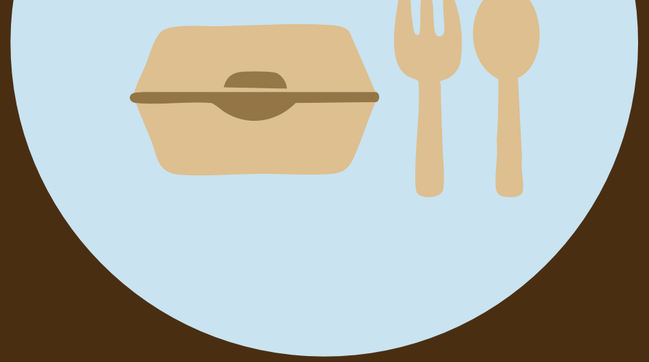

COMPOSTING CONSORTIUM

CLOSED LOOP CENTER for the Circular Economy

Incentivizing Compostable Packaging Recovery Through EPR Programs

A FRAMEWORK FOR COMPOSTER REIMBURSEMENT

Table of Contents

About Closed Loop Partners & the Composting Consortium

About Closed Loop Partners

Closed Loop Partners is at the forefront of building the circular economy. The company is comprised of three key business segments. Closed Loop Capital Management manages venture capital, private equity and catalytic capital & private credit investment strategies on behalf of global corporations, financial institutions and family offices. The Center for the Circular Economy unites competitors and partners to tackle complex material challenges and implement systemic change to advance circularity. Closed Loop Builders focuses on incubating, building and scaling circular economy infrastructure and solutions across the U.S. Closed Loop Partners is based in New York City and is a registered B Corp. For more information, please visit www.closedlooppartners.com. .

About the Composting Consortium

The Composting Consortium, managed by the Center for the Circular Economy at Closed Loop Partners, is a multi-year industry collaboration on a mission to build a world where organics are kept in circulation. The Consortium advances composting infrastructure and the recovery and processing of food-contact compostable packaging and food scraps in the U.S., to reduce food waste and mitigate climate impact. The Consortium brings together leading voices across the composting and compostable packaging value chain—from the world's leading brands to best-in-class composters running the operations on the ground. Through in-market tests, deep research and industry-wide collaboration, the Consortium is laying the groundwork for a more robust, resilient composting system that can keep food waste and compostable packaging in circulation.

Acknowledgments

Thank you to all our partners who were involved in the robust data collection and iterative feedback process that led to this report. The process involved stakeholders across the entire composting value chain, including composters, composting industry groups, global brands, packaging manufacturers, certification bodies and NGOs in the Composting Consortium network. Additionally, thank you to the subject matter experts outside of our immediate network who provided thoughtful feedback on our framework and methodology, including various agencies with EPR needs assessment experience, state regulatory agencies and select EPR Advisory Board representatives. Lastly, thank you to Craig Coker for his collaboration on the creation of the reimbursement framework. The input we received from these stakeholders was crucial to ensuring the real-world applicability of this work.

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EXECUTIVE SUMMARY

Why did we undertake this work?

Extended Producer Responsibility (EPR) has recently emerged in the United States as a policy mechanism with the potential to accelerate the circular economy, by encouraging more sustainable packaging designs, providing funding for recycling infrastructure, and introducing new incentives for brands and manufacturers to recover the materials they produce. When designed thoughtfully, EPR can be used as a tool for expanding composting infrastructure in the U.S. and can help fund the collection and processing of certified, food-contact compostable packaging.

The Composting Consortium's research has shown that compostable materials, alongside reusable and recyclable materials, play a key role in a circular economy. Certified, food-contact compostable packaging serves as a vessel to divert valuable food scraps from landfill and can help reduce associated greenhouse gas emissions. However, with few exceptions, most EPR programs around the world overlook or exclude compostable packaging and the role it plays in building a circular economy. We want to change that reality by illustrating why compostable packaging is a key component of successful EPR programs. Equally important, we believe composters who accept compostable packaging should be adequately reimbursed for their contribution to a circular economy.

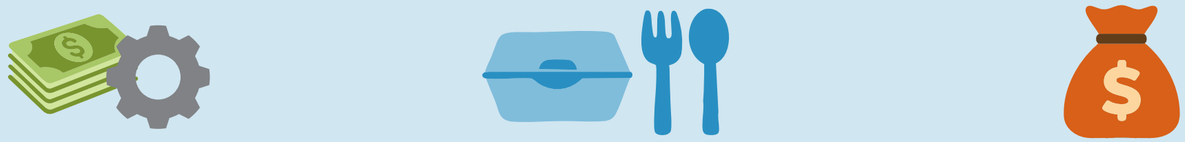
This analysis and framework are meant to support Producer Responsibility Organizations (PROs), regulatory agencies and legislative staff in developing thoughtful EPR programs and EPR investment strategies. Since the market size of conventional plastics and other recyclable commodities like aluminum and glass are far greater than the market size for compostable packaging, it's likely that EPR reimbursement for the composting industry will be initially limited as state programs roll out. **This report provides guidance to decision-makers on how to strategically allocate comparatively limited funding downstream to composters, ensuring it is being put to its best and highest use, while aligning with a state's EPR program goals.** Within the report, we outline a reimbursement framework to incentivize composter participation in EPR programs. We also offer practical recommendations for using EPR funds to enhance composting infrastructure and increase the recovery of compostable packaging.

Introduction to the Composter Reimbursement Framework

This report and framework are results of a collaborative data analysis between the Composting Consortium and 10 of our composter partners. **We developed this framework and supporting recommendations as a foundation for the industry to encourage EPR programs to support composting infrastructure and incentivize the recovery of certified, food-contact compostable packaging.** We opted for a harmonized approach instead of a state-specific one, aiming for simplicity, replicability and feasibility. **This framework is for newly established and emerging EPR programs that are working to determine how to include compostable packaging within their programs and how to charge compostable packaging fees.**

Within this reimbursement framework, we propose a "volume-precision" approach, which compensates a composter based on the volume of compostable packaging that is processed at each facility.

The simple calculation for this approach is as follows:



Operational reimbursement value	=	% of total compostable packaging processed at facility	X	total available funding for composter reimbursement

Calculating the reimbursement for each composter depends on four key variables, which are explored in Part 1 of this report.

- **amount of money available** in that specific EPR program
- **number of composters** processing compostable packaging in the state
- **volume of compostable packaging** each composter processes
- **how that volume compares** to that of other composters in the state

The volume-precision framework reimburses composters based on how much compostable packaging they process relative to fellow composters in their state. There is a direct correlation between the amount of compostable packaging processed, and the dollar amount that is reimbursed to the composter. This approach incentives greater acceptance of compostable packaging and rewards early adopters (i.e., composters who already accept compostable packaging or are preparing to accept these materials).

Our analysis, in partnership with composters, supported our hypothesis: **the cost of processing compostable packaging is highly variable based on operating choices and the regions in which composters operate.** Unlike recyclable commodities, there is no standard rate for handling compostable packaging. This is why we have applied a volumetric approach to our framework, rather than a cost-based approach. We believe that, in time, as programs mature and as compostable packaging becomes more widely accepted, it may be possible to calculate based on costs (see Appendix A: *Can Composter Reimbursement Be Approached Like Recycling Reimbursements?*)

Our collaborative, composter-led approach and analysis unearthed critical insights into what's needed to encourage composter participation in EPR programs, how EPR financing can strengthen the composting industry, and the unrealized potential for compostable packaging within EPR programs. **We've developed a simplified and efficient reimbursement process, along with eligibility criteria and verifiable data collection and reporting requirements** (see Appendix B: *The Importance of Waste Characterization Studies in Influencing Composter Reimbursement*). More details on our reimbursement framework can be found in Part 1 of this report.

SUMMARY OF KEY TAKEAWAYS: HOW TO INCENTIVIZE COMPOSTER PARTICIPATION IN EPR PROGRAMS AND INCREASE THE RECOVERY OF COMPOSTABLE PACKAGING

Prioritize composter reimbursement

The first step to incentivize composter participation in EPR programs is to ensure composters are appropriately reimbursed for processing compostable packaging.

Develop composting infrastructure

Investing in and expanding composting infrastructure is essential for the success and longevity of an EPR program. Without a long-term investment plan, material recovery is unlikely.

Collaborate with composters

Those who are involved in EPR program and policy development—including regulatory agencies, policymakers and the PRO, must collaborate with composters to create realistic reimbursement frameworks that benefit both the compostable packaging industry and composting industry.

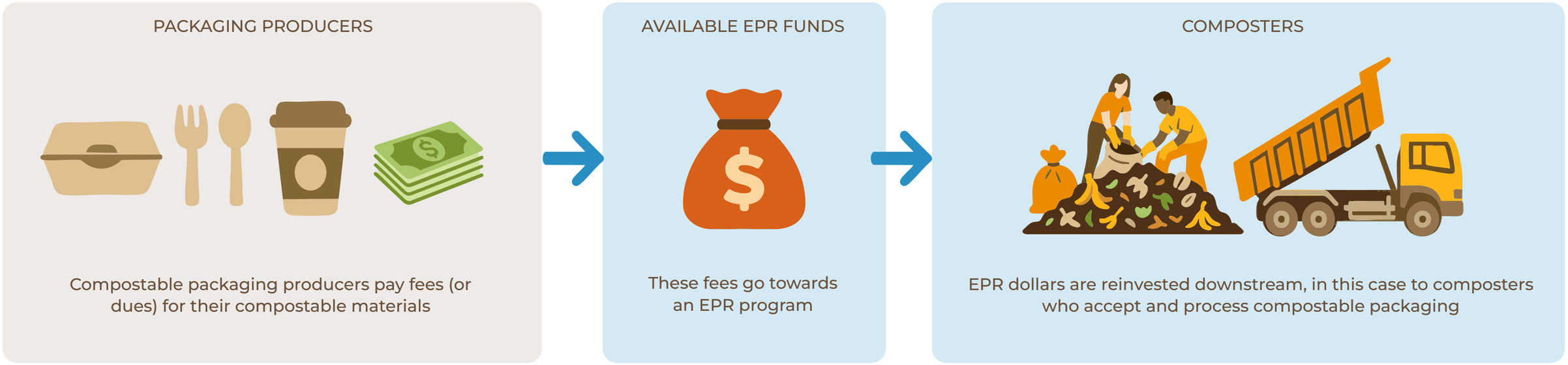
PART 1
COMPOSTER REIMBURSEMENT FRAMEWORK

Our Focus on Composter Reimbursement Within an EPR Program

EPR is designed so that packaging producers must pay fees, or dues, for the packaging materials that are sold into a particular market. As Figure 1 shows, within a state EPR program, payment is collected from producers and enters a fund, which we will refer to henceforth as an "EPR fund" for simplicity. That money is then allocated and redistributed back into the state's recycling system. Producer payments and reimbursement payments are connected but distinct. The framework and recommendations outlined in this report focus on the reimbursement side of the equation. A sound reimbursement approach will be critical to the success of any EPR program, especially one that is focused on encouraging composting infrastructure.

Our framework identifies how to allocate and invest EPR dollars downstream to support circular outcomes for compostable packaging. We gathered composters' perspectives on how EPR funding could support the collection and processing of certified compostable packaging and the expansion of composting infrastructure. Our analysis also takes composter operational costs into account—a critical consideration in the reimbursement strategy.

FIGURE 1



The framework we've developed is volume-based. It is designed to incentivize greater acceptance of compostable packaging and rewards early adopters (i.e., composters who already accept compostable packaging or are preparing to accept these materials), as the reimbursement is based on the relative volume of compostable packaging processed by composters in a given state. There's a direct correlation between the amount of compostable packaging processed and the dollar amount that is reimbursed to the composter. As a result, our proposed volume-precision framework relies on a minimum of twice annual (or more frequent) waste characterization studies conducted on site, at each facility, by a qualified third party (see Appendix B for more details). We believe this framework can promote better data collection and provide an in-depth understanding of which materials make their way to composting sites—critical information for education and outreach programs, producer fees and eco-modulation fees.

This framework is replicable and realistic; it works well for EPR programs that that are in their early years, and can be refined over time as programs mature and better data is collected. This framework is also resource-intensive, as it requires consistent third-party waste characterization studies to track and report volumes of compostable packaging at each compost facility. The PRO would be financially responsible for these audits, and labor and data analysis would be conducted by a third party. In this report, we provide a baseline reference for waste characterization studies, modeled after the Composting Consortium's contamination study and report, *Don't Spoil the Soil*. The methodology from this body of research can be used as a starting point for future waste characterization studies.

Three primary objectives of this research:

1. Drive consensus on composter reimbursement rates that are equitable, economically viable and make sense for the composter business model.

2. Develop a realistic, replicable framework for PROs to use in current and future EPR state program plans.

3. Encourage the adoption of certified food-contact compostable packaging and strengthen composting infrastructure, integrating both into the circular economy.

Methodology for Composter Reimbursement

Composting industry representation on state EPR Advisory Boards is imperative for the long-term success of EPR;[i] composters were key collaborators on this reimbursement framework. In partnership with a cohort of Composting Consortium composter partners, we developed a framework for composter reimbursement that reflects how EPR funding can be best applied downstream, ensuring optimal outcomes for both the producer (i.e., brands, packaging manufacturers) and the processor (i.e., composter). In addition, we've created qualitative recommendations for supporting composting infrastructure in accordance with EPR objectives. We opted for a harmonized approach instead of a state-specific one, aiming for simplicity, replicability and feasibility.

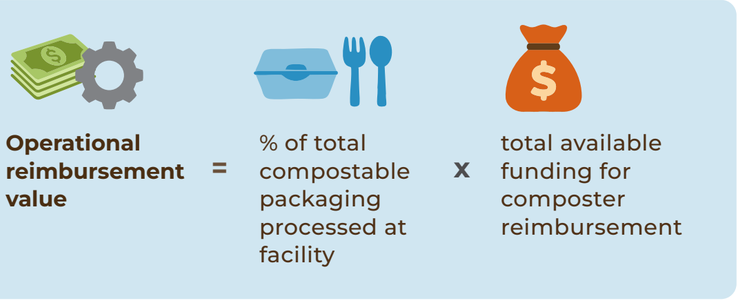
The data analysis and feedback process took place from fall 2024 to spring 2025. Data collection and engagement predominantly included composters from California, Colorado, Maryland, Massachusetts and Minnesota, but the cohort was not exclusive to these states. While each of these states is unique, they are all (except Massachusetts) governed by the same PRO organization, Circular Action Alliance (CAA). Each state has a distinct approach towards compostable packaging, but there are commonalities related to composting found throughout each state's legislation and needs assessments. We also assessed EPR programs in Canada, the United Kingdom and Italy. Based on our learnings and observations, we identified several aspects worth replicating and exploring further, alongside notable gaps. We incorporated these insights, discussions and debates into the framework and analysis presented in this report.

FIGURE 2. WHAT KIND OF DATA DID WE COLLECT FROM OUR COMPOSTER PARTNERS?

- ✓ Feedstock acceptance
- ✓ Hauling
- ✓ Facility & equipment
- ✓ Screening & processing
- ✓ Processes to manage contamination
- ✓ Cost drivers including but not limited to labor, equipment & time to process
- ✓ Compost end markets

Reimbursement Formula: The “Volume-Precision” Framework

Historically, EPR programs have assessed fees based on material weight. When it comes to operational reimbursement, **we recommend that reimbursement should be assessed on a volume basis, not a weight basis.** Composting is a volumetric business, and as such, volume is a more accurate measure of composter operating costs than weight. Most compost sales are made by the cubic yard. Composters rely on visual inspections to gauge levels of contamination, and results are expressed on a percentage basis, by volume. We know that material weights don’t tell the full story, as there are varying densities of compostable materials, like thin plastic films and flexibles (e.g., compostable snack packaging).



There are three preliminary assumptions behind the volume-precision framework:

1.
To be eligible, composters must prove that they accept, and responsibly process, certified compostable packaging. For more details, refer to the section *Considerations for Composter Reimbursement Eligibility*

2.
The percentage of total compostable packaging processed at a facility represents its share of overall compostable packaging volume compared to other eligible facilities in the state.

3.
Understanding the precise volume or percent of compostable packaging that is processed on-site relies on consistent, verifiable waste characterization studies at each facility.

A Note on Language and Terminology

This report uses the terms “compostable packaging,” “certified compostable packaging,” “food-contact compostable packaging” and “certified, food-contact compostable packaging” interchangeably. In each instance, we are referring to products and packaging made from certified industrial compostable (e.g., BPI certified) materials which are designed to deliver food scraps to compost facilities and divert food waste from landfill. Composters who accept compostable packaging generally view these materials as a neutral part of their process. Many of the composters who accept these materials agree that compostable packaging provides a sustainable alternative to single-use plastic, acts as a bulking agent (i.e., a carbon source), and can help increase food waste volumes at their facilities.

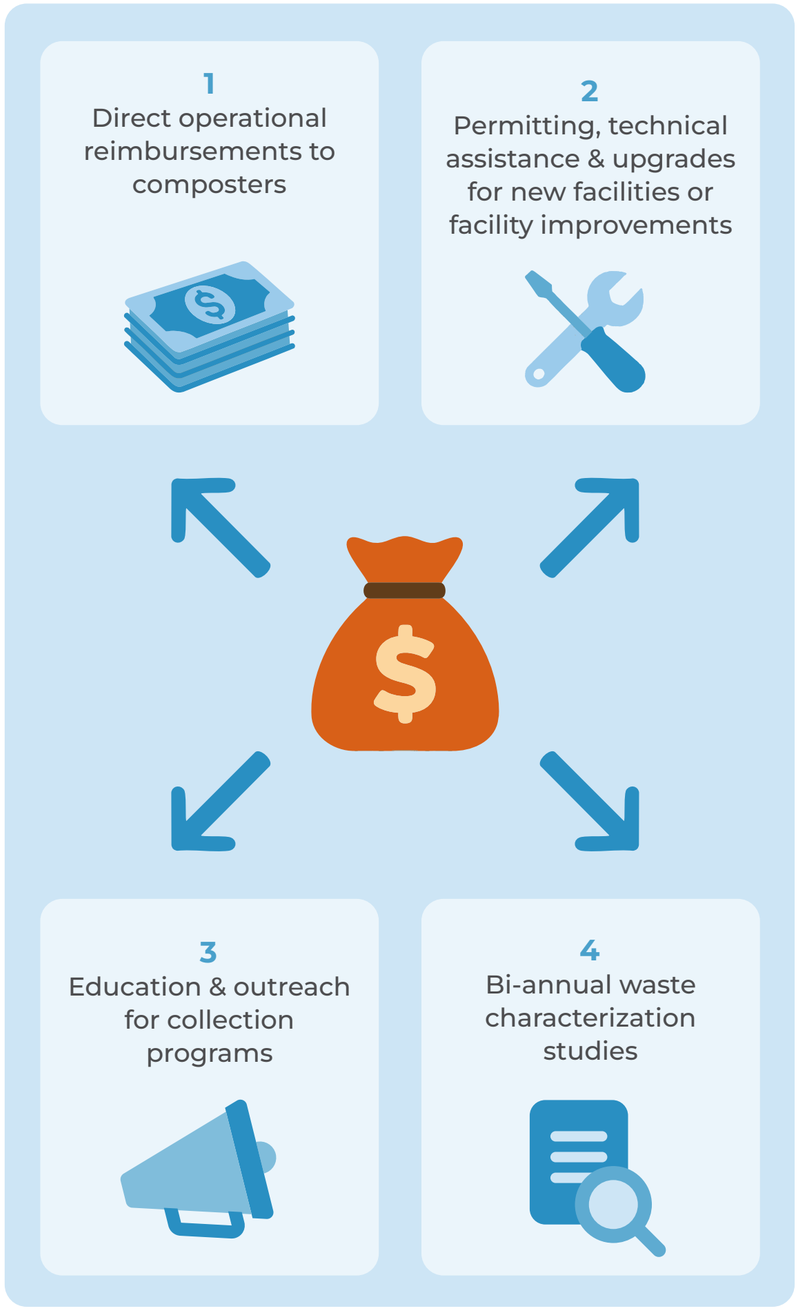
Figures 3 and 4 lay the groundwork for the hypothetical application of our volume-precision framework. The composter archetypes and dollar amounts laid out in these hypothetical scenarios were informed by data collection from our composter partner cohort. The information in these models should not be taken as absolute. These scenarios are meant to be illustrative and show the variance in composter business models and ideal ways in which reimbursement could unfold. For the purposes of this exercise, we're assuming that all these composters operate in the same state.

Imagine that compostable packaging producers have fulfilled their obligations and paid their respective fees (or dues) for compostable materials in a particular market. These payments create an EPR fund which is managed by the PRO and redistributed to the composting industry through various channels. In this scenario, that money can be redistributed back to the composting industry in several ways, and in different dollar amounts. **As a starting point, the Consortium proposes four reimbursement categories to cover a specific set of expenses.**

We asked composters in our network about incentives for participating in EPR, and how EPR dollars could encourage more composters to accept and recover compostable packaging.

Their responses shaped our reimbursement distribution model. We recommend these four reimbursement categories as a starting point, because they are easy to understand and applicable to most EPR programs. However, the PRO could adapt, amend or expand these categories based on the structure and requirements of a particular state's EPR program. Over time, as the EPR program matures and compostable packaging is more widely accepted and collected, the PRO could reevaluate the prioritization of these reimbursement categories. Figure 3 provides an illustration of the reimbursement distribution.

FIGURE 3. AN EXAMPLE OF THE REIMBURSEMENT DISTRIBUTION MODEL



Step 1

We recommend that the PRO begins by focusing on direct operational reimbursement to composters who accept compostable packaging. For compostable packaging to work in an EPR system, the EPR program must ensure that there are adequate recovery systems in place for compostable materials. Moreover, incentivizing "early adopters" is critical to build economic incentives for composter participation. One composter we spoke to explained,

"If I were to participate, the reimbursement would, at a minimum, have to cover my operating costs to process these materials, including contamination removal and wages for my workers."

The Composting Consortium agrees that it's critical for composters to be adequately reimbursed for the time, energy and resources spent recovering and processing compostable packaging, and our model takes these costs into consideration.

Step 2

After eligible composters have been reimbursed, the PRO should invest any remaining cash into permitting, technical assistance and upgrades to build new facilities or improve the processing efficiency at existing facilities. These funds are essential for infrastructure expansion and new projects and can help ensure that the EPR program achieves scale and longevity. We explore this further in Part 2 of this report.

Step 3

A remaining, but smaller portion of funding should be invested in education and outreach for organics collections programs and composting. A key benefit of investing in education and outreach is that it helps to ensure the recycling and organics streams remain clean and contaminant-free, and that packaging and products end up at the right processing facility.

Several composters we surveyed agreed that the biggest challenge with taking compostable materials is contamination from non-compostable products, and addressing product labeling and design issues is crucial to encourage composter participation in EPR programs.

The Composting Consortium and Biodegradable Products Institute (BPI) led extensive national research on consumer perception of compostable packaging. This research uncovered several best practices for brands and manufacturers when designing compostable and non-compostable packaging. Our study found that U.S. consumers had an easier time identifying compostable packaging where there were two to three "compostable" call outs on the product or package, accompanied by the BPI certification mark. The PRO can refer to the best practices in our report, *Unpacking Labeling and Design: U.S. Consumer Perception of Compostable Packaging*, when determining how eco-modulation, especially when supplemented with strong labeling laws, could be used as a tool to reduce contamination in the organics streams and encourage acceptance of compostable packaging.

Step 4

Finally, we suggest setting aside enough money to support twice-annual, third-party waste characterization studies at compost sites that accept compostable packaging. Understanding the makeup of organics feedstock is an important element of our framework. More details on waste characterization studies can be found in Appendix B: *The Importance of Waste Characterization Studies in Influencing Composter Reimbursement.*

As shown in Figure 4, we've modeled a scenario in which six composting facilities in one EPR state accept compostable packaging. These six composters vary in size, capacity and throughput, business model, population size serviced, composting technology, and operational and capital expenses, but they all accept compostable packaging. To demonstrate the diversity of business models, imagine these six archetypes:

FIGURE 4. A HYPOTHETICAL APPLICATION OF THE VOLUME-PRECISION FRAMEWORK: SAMPLE COMPOSTER ARCHETYPES BASED ON VOLUME PROCESSED

Who is eligible for reimbursment?

Composter A

One of the largest, privately-operated facilities processing nearly half of the state's recovered compostable packaging

Composter B

A large publicly owned, privately-operated facility processing about 40% of the state's recovered compostable packaging

Composter C

A mid-sized, privately-operated facility processing 6% of the state's recovered compostable packaging

Composter D

A mid-sized, privately-operated facility processing 3% of the state's recovered compostable packaging

Composter E

A small, privately-operated facility processing 1% of the state's recovered compostable packaging

Composter F

A micro municipal facility processing less than 1% of the state's recovered compostable packaging

Calculating the reimbursement for each composter depends on four key variables, which are laid out in Figure 5.

The amount of money available in that specific EPR program

The number of composters processing compostable packaging in the state

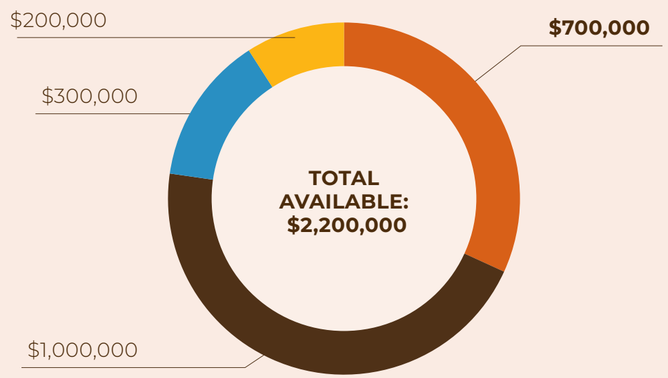
The volume of compostable packaging each composter processes

How that volume compares to other composters in the state

Note: To determine the percentage of total compostable packaging processed at a facility, divide the amount of compostable packaging recovered at that facility by the total amount of compostable packaging recovered in the state. For example, Composter D processed 560 cubic yards (cy) of compostable packaging out of 16,755 total cubic yards of compostable packaging recovered statewide. This composter handles just over 3% of the state's recovered compostable packaging. Based on our analysis and feedback from composters, we suggest the PRO aims to cover the operating costs per cy of compostable packaging processed, plus an additional 15%.

FIGURE 5. A HYPOTHETICAL APPLICATION OF THE VOLUME-PRECISION FRAMEWORK: SAMPLE REIMBURSEMENT VALUE BREAKDOWN

EPR FUND – TOTAL AVAILABLE REIMBURSEMENT FOR COMPOSTING SYSTEMS



KEY

- OPERATIONAL REIMBURSEMENT TO COMPOSTERS WHO ACCEPT COMPOSTABLE PACKAGING
- EDUCATION & OUTREACH FOR ORGANICS COLLECTIONS PROGRAMS
- PERMITTING, TECHNICAL ASSISTANCE & FACILITY UPGRADES
- BI-ANNUAL WASTE CHARACTERIZATION STUDIES

	ALL ORGANICS PROCESSED (CY)	RECOVERED COMPOSTABLE PACKAGING (CY)	PROPORTION OF RECOVERED COMPOSTABLE PACKAGING (%)	COMPOSTER REIMBURSEMENT VALUE
COMPOSTER A	110,000 CY	8,000 CY	47.7%	$334,228.59
COMPOSTER B	140,000 CY	7,000 CY	41.8%	$292,450.01
COMPOSTER C	38,500 CY	1,000 CY	6.0%	$41,778.57
COMPOSTER D	15,000 CY	560 CY	3.3%	$23,396.00
COMPOSTER E	11,000 CY	175 CY	1.0%	$7,311.25
COMPOSTER F	2,000 CY	20 CY	0.1%	$835.57
TOTAL	**316,500 CY**	**16,755 CY**	**100%**	**$700,000.000**

Dollar amounts are hypothetical and for illustrative purposes only. Volumes are based on real-world composter data.

CY = CUBIC YARDS

As the model shows, a composter's reimbursement value (i.e., their annual reimbursement paycheck) depends on the total available funds and the volume of compostable packaging processed at a specific facility. When looking at overall recovered compostable packaging, we have intentionally made the distinction between the volume of recovered compostable packaging versus what is sold into the state market, as we know that the two are not the same. A state could replicate this analysis and approach by adding or subtracting the number of eligible compost facilities, so that it's a state-representative model.

In this hypothetical example, there's a total of $2.2 million in the EPR fund for composting systems. In reality, this dollar amount is wholly dependent on two factors:

1. **How much compostable packaging is sold into a particular market; and**

2. **The producer fees assigned to compostable packaging in a state EPR program.**

The PRO is responsible for determining that information. In this model, we've carved out $700,000 of the total available $2.2 million for composter reimbursement—nearly 1/3 of the overall available funding. As such, reimbursement checks range from approximately $800 to just over $330,000. **These payouts reflect the relative volume of compostable packaging processed by each facility.** For example, Composter A receives the largest reimbursement because they process nearly half of all recovered compostable packaging in the state. **A key benefit of a volume-based approach is that it prevents deficits, as reimbursement is drawn from available funding.**

Strategic Distribution of EPR Funds

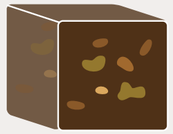
Ultimately, it's up to the PRO to decide how much cash from EPR programs will be directed downstream, and for what purpose. In our model, nearly 1/3 of the total EPR funding for composting systems goes towards direct operational reimbursement.

We asked composters in our network: how do you think payments should be made in a way that is fair and equitable to both the composter and the producer? Their responses generally fell into the following four categories.

We encourage the PRO to consider the following factors when determining how cash will be re-invested downstream into composters' businesses and composting infrastructure.

1

Volume-Based Reimbursement



As our "volume-precision" framework suggests, **payments should be based on the volume of compostable packaging processed,** not weight or tonnage, to account for the varying densities of compostable materials, like thin plastic films and flexibles.

2

Compensation for Operational Costs and Added Complexities

Given the added complexities that often come with handling compostable packaging (e.g., contamination from look-alike packaging that can slow down a composter's processing time), reimbursement should, whenever possible, cover these costs. For example, we know that composters spend about 20% of their operating costs addressing contamination of the stream. If this can't be remedied through direct operational reimbursement, it should be addressed through targeted education and outreach efforts.

As part of this analysis, we worked with composters to understand the volumes of material they process as well as their operating costs. As shown in Figure 5, compostable packaging makes up about 5.3% of the volume of total organics processed in the

sample EPR state (16,755 cy over 316,500 cy). The aggregate operating expenses (OpEx) of the six composters in our model (Composters A-F) is approximately $11 million per year. As such, we can assume that about $600,000 in OpEx (5.3% of $11 million) goes towards managing compostable packaging. In our model, composters are reimbursed in full for OpEx for managing compostable packaging plus an additional 15% bonus to account for these added complexities. With this approach, the reimbursement rate comes out to just under $42/cy of compostable packaging. We recognize that, even with the added 15%, this amount may not be enough to justify participation for all composters, but we believe it's a logical starting point.

What To Do When Funding Is Limited:
Our model shows a scenario in which cumulative OpEx costs are less than the total available funding. In a state with more robust composting infrastructure (e.g., California), it's possible that the cumulative OpEx may surpass the total available funding. In this scenario, the framework is still functional, since composters are reimbursed based on the relative volumes of compostable packaging processed. However, the reimbursement rate may be lower than the OpEx for managing compostable packaging. In this instance, the PRO would cap reimbursement at a specific dollar amount. We encourage the PRO to work closely with their Composting Industry and Compostable Packaging Industry Advisory Board Representatives to determine a reimbursement amount that makes sense based on a state's EPR budget. **As a starting point, the PRO should gather the following data from composters in their state to understand the true costs of processing compostable packaging. The PRO could use this information as input for determining compostable packaging producer fees.**

- **Total volume of organics processed** per year
- **Total volume of compostable packaging processed** per year
- **Annual OpEx,** including tip fees
- **Commodity revenue and/or the sale price** of finished compost products
- **The cost of purchasing and/or maintaining equipment** and machinery (CapEx)

3

Factoring in the Price of Finished Compost

It could also be argued that an adequate reimbursement rate should be based on the commodity value of finished compost made from food waste and compostable packaging. In our model and analysis, the average cost of finished compost was approximately $37/cy, ranging from roughly $13/cy to $70/cy. The cost of finished compost varies greatly depending on the quality of the product, the region in which it's produced and sold, product demand, and the use-case (e.g., landscaping, stormwater management, agriculture, etc.).

The Composting Consortium encourages compostable packaging producers to purchase finished compost in EPR states, and apply it to their own company campuses, or invest it back in the local communities where they operate. Doing so encourages a closed loop system and incentives composters to accept compostable materials, because there would be

a secure end market for their finished product. Having a guaranteed buyer can help alleviate concerns among composters who worry that accepting compostable packaging might hinder their ability to sell finished compost. The composters in our network agree that for EPR to work for composting, there must be strong end markets in place for the finished product.

The predominant end market that is often cited, and inhibited by, compostable packaging is organic agriculture. This consideration is especially poignant in a state like California, where organic agriculture is one of the leading end markets for composters, and compostable packaging is not an allowable input in organic compost.

We asked 10 composters across the country, and nine stated that organic agriculture and organic lawn care excluded, accepting compostable packaging does not inhibit their ability to sell to end markets in any meaningful way.

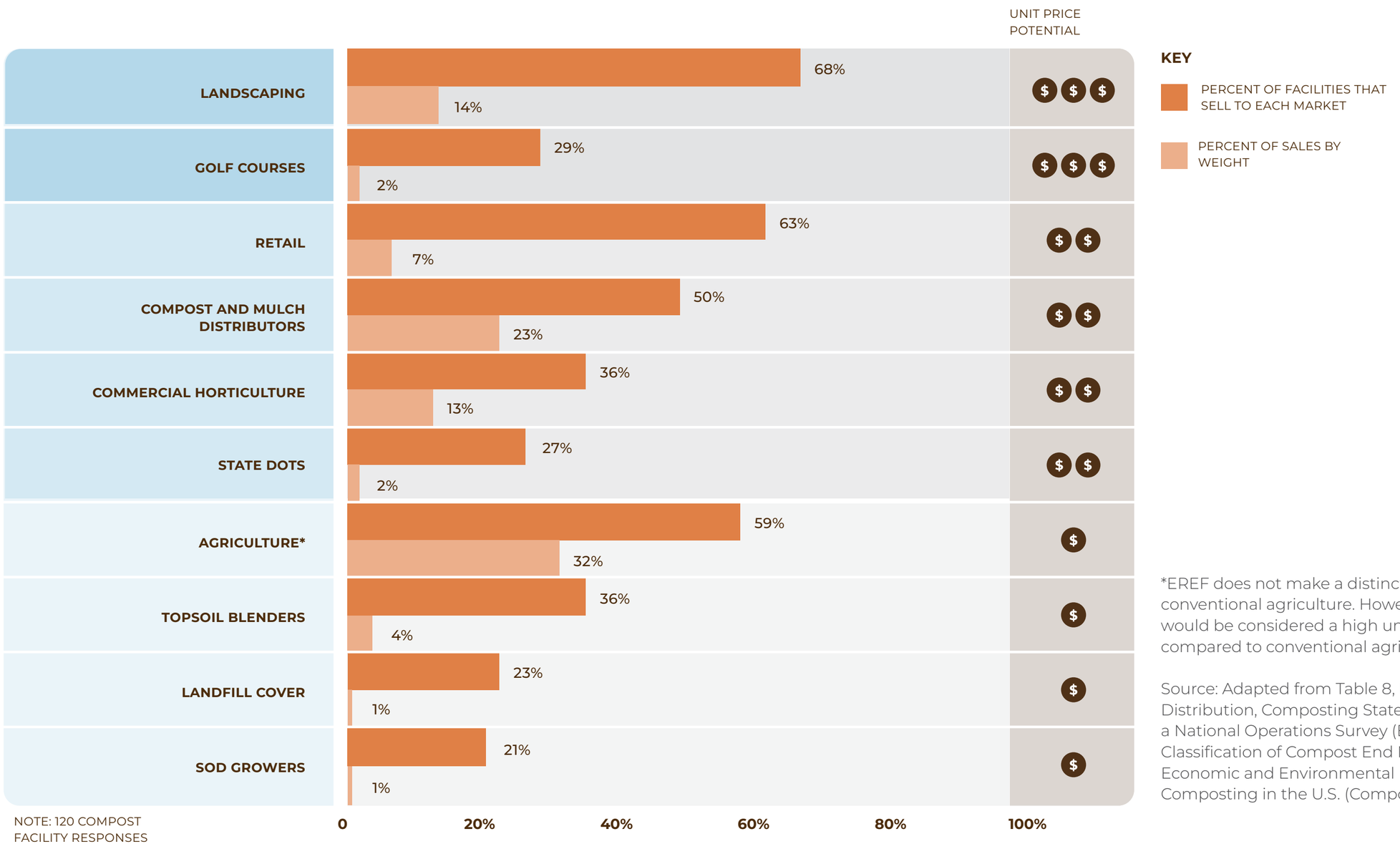
This sentiment suggests that composters who accept compostable packaging have many viable end markets beyond organic agriculture.

Note: As of spring 2025, the National Organic Program (NOP) does not allow certified compostable packaging as an input to certified organic compost. The organic seal is issued by the Organic Materials Review Institute (OMRI). OMRI reviews products to ensure they meet National Organic Program (NOP) standards, meaning a product with the OMRI seal has been verified to comply with NOP regulations and is suitable for certified organic agriculture.iii

As shown in Figure 6, the Composting Consortium's investment research identified the unit price potential of various end markets which composters can sell to. We overlaid those prices with data from the Environmental Research & Education Foundation (EREF)'s 2024 report, Composting State of Practice: Results from a National Operations Survey.

EPR presents an opportunity to bolster responsible end markets by investing in the composting businesses that serve them. Doing so can signal new market demand, create robust markets and ensure that composters have a guaranteed buyer for their finished compost when they accept compostable packaging. For example, certified organic compost is widely understood to be one of the highest-value soil amendments, but finished compost used for emerging markets like stormwater management or golf courses have the potential to be sold for similar high dollar values. There are many established and emerging end markets for composters who accept compostable packaging that could be bolstered through EPR programs.

FIGURE 6. LEADING COMPOST END MARKETS IN THE U.S., BY TOTAL TONS SOLD



NOTE: 120 COMPOST FACILITY RESPONSES

*EREF does not make a distinction between organic and conventional agriculture. However, organic agriculture would be considered a high unit price potential ($$$) compared to conventional agriculture ($)

Source: Adapted from Table 8, Markets for Compost Distribution, Composting State of Practice: Results from a National Operations Survey (EREF, 2024) and Table 16, Classification of Compost End Markets, Unleashing the Economic and Environmental Potential for Food Waste Composting in the U.S. (Composting Consortium, 2024)

4

Comprehensive Reimbursement for the Whole System

The vertically integrated composters we spoke to affirmed that EPR funds should support both the collection and processing of compostable packaging, ensuring proper handling from start to finish. Haulers are often the first line of defense in the collection process and therefore have the most visibility and control over the quality of materials that are collected in the stream. As such, they play a crucial role in both the quality and cleanliness of the organics stream, as well as the volume of material diverted from landfill. Reimbursement for collection and hauling could fall under the definition of education and outreach, depending on how the EPR plan is set up.

In summary, a processor's operating costs can be a helpful indicator to inform aspects of reimbursement, but they shouldn't be the deciding variable *(see Appendix A for details)*.

As of today, we do not think conventional recycling reimbursement formulas are translatable to the composting industry. Instead, we encourage the PRO to utilize and build upon our volume-precision framework for EPR programs in their initial years. Over time, as EPR programs are established, and more compostable packaging is collected, we can assume that the range of operational costs would tighten, making it possible to approach composting reimbursement in a way that more closely resembles conventional recycling.

Considerations for Composter Reimbursement Eligibility

According to BioCycle, more than 200 composters in the U.S. today accept and process some or all formats of compostable packaging,[iv] but there is no official manual or industry guide for managing compostable packaging. The US Composting Council is working to create a "good management practice" guide as a tool for the industry. This type of resource could be used by the PRO, and by composters themselves, as a verification reference to determine reimbursement eligibility. In the absence of this type of verification resource, **we believe it is essential for composters to meet these basic criteria to be eligible for EPR reimbursement:**

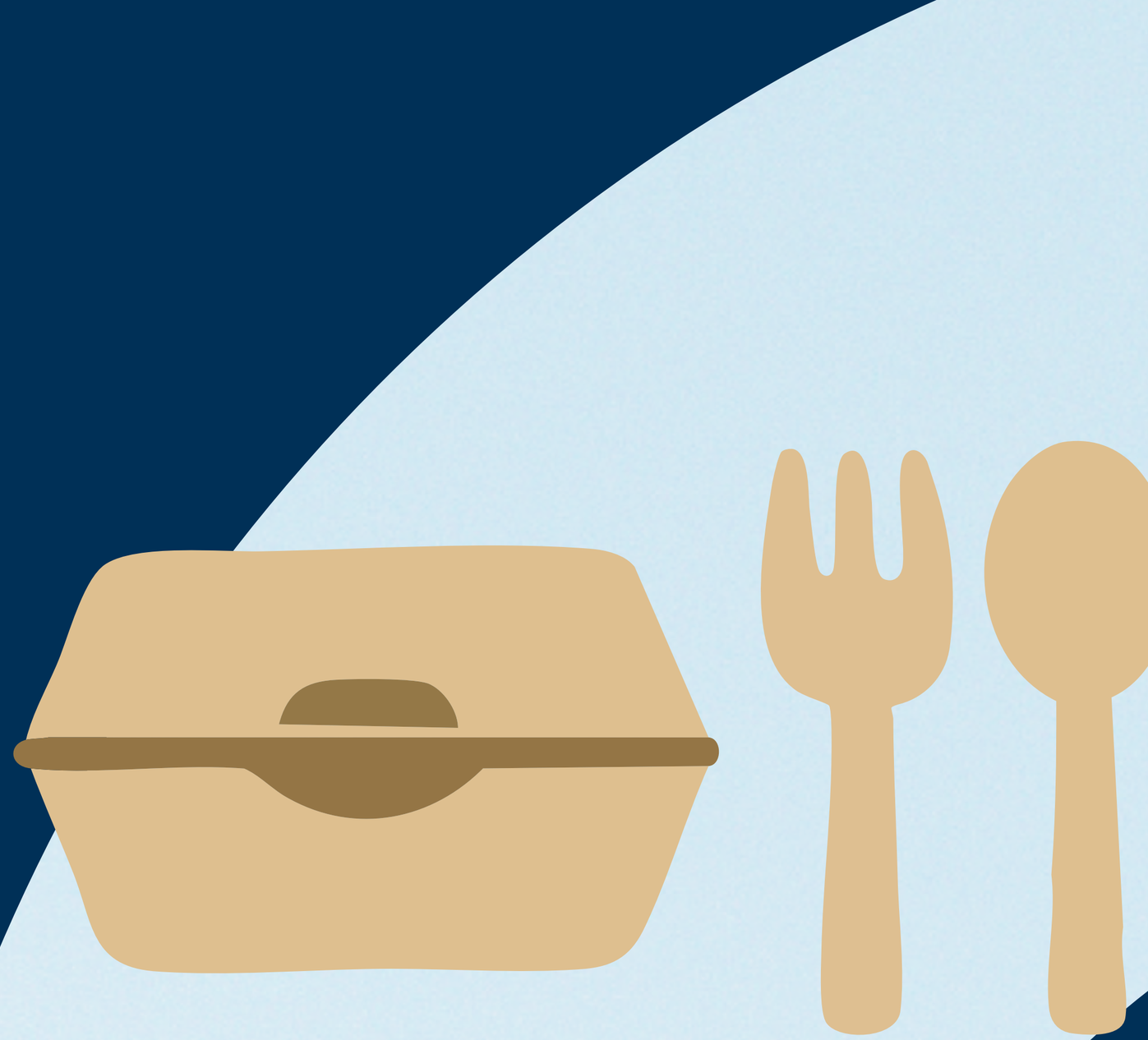
1. **Facility proves that they accept and can** successfully process certified compostable packaging in their composting operations.
2. **Facility does not intentionally** pre-remove compostable packaging, run compostable packaging through a depackager, and/or screen out compostable packaging during the composting process.
3. **Facility proves that they can** consistently produce a high-quality finished compost.
4. **Compost produced by the eligible facility must meet Seal of Testing Assurance (STA)**. Compost manufacturers in the STA Certified Compost program are required to meet high standards, including frequent testing via third party labs, transparent product information and regulatory compliance.[v]

In addition to the proposed waste characterization studies, it is reasonable for the PRO to request basic reporting and documentation from eligible composters. For example, composters can visually audit and report estimates on the volumes of compostable packaging processed at their site. It's typical for composters to take photographs of the loads that are dropped at their sites to monitor contamination, and these photos could be used as a cross-reference against waste characterization study data.

As the PRO continues to think about how to define composter eligibility, they could look to the United Kingdom's EPR programs for inspiration. In the UK, accredited materials recovery facilities (MRFs) issue and sell Packaging Waste Recovery Notes (PRNs) to certify that a specific amount of packaging has been recovered and recycled at their facility. The basic formula used is 1 PRN = 1 metric tonne of recycled/reprocessed material. MRFs then sell those PRNs to producers who need them to comply with EPR regulations. To help producers meet this obligation, the PRO will purchase different types of PRNs to help offset producer fees for materials like plastic, aluminum and glass. The revenue from PRN sales supports recycling infrastructure by funding activities like collection, sorting and processing to meet national recycling targets. The Compostable Coalition, a UK-based initiative, is exploring how PRN notes could be issued by compost facilities against recovered compostable packaging. Our study's proposed bi-annual waste characterization studies could be used as a verification tool against PRNs in future EPR programs.

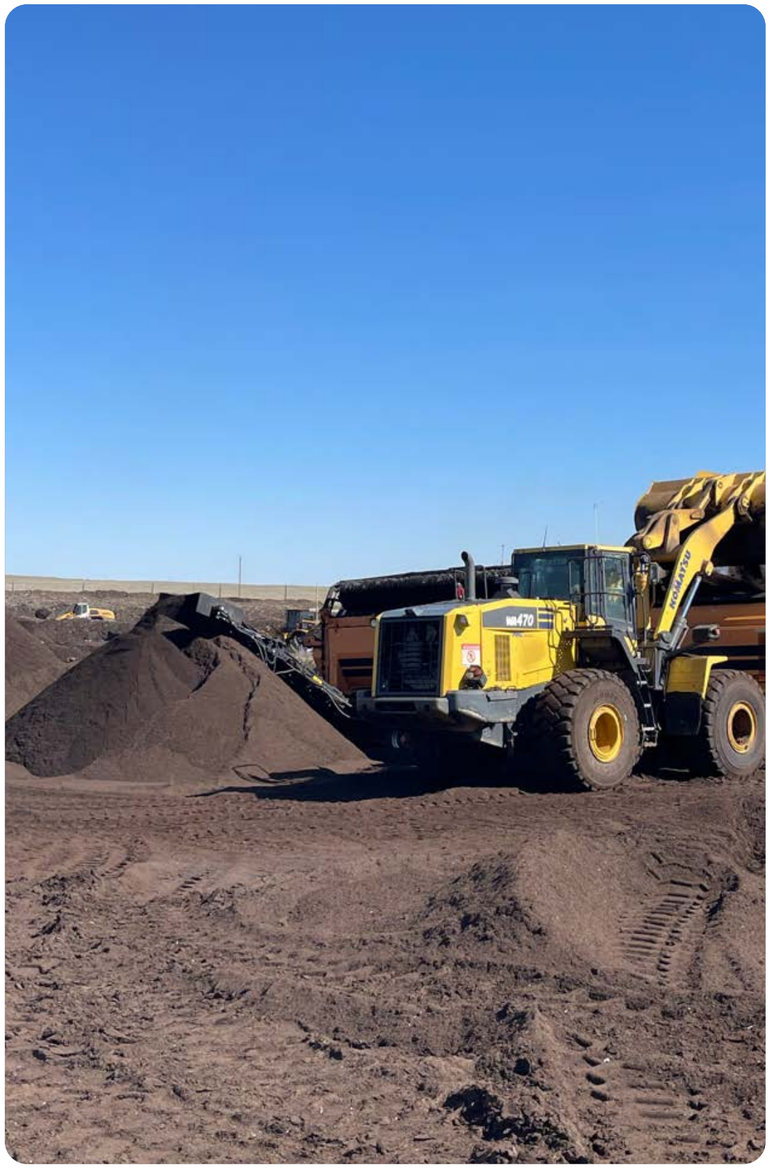
PART 2

HOW EPR INVESTMENT CAN INCREASE ACCEPTANCE OF COMPOSTABLE PACKAGING



There is no specific equipment or machinery required to process certified compostable packaging in commercial composting systems. In fact, as the findings from our report *Breaking It Down: The Realities of Compostable Packaging Disintegration in Composting Systems* shows, one of the most important indicators for successfully processing compostable packaging is meeting reasonable operating conditions, including time, temperature and moisture. **However, having the right screening, sifting and even vacuum technology can enable more efficient management of compostable packaging.**

Purchasing and maintaining machinery is often a significant capital expense for composters. Given this, we wanted to understand if composters had to make changes or upgrades to their facility to more efficiently manage compostable packaging. Most composters we spoke to who accept compostable packaging have been doing so since they were established. Because of this, any upgrades made were not distinctly associated with compostable packaging. There were also a handful of composters we spoke to who have deliberately made changes and upgrades to their facility to more efficiently handle compostable packaging and reduce contamination. For example, several composters have invested in equipment to manage lightweight plastic contamination.



Recognizing the added benefits of specific equipment and automated infrastructure, our framework includes a reimbursement category for permitting, technical assistance and facility upgrades. There are many ways in which funding could be applied. **For example, this funding could be spent on facility upgrades to expand capacity or equipment that improves processing efficiency.** Funding could also be used to pay for technical assistance to enhance a facility's ability to efficiently process materials and accept a wider range of complex materials, like food waste and compostable packaging. Another example of technical assistance could come in the form of trialing compostable packaging with entities like the Compostable Field Testing Program (CFTP). This type of approach incentives innovation and investment, helping smaller composters grow to enhance their overall capacity and the volumes of food waste and compostable packaging that they're able to handle.

Figure 8 provides a range of capital investments and upgrades that composters might make to improve their capacity to process compostable packaging. Composting facilities rely heavily on mobile equipment for handling materials. These machines typically have a lifespan of seven to 10 years. The cost ranges in the table are influenced by differences in processing capacity, the level of automation and the manufacturing quality.[vi]
The PRO should prioritize these capital investments and upgrades when deciding how EPR dollars could support future composting infrastructure, improve existing infrastructure, and increase the collection and recovery of compostable packaging.

FIGURE 8. CAPITAL INVESTMENTS AND UPGRADES THAT CAN IMPROVE A FACILITY'S CAPABILITY TO ACCEPT COMPOSTABLE PACKAGING, ACCORDING TO COMPOSTERS

Note: These investments and upgrades support the basic functions of collecting and processing organics to make compost, whether compostable packaging is accepted or not.

Equipment & Machinery	Vacuum extraction systems $50,000 – $250,000	Slow-speed shredders and grinders $350,000 – $1.25M	Trommel- and star-screens $250,000 – $500,000+
Collection & Education	Collections bins Prices vary based on location, service agreements and customer type (i.e., residential vs. commercial)	Bin tags, labels and stickers Often starting as low as $1 per label, tag or sticker	Education & marketing materials Variable depending on availability of dedicated marketing or E&O staff
Infrastructure & Processing Capacity	Retrofit yard waste facilities	Pad surfaces and mixing areas	Leachate and stormwater management
	Ranging from $1M to $25M+ depending on various factors, including but not limited to permitting costs, procurement of materials, construction and engineering costs, etc.		

PART 3

A BRIEF GUIDE TO THE COMPOSTING BUSINESS MODEL

As this report has highlighted, **the true cost of processing compostable packaging varies widely according to differences in facility size, throughput, geographical location, community buy-in and awareness, and facility operating costs**—and there are many factors that influence a facility's operating costs. Of note, the cost of managing compostable packaging is often conflated with the cost of managing contamination, but they are not one and the same. In the context of EPR producer fees and reimbursement, it's imperative that the industry finds a way to clearly differentiate between the two.

Labor and education are the most common and recurrent investments made by composters to manage compostable packaging. Labor, broadly speaking, refers to the daily costs of running a composting facility. Labor encapsulates all employees responsible for operating compost machinery and equipment, their hourly wages and benefits, administrative staff and costs, compliance managers, and on-site contamination management. Education and outreach costs cover things like on-cart labels and signage, website management, fliers and pamphlets, community tutorials and site visits, and the staff who undertake these efforts to ensure materials end up in the right bin.

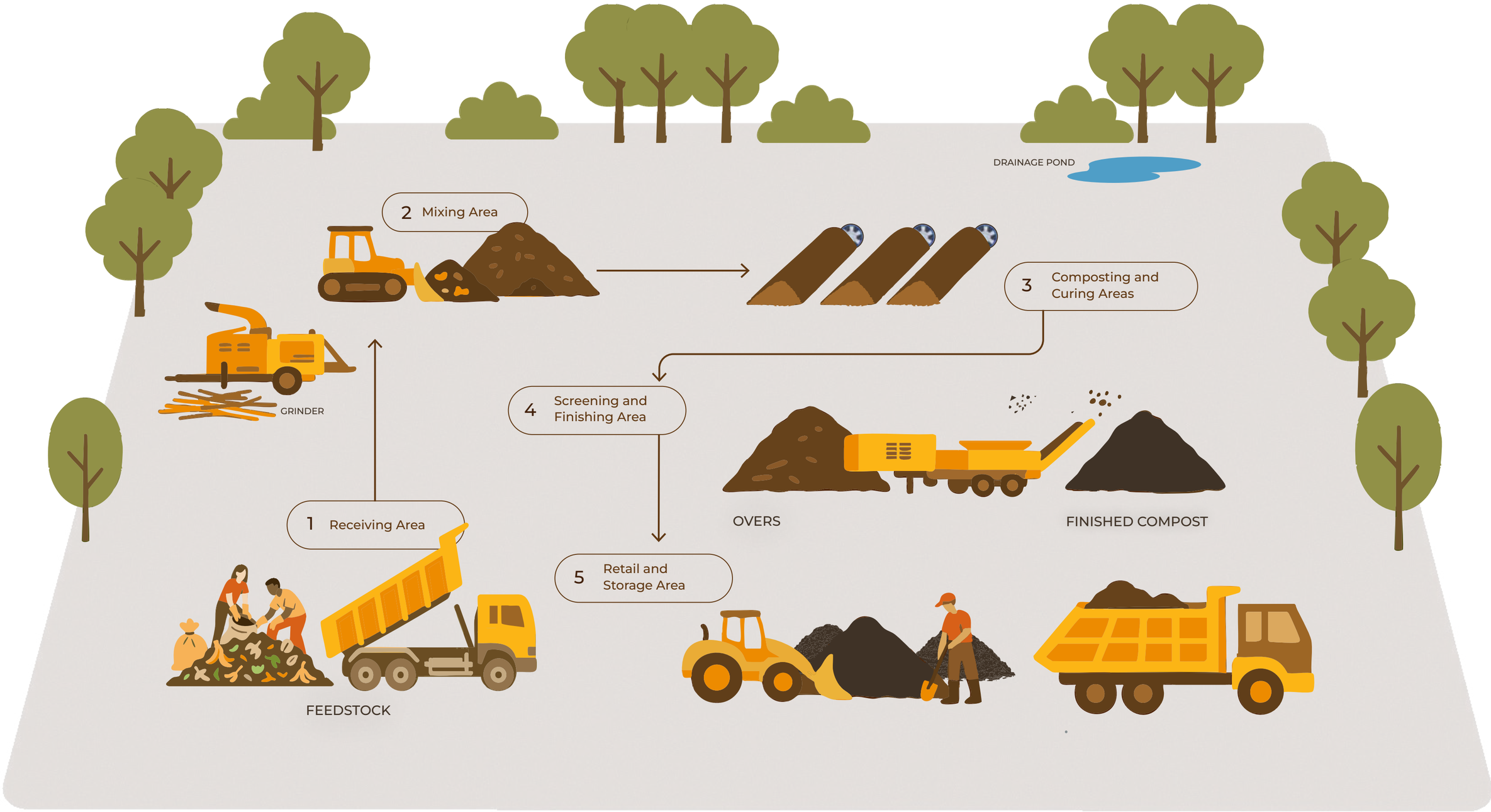
Many EPR programs have included line items to sponsor education and outreach. We found that composter education and outreach costs can vary dramatically depending on whether the composting facility has full-time staff who are dedicated to education and marketing.

"At the peak of contamination, before we changed our acceptance policy, we were spending at least 50% of our marketing costs on contamination mitigation (e.g., creating collateral, hosting meetings, etc.) Municipalities weren't managing it, and there's no real penalty for contamination to residents or commercial businesses, so we had to step up and fill the education gap."

Typical Costs of Running and Siting a Compost Facility

Understanding the business model of composters who process food scraps and food-contact compostable packaging is a critical first step to developing thoughtful EPR programs that include composting and compostable packaging. While it is true that there is no one-size-fits-all compost facility set-up, there are general commonalities about the inputs, processes and outputs that connect this sector. While most of the composting industry utilizes windrow technology,[vii] aerated static pile (ASP) technology is the fastest growing composting technology in the United States today because of its faster processing times (i.e., 120–180-day windrow process vs. 45–60-day ASP process). Figure 9 shows a visual layout of an ASP facility, but there are many other technologies and facility setups, including in-vessel, covered ASP and more.

FIGURE 9. COMPOST MANUFACTURING PROCESS FLOW DIAGRAM



As a rule of thumb, composters make about 75% of their revenue from their tip fees and 25% from product sales. Tip fees are the charges for accepting organic waste that is dropped at their site. Figure 8 shows material getting tipped at the site and a flow chart of the composting process. **According to a 2024 report by EREF, food waste and compostable packaging have the highest tip fees in the market compared to any other feedstock, on average about $50/ton (or $25/cy).**[viii] This suggests that composters who accept compostable packaging can charge a premium for the feedstock, providing motivation to accept these materials. The main cost drivers for composting facilities—regardless of the materials they manage—are labor, contamination management, and equipment purchase or upgrades.

A composter's greatest assets are their land, operating equipment and technology, and their team. Table 2 captures the basic economic factors of running a composting operation. Typical net profit margins for composters range from about 6% to 8%,[ix] and the cash flow for running operations predominantly comes from tip fees and sales revenue. The cost of composting machinery and equipment has risen exorbitantly since 2020.

In fact, the industry has seen a 4x increase in the costs of equipment like trommel screens and depackagers.[x] Despite this dramatic increase in capital expenses, the cost of finished compost has not risen to match the rising costs of inflation.

TABLE 2. RUNNING A COMPOSTING OPERATION

Composter Type	• Processor • Hauler-processor
Composter Revenue Sources	• Tip fees: ~75% of income • Product sales: ~25% of income • Contracts
Typical Profit Margins	Net margin 6% to 8%
Finished Compost $	On average sells for $10 to $70 per cubic yard
Cost Drivers	OpEx: Labor, contamination management CapEx: Machinery/ equipment

The costs mentioned are specific to running a facility, but there are also costs to consider for siting and building facilities. In the United States, the costs of retrofitting yard waste facilities to accept food waste are highly variable and dependent on the regulatory and permitting landscape in the composter's location. Similarly, greenfield investments (i.e., building from the ground up) can vary widely from $1 million to $20 million with long lead times (2-5 years).[xi]

At the highest level, there are two types of composters: a processor and a hauler-processor. A processor owns or operates a facility and receives their inbound feedstock from external haulers/ sources, whereas a hauler-processor is vertically integrated, meaning they collect feedstock, transport the feedstock to their facility and process those materials into compost. Additionally, compost facilities can be municipally owned and operated, privately owned and operated, or a combination of the two. Their customer segment is diverse, including farmers, landscapers, residents, commercial businesses, municipalities and government agencies.

PART 4
CONCLUSION

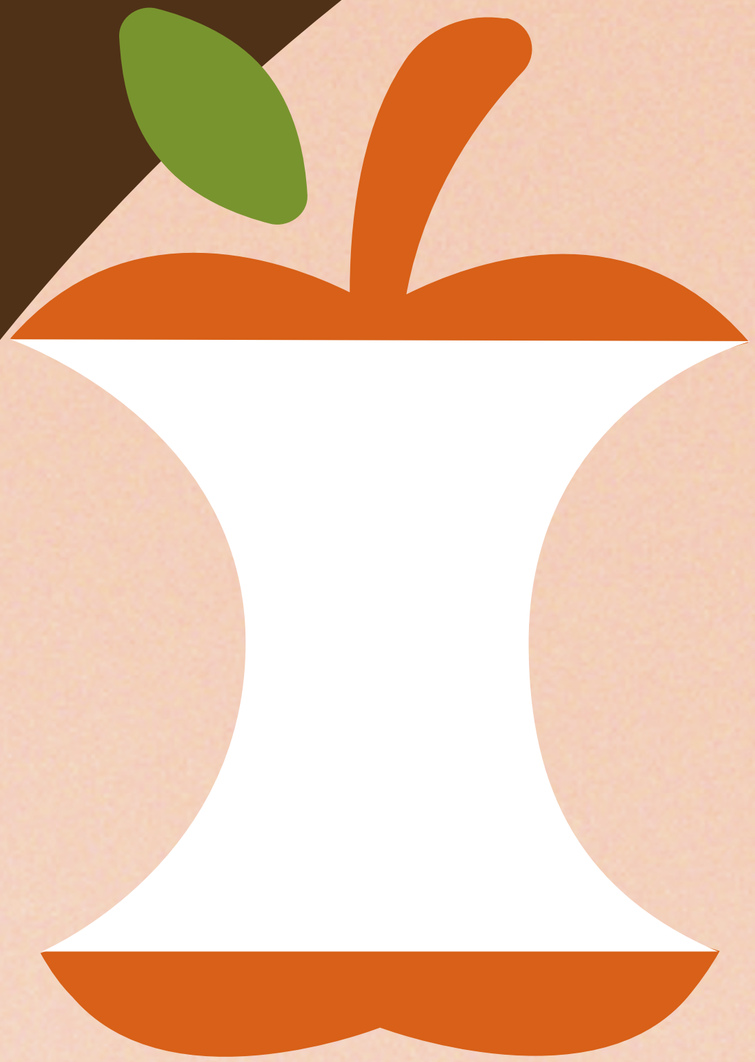
The escalating issue of conventional plastic packaging waste has catalyzed innovation in reusable, recyclable and compostable packaging solutions, and continues to spur EPR legislation throughout the U.S. For many U.S. communities, it's not a matter of if EPR will be rolled out in their state, but when.

EPR is a mechanism to encourage positive transformation for the composting industry. Given the relatively low volumes of compostable packaging in the market today, initial funding from producer fees will be limited. One role EPR can play is to encourage greater adoption and acceptance of new packaging materials, like certified compostable packaging, while spurring more efficient waste management practices. In the first few years that EPR plans roll out across the country, it's unrealistic to expect hundreds of millions of dollars to build new compost facilities or invest in existing facilities. Therefore, it's crucial to plan for a gradual on-ramp over the next decade to drive economic incentives and infrastructure growth across the composting industry.

In the future, EPR dollars could also finance renovations to yard waste composting facilities to enable them to accept more complex materials, like food waste and compostable packaging. States like Colorado are exploring this as part of their longer-term vision for EPR, with the acknowledgement that we are at least a decade away from that type of investment. These economic realities should be considered by the PRO when determining the highest use case for EPR reimbursement dollars, and how to scale food waste composting infrastructure that can process more food-contact compostable packaging.

In the absence of knowing how much EPR funding will be made available in each EPR state, our proposed framework aims to strike an equitable balance between the producer and the composter. **The Composting Consortium remains optimistic and eager to see what evolving EPR programs in the U.S. can offer the composting and compostable packaging industries. It is our hope that this framework and analysis can inspire future EPR programs to recognize composters and compostable packaging producers as equal and important players in EPR programs.** We encourage readers who found this research compelling to reach out to the Center for the Circular Economy at Closed Loop Partners to learn more about our work.

APPENDIX



Appendix A

Can Composter Reimbursement Be Approached Like Recycling Reimbursements?

As we undertook this analysis, we looked at examples and models from existing EPR programs, and we asked ourselves: is it possible to construct a framework for composter reimbursement that more closely resembles traditional recycling? We looked at Colorado's EPR Program Plan (spring 2025) as an example, in which the proposed approach for composting facilities will be different from that for materials recovery facilities (MRFs). **Our volume-precision framework builds upon, and aims to refine, the Colorado approach in a way that can be replicated across all EPR states.**

According to the spring 2025 draft of Colorado's EPR Program Plan, the PRO will begin by offering a per-ton or per-cubic yard processing incentive to facilities that currently accept and process compostable packaging. Funding will be based on dues from compostable packaging producers, determined by the volume supplied. Funding will then be scaled based on the volume of source-separated organics managed by the participating facility.[xii] By comparison, the MRF reimbursement calculation in Colorado's Program Plan is as follows:

- Total Cost Per Ton + Profit Per Ton = Per ton Processing Fee
- Processing Fee – Blended Commodity Revenue Per Ton = Net Price Per Ton
- Base Reimbursement = Net Price Per Ton * Tons Delivered to MRF

We used these formulas as an OpEx-based approach to translate reimbursement to the composting business model. As we tested this theory, we ran into the following challenges:

Incentivizing Inefficient Spending: One major critique of an OpEx-based formula is that it effectively rewards composter operators who have higher operating expenses per cubic yard processed. Just because a composter has a larger budget and spends more money per cubic yard does not guarantee they do a better job with their process, nor that they produce higher quality compost. Moreover, in instances where the per ton processing fee was less than the blended commodity revenue, the MRF formula led to a negative "base reimbursement value."

Inequity in Composter Payments: Unlike the volume-precision framework where the reimbursement rate is standardized across the board, we found that the reimbursement rate with the MRF formula varied widely because it was dependent on facility costs. This inequity creates mixed incentives for composters and would likely disincentive many composters from participating in EPR.

Commodity Value Consideration: The input-output relationship of composting is not comparable to plastics recycling, meaning the volumes that enter a facility don't equal the volumes that exit the facility. In composting, organic waste and compostable packaging enters a composting site, and an entirely new product (i.e., finished compost) emerges. In conventional recycling, when a material enters a MRF, a new recycled commodity is created (e.g., a PET bottle is converted, through many steps, into an rPET bottle). However, if compostable packaging has done its job, the material should be virtually non-existent in the finished compost. Thus, the comparison between recycling and composting is not parallel or directly applicable, and the inclusion of the commodity value of finished compost remains up for debate.

Appendix B

The Importance of Waste Characterization Studies for EPR Programs and Operational Reimbursement

Volumetric-based compensation relies on an understanding of material flows across a particular market. Consistent waste characterization studies or waste audits conducted by a verified third party are crucial for accurate reporting on how much certified compostable material is processed at each composting site.

Waste characterization studies can provide precise data on the material makeup of feedstock that ends up at a composter's site. When setting fees and determining covered material lists, the PRO will look at how much packaging is being sold and collected for recycling, composting or disposal. The level of precision afforded by waste audits gives greater insight into the gap between the volume of compostable packaging that is sold into the market versus what ends up in organics bins. As we know, many compostable materials end up in the trash or recycling. The same is true for recyclable and disposable materials, many of which wind up at composting facilities, leading to significant contamination issues.

Having a detailed understanding of composter feedstock also provides better data that can later inform education and outreach plans, producer fees and eco-modulation fees. This approach isn't unique to composting; it can also be applied to conventional recycling, where MRFs face similar challenges with contamination.

Quantifying how much compostable packaging is processed at a composting facility is difficult unless someone is intentionally weighing, measuring and sorting each inbound load—an unrealistic task since compostable packaging is often co-mingled in organic streams. The PRO would be responsible for covering the cost or labor of waste audits. While this auditing technique is time and labor intensive, it is not unattainable. For example, waste characterization studies are a basic part of EPR state needs assessments, which are used to understand the material composition of each stream—whether it be trash, recycling or organics. The approach used in these types of state waste characterization studies could be replicated for compost site waste audits.

The challenge is making these waste characterization studies replicable, scalable and affordable. In the hypothetical scenario laid out in Figure 5, there are six participating compost facilities in the state. We propose that each facility requires two audits per year (12 audits total). While these costs would be (theoretically) covered by the PRO, it's important to point out that this cost still comes out of the EPR fund. Theoretically, as contamination rates stabilize and better data on the average volumes received by each compost facility is available, the funds allocated for waste auditing could be redirected to other areas. Without a waste audit, the PRO is left to rely on self-reporting from the composter.

Appendix B

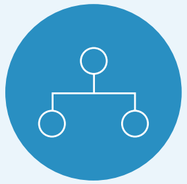
Proposed Sampling Methodology

The PRO can look to the Composting Consortium's methodology in our contamination report, *Don't Spoil the Soil*, as a starting point. Ideally, multiple feedstock samples should be collected across several days. Due to the variability of the compost season, it's advisable to conduct sampling at least twice a year—once during peak season and once during off-peak season. For example, if testers are onsite daily, they could pull representative samples once daily for five consecutive workdays. The PRO should determine in advance which material categories are of interest using the state's covered materials list as a reference to ensure the right materials are captured and catalogued. This type of auditing is helpful because not only does it provide insight into the volume of compostable materials, but it can also be used to understand the volumes of non-compostable materials like conventional plastic or metal that wind up at a compost facility. More details are outlined below in Table 3.

Appendix B

TABLE 3. BASIC CONSIDERATIONS FOR CONDUCTING A WASTE CHARACTERIZATION STUDY

Set up a team of at least two to three field personnel to take measurements. Ideally, it's good to have the same researchers conduct all waste audits to maintain consistency across sampling. While support from the compost facility staff is always helpful, it should not be required or expected. Do your best to minimize interruptions to daily operations.



While it may be tempting to try and catalogue all covered material types, keep in mind that the more categories that are recorded, the longer it will take to complete the waste sort. At the highest level, it makes sense to sort samples into two primary categories: certified compostable plastic and certified compostable fiber. From there, the categories can be broken down further by material type and format depending on the state's covered materials list.

The equipment and materials required for waste characterization studies are relatively inexpensive. Those include personal protective equipment (PPE), 5-gallon buckets for sorting and measuring materials, a scale if choosing to weigh materials, a camera to capture photos of the materials, a ruler for taking volume measurements, and a laptop for logging and recording the findings.

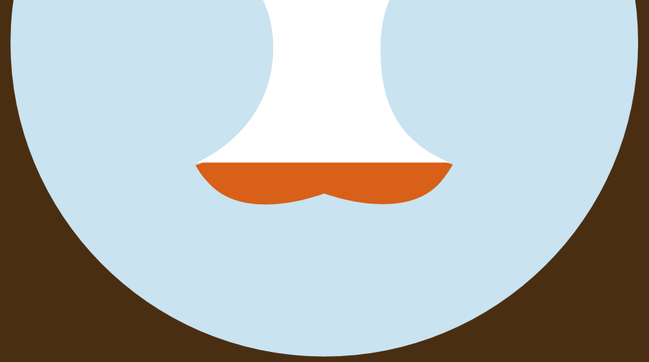
Consider that composting is highly seasonal. Samples should reflect year-round average throughput, so consider testing at two points of the year (e.g., once during peak season and once during off-season) to get a representative sample set.

200 lbs. is a good starting point but should be considered the minimum. As part of our contamination research, the Composting Consortium pulled 200 lb. representative samples at three points of the composting process. If possible, aim to collect samples up to 400 lbs.

Source: The Composting Consortium's 2023 Contamination Study and input from RRS (Resource Recycling Systems)

End notes

i. Policy Brief: Optimizing EPR Through Comprehensive Needs Assessments - Closed Loop Partners
ii. Contamination at Composting Facilities - Closed Loop Partners
iii. FAQ | Organic Materials Review Institute
iv. BioCycle Nationwide Survey: Full-Scale Food Waste Composting Infrastructure In The U.S. | BioCycle
v. Using STA Certified Compost
vi. Ibid.
vii. BioCycle Nationwide Survey: Full-Scale Food Waste Composting Infrastructure In The U.S. | BioCycle
viii. 2024-Composting-State-of-Practice | EREF
ix. Unleashing the Economic and Environmental Potential for Food Waste Composting in the U.S.: A Guide for Investors, Policymakers and the Compost Industry - Closed Loop Partners
x. Coker Composting & Consulting, 2024.
xi. Unleashing the Economic and Environmental Potential for Food Waste Composting in the U.S.: A Guide for Investors, Policymakers and the Compost Industry - Closed Loop Partners
xii. Producer Responsibility program | Colorado Department of Public Health and Environment



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