).

Pallet: A durable platform, often made of wood, plastic, or metal, that is designed for multiple uses to store and transport goods in a supply chain.

Pallet wrap: A durable, eco-friendly alternative to single use plastic stretch film, designed to secure palletized loads for repeated use. Made from materials like heavy-duty mesh, vinyl, or canvas, these wraps often feature straps or hook and loop fastener for easy application and removal.

Plastic: A synthetic or semisynthetic material chemically synthesized by the polymerization of organic substances that can be shaped into various rigid and flexible forms, and includes coatings and adhesives; includes, without limitation, polyethylene terephthalate (PET), high density polyethylene (HDPE), polyvinyl chloride (PVC), low density polyethylene (LDPE), polypropylene (PP), polystyrene (PS), polylactic acid (PLA), and aliphatic biopolyesters, such as polyhydroxyalkanoate (PHA) and polyhydroxybutyrate (PHB), but does not include natural rubber or naturally occurring polymers such as proteins or starches (PRC section 42041(t)).

Plastic Component: Any single piece of covered material made partially or entirely of plastic. A plastic component may constitute the entirety of the covered material or a separate or separable piece of the covered material (PRC section 42041(u)).

Plastic Covered Material: Packaging made entirely or partially of plastic as defined in PRC section 42041(t).

Polyethylene Terephthalate (PET #1): A type of plastic commonly used for packaged goods.

Pooling: A system wherein standardized packaging is transported after cleaning to the closest filling location where it is needed, and to any manufacturer participating in the return network, potentially reducing the total distance between sorting and cleaning centers and the filling sites.

Postconsumer recycled content: Products or materials that were bought, used, and recycled by consumers (e.g., a newspaper that has been purchased, recycled, and used to make another product would be considered postconsumer material; sometimes referred to as just recycled content).

Prefill: Prefilled packaging system providing packaging that is filled by a manufacturer and designed to be a part of a system wherein it is returned to the producer or a third-party entity for reuse. [35]

Priority population: Refers to disadvantaged communities, low-income communities, communities in rural areas, and Tribes. These communities are defined as follows:

- **Disadvantaged communities:** An area identified by the California Environmental Protection Agency pursuant to Health and Safety Code section 39711 or an area identified as a disadvantaged unincorporated community pursuant to Government Code section 650302.10 (PRC section 42041(i)). In 2022, CalEPA released an updated designation of disadvantaged communities and currently defines disadvantaged communities as:
  - The top 25% of census tracts experiencing disproportionate amounts of pollution, environmental degradation, and socioeconomic and public health conditions according to the Office of Environmental Health Hazard Assessment's CalEnviroScreen 4.0 tool.
  - Census tracts lacking overall scores in CalEnviroScreen 4.0 due to data gaps but receiving the highest 5% of CalEnviroScreen 4.0 Pollution Burden composite scores.
  - Census tracts identified in 2017 as disadvantaged, regardless of their scores in CalEnviroScreen 4.0; and
  - Lands under the control of federally recognized Tribes.
- Low-income community: An area with household incomes at or below 80% of the statewide median income or with household incomes at or below the threshold designated as low income by the Department of Housing and Community Development's list of state income limits adopted pursuant to Health and Safety Code section 50093 (PRC section 42041(n)).

- Rural Area: Has the same meaning as defined in Health and Safety Code section 50101 (42041(ah)).
- California Native American Tribes: A Native American Tribe located in California that is on the contact list maintained by the Native American Heritage Commission for the purposes of Chapter 905 of the Statutes of 2004.

Product: A good and the packaging or food service ware that contains it.

Recycled content: Products or materials that were bought, used, and recycled by consumers (e.g., a newspaper that has been purchased, recycled, and used to make another product would be considered postconsumer material). Sometimes referred to as just recycled content or as postconsumer recycled content (PCR).

Refill/Refillable: Refers to products refilled or reused by the consumer.

Refill via concentrate: Refill via concentrate products deliver the good in a concentrated liquid, capsule/tablet, or powder form, to be reconstituted by the consumer in a reusable/refillable container provided by the producer, typically as part of the first product purchase. It is differentiated from single use concentrate because it is reconstituted in a package provided for that specific brand and product.

Reformulation: A process of altering a product's composition or processing (e.g., to allow for compatibility with expanded range of packaging types).

Retort processing: Method of heat-treating food inside a sealed package to make it commercially sterile, extending its shelf life and allowing it to be stored at room temperature. It requires a higher level of material strength and stability compared to hot-filling which can cause distortion as the pack cools, requiring thicker walls or structural reinforcement.

Reusable/Reuse: Refers to packaging or food service ware refilled or reused by the producer (PRC section 42041(af)).

Reusable Plastic Container (RPC): Durable plastic container designed for multiple uses and cycles, typically made from a durable polypropylene or similar material.

Right-size/Right-sizing: Reducing the amount of material used to package an item by reducing unnecessary space or eliminating unnecessary components of the packaging.

Rural: Defined by Rural-Urban Commuting Area (RUCA) codes, a Census-based classification system used by the United States Department of Agriculture (USDA), on the following characteristics of a geographic area based on the following commuting patterns: primary flow within an small town urban area of 9,999 or fewer people, or primary flow of 10% or more of the population to a small town urban area.

Single Use Packaging: Packaging that is routinely recycled, disposed of, or discarded after its contents have been used or unpackaged, and typically not refilled or otherwise reused by the producer (PRC section 42041 (e)(1)(A)).

Single Use Plastic Food Service Ware: This includes, but is not limited to, plastic-coated paper or plastic-coated paperboard, paper or paperboard with plastic intentionally added during the manufacturing process, and multilayer flexible material.

Skip-the-stuff: Practice of not providing single use plastic and nonplastic food service ware like utensils, napkins, and condiment packets (or only providing them upon consumer request), rather than automatically including them, especially in takeout and delivery orders.

Source Reduction: The reduction in the amount of covered material created by a producer relative to a baseline. Methods of source reduction include, but are not limited to, shifting covered material to reusable or refillable packaging or a reusable product or eliminating unnecessary packaging. It excludes the following ((PRC section 42041(aj)): (1) Replacing a recyclable or compostable covered material with a nonrecyclable or noncompostable covered material or a covered material that is less likely to be recycled or composted (PRC section 42041 (aj)(1)); (2) Switching from virgin covered material to postconsumer recycled content (PRC section 42041(aj)(2)).

Suburban: Defined by Rural-Urban Commuting Area (RUCA) codes, a Census-based classification system used by the United States Department of Agriculture (USDA), on the following characteristics of a geographic area based on the following commuting patterns: primary flow within a micro urban area of 10,000-49,999 people, or primary flow of 10% or more of the population to a micro urban area.

Tote (reusable): Portable, box-type industrial containers, generally with secure, closed tops and built-in handles, designed for the secure transport and storage of products. The tote can be collapsible or stack-and-nest to conserve space when empty.

Urban: Defined by Rural-Urban Commuting Area (RUCA) codes, a Census-based classification system used by the United States Department of Agriculture (USDA), on the following characteristics of a geographic area based on the following commuting patterns: primary flow within an urban area of 50,000 or more people, or primary flow of 10%or more of the population to a metro urban area.

Urban (GIS): Defined by the Census Bureau, as a densely developed territory that contains at least 2,000 Housing units or have a population of at least 5,000.

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