Retail Food Waste Action Guide

2018

ReFED | Rethink Food Waste *Through Economics and Data*

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ABOUT ReFED

ReFED is a collaboration of over 50 private, nonprofit, and public-sector leaders committed to reducing food waste in the United States. The organization engages stakeholders throughout the food system to implement solutions, envisioning a future where combatting food waste is a core driver of business profits, job creation, hunger relief, and environmental protection.

PROJECT TEAM

The development of the Retail Food Waste Action Guide was led by ReFED, including Chris Cochran, Eva Goulbourne, Chris Hunt, and Angel Veza in partnership with Deloitte Consulting LLP.

ReFED

Deloitte Consulting LLP works with grocery and food businesses across the supply chain to address merchandising decisions, transform supply chains, and develop economically sound diversion strategies. Team members included Blythe Chorn and Kyle Tanger.

Deloitte.

Graphic design by Ocupop, including Abby Lindstrom, Michael Nieling, and Jason Reimer.

OCUPOP

INDUSTRY PARTNERS

This guide was developed in partnership with the Food Waste Reduction Alliance and its members to accelerate waste reduction activities across the food industry. The Food Waste Reduction Alliance contributed valuable insights, data, and industry perspectives to inform the analysis and solutions presented in the guide.

FOOD WASTE REDUCTION ALLIANCE

Special thanks to the following companies for providing examples and thoughtful input: Ahold Delhaize, The Kroger Company, Sprouts Farmers Market, Inc., and Walmart Stores, Inc.

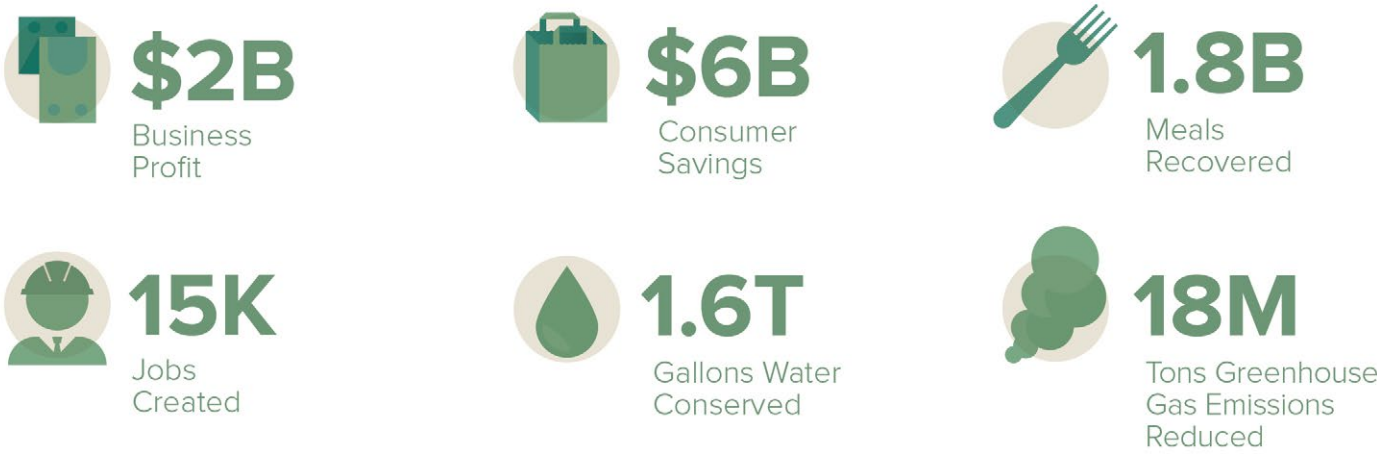
ABOUT THE ROADMAP

In 2016, ReFED published *A Roadmap to Reduce U.S. Food Waste by 20 Percent* (***refed.com/roadmap***), the most comprehensive analysis of U.S. food waste and solutions conducted to date. ReFED now works with food businesses, foundations, investors, innovators, and policymakers to implement food waste solutions at scale, putting us on the path to achieving the USDA/EPA goal of halving food waste by 2030.

- The *Roadmap* shows a path to a 20% reduction of food waste through 27 cost-effective, scalable solutions. These solutions would reduce food waste by 13 million tons annually, generating $100 billion of cumulative economic value over the next decade.[1]

ANNUAL BENEFITS GENERATED BY ROADMAP SOLUTIONS

Learn more at refed.com



ABOUT THE RETAIL FOOD WASTE ACTION GUIDE

This *Guide* is designed to help retail businesses understand the size of the food waste prize and provide industry-specific guidance on implementing food waste reduction solutions and recommendations. It is designed for sustainability directors and business function leaders in the U.S. retail industry responsible for creating and implementing food waste reduction strategies. The *Guide* aims to:

- Provide an overview of the national food waste challenge and the retail industry's opportunity to address it while improving business outcomes.
- Present an array of proven prevention, recovery, and recycling solutions to help the industry prioritize and accelerate waste reduction activities.

THE OPPORTUNITY

Today, the United States spends over $218 billion – 1.3% of GDP – growing, processing, transporting, and disposing of food for human consumption that is never eaten. That equals 52.4 million tons of food sent to landfill, and an additional 10.1 million tons left unharvested on farms, totaling roughly 63 million tons of annual food waste.[2]

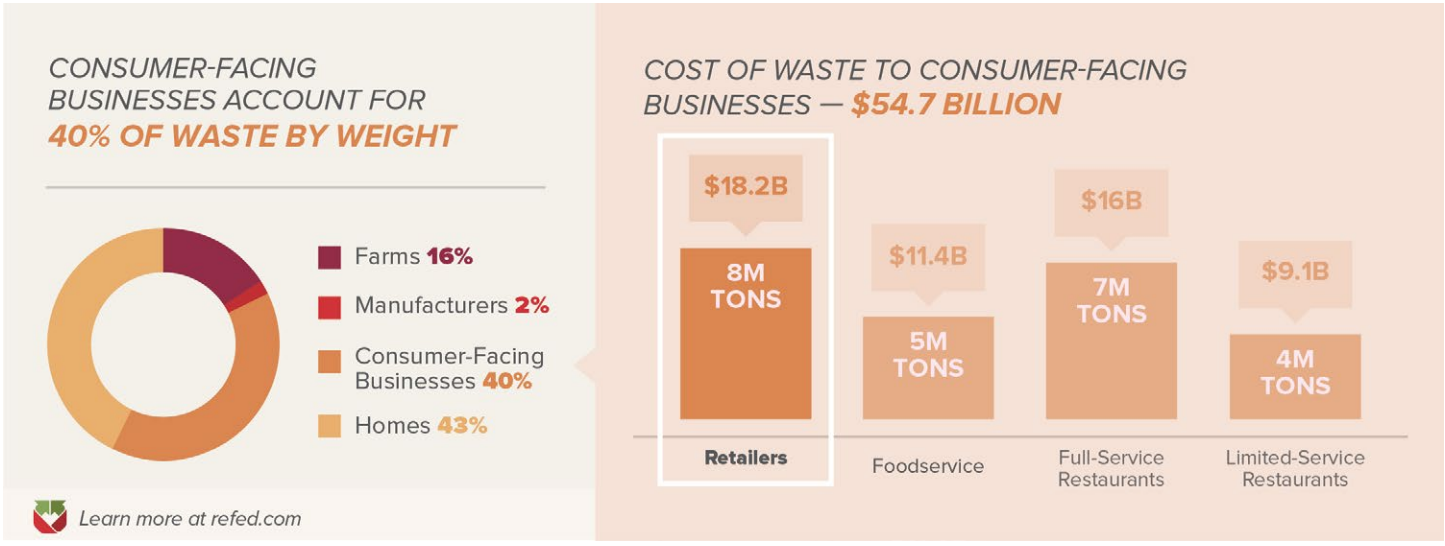
Food waste reduction goals have been established by institutions across the globe, including a goal set by the U.S. government in 2015 to reduce food waste by 50% by 2030.[3] ReFED's *Roadmap to Reduce U.S. Food Waste* shows an achievable path to a 20% reduction of food waste within a decade.[4]

Addressable food waste can be found throughout the supply chain, which ReFED divides into four segments: farms, food manufacturers, consumer-facing businesses (including distributors, retail grocers, restaurants, foodservice providers, and institutions), and homes (including all consumers).

In the retail sector, supply chain complexity, interconnected drivers, and entrenched food waste cycles have led many retailers to consider food waste a cost of doing business. Food waste drivers in the retail sector include:

- Reluctance to change stocking practices or product sizes that are closely tied to brand identity and customer satisfaction.
- Silos within businesses leading to decisions that inadvertently create waste, e.g., holding on to safety stock to ensure in-stock availability even though the majority of that stock may go to waste.
- Limited understanding of how food waste reduction solutions can enhance product freshness and drive revenue.
- High customer standards for freshness that lead to the disposal of safe, edible food perceived to be past its prime or approaching its "expiration" date.
- Customer demand for variety and consistency in food products, which can strain retailers' inventory management and food purchasing.

Retailers are beginning to recognize the financial and reputational value of food waste: for example, 3 of the top 10 U.S. retailers have set a public zero food waste-to-landfill goal.[5] Retailers are also joining food waste reduction coalitions and organizations such as the International Consumer Goods Forum,[6] Champions 12.3,[7] and United States Food Loss and Waste 2030 Champions,[8] all of which feature reduction goals and work to increase accountability and better coordinate retailer efforts.



FINANCIAL VALUE

The U.S. retail food sector generates 8 million tons of waste a year in distribution centers and stores, or $18 billion a year in lost value.[9] On average, the value of wasted food in retail is equal to roughly double the profits from food sales.[10]

ON AVERAGE, RETAILERS WASTE ROUGHLY DOUBLE THEIR FOOD PROFITS.

The case for prevention—not paying to discard product that has been purchased for sale—is clear. The financial cost of food waste is expected to continue to grow: agriculture and food prices are expected to increase over the next five years with continued growth in demand, fuel price fluctuations, and weather volatility. Further, the costs associated with purchased food are rising—in particular the cost of labor to handle and sort food.[11] Growth in assortment, meanwhile, adds significant costs but does not add proportionally to revenues.[12] Despite the growth of online grocery, fresh food continues to drive traffic to brick-and-mortar stores, where prevention solutions can prolong freshness and reduce waste.

The financial rationale for donations is also building as retailers implement benefits from the Bill Emerson Food Recovery Act and other supporting policy. While donations should never create business profit, they are becoming more cost-effective than sending surplus food to landfill. For example, under the previous federal standard food donation deduction, a business could only claim the cost basis of donated inventory. The 2015 passage of the PATH Act, however, enhanced the donation deduction and made it permanent.[13] The result: an offset for the cost of donated food as well as some of the costs of handling, storing, or transporting food for donation—and a stronger business case for food recovery.

Recycling can also create economic value for retailers. Partnering with recycling vendors to haul and process food waste requires minimal initial investment. And while the upfront financing costs of investing in retailer-owned and operated infrastructure are higher, rising energy prices and growing markets for outputs improve the cost-benefit business case. Shifts in policy and infrastructure are also making recycling a more attractive financial choice than landfilling food waste. Examples include landfill bans imposed by local and state governments and “pay-as-you-throw” pricing, both of which make recycling comparatively more economical. Innovations in recycling technologies such as small-scale anaerobic digestion may also improve the business case for retailers to recycle food waste.

REPUTATIONAL VALUE

The growing reputational value of food waste reduction—while harder to quantify than costs of purchased food or tipping fees for example—can also have a bottom line impact. Food waste is a tangible, highly visible problem gaining public attention. It affects retailers’ reputation with customers, employees, and investors, and can impact retailers’ brands.

Consumer Education Campaigns such as the Natural Resources Defense Council and Ad Council’s savethefood.com build awareness of the economic, social, and environmental consequences of food waste.[14] Increased coverage in the popular media—such as segments on Last Week Tonight with John Oliver, CBS Evening News, and NBC’s Today Show covering date labeling; FYI’s Scraps, a no-waste cooking show; and the 2017 Anthony Bourdain documentary *Wasted!*—are also increasing consumer awareness.[15] Retailers can enhance brand perception and customer loyalty by effectively communicating food waste efforts to an increasingly engaged consumer base.

SOLUTIONS LANDSCAPE

FOOD RECOVERY HIERARCHY

ReFED has adapted the Environmental Protection Agency (EPA) Food Recovery Hierarchy framework to categorize the solutions to reduce food waste, prioritizing prevention first, then recovery, and finally recycling, to maximize economic, social and environmental benefits. [16]

PREVENTION

- Mostly nascent, prevention solutions offer the highest returns to retailers and are growing the fastest, with new solutions emerging that build on new technologies and digital capabilities.
- Prevention requires significant internal collaboration across business functions as efforts to reduce waste in one department can create more waste further along the value chain.
- Industry partnerships such as ReFED and the Food Waste Reduction Alliance have made advances to mobilize food companies to spread the costs of prevention solutions such as **Standardized Date Labeling** that create more benefits for consumers.

RECOVERY

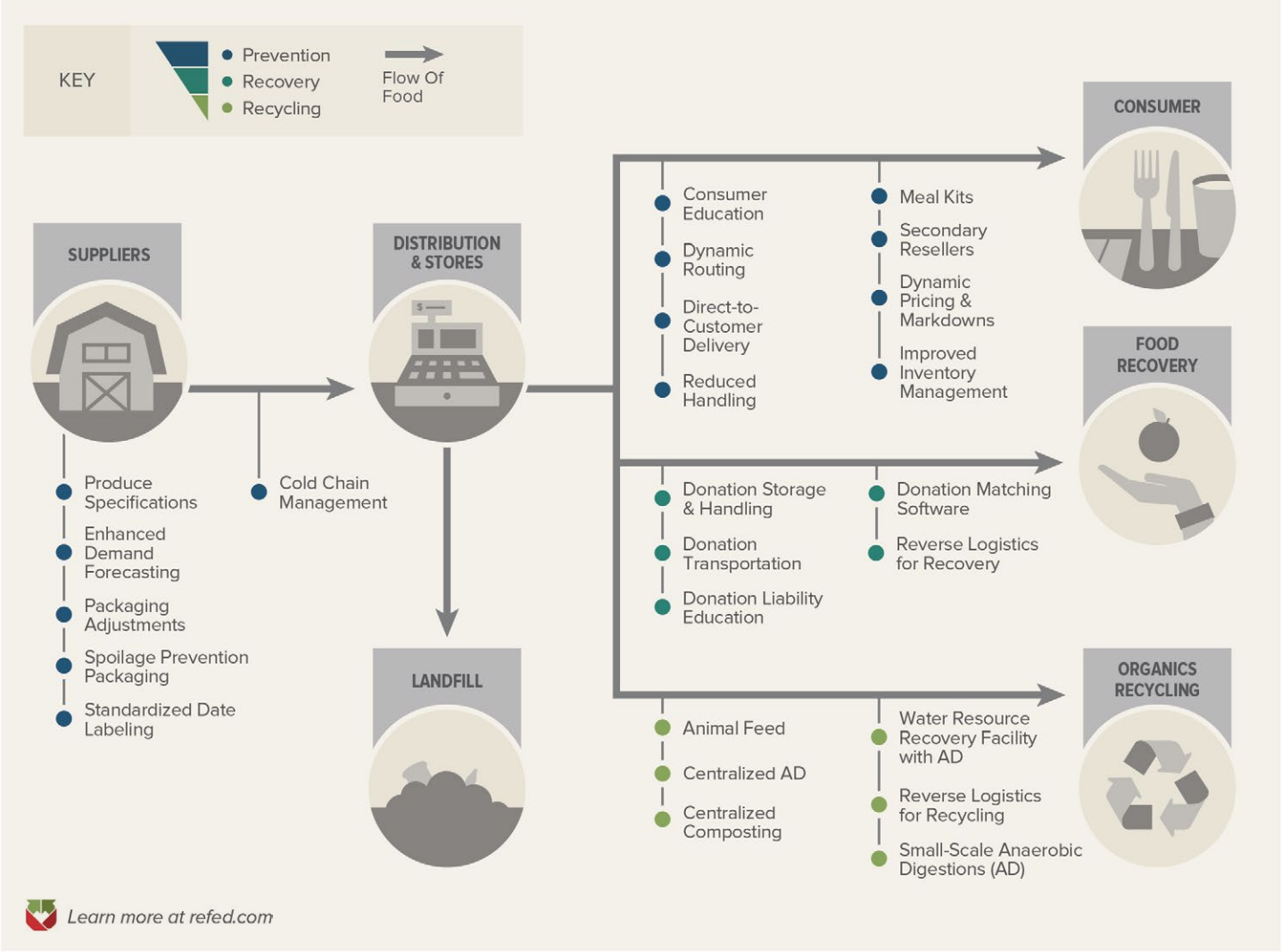
- Most retailers have some form of donation program in place already but could increase store coverage and donation capture rates.
- The Protecting Americans from Tax Hikes (PATH) Act has enabled enhanced deductions that allow businesses to claim both the cost basis and half of potential profits if inventory can be sold at fair market value, increasing the value of donation for retailers.[17]
- Recovery is becoming more feasible with the emergence of prevention solutions such as **Enhanced Demand Forecasting**, which enables retailers to better forecast food available for donation.

RECYCLING

- The recycling rate of unsold food within retail is an estimated 10%,[18] leaving significant untapped potential.
- The economics of recycling are highly sensitive to local prices of labor, property, disposal fees, compost values, and energy prices—retailers can adopt a regional approach to identifying and testing recycling opportunities to maximize value.
- Retailers can pilot new technologies and processes (e.g., depackaging, compostable packaging, and reverse logistics) to improve the economics of recycling.

RETAIL SUPPLY CHAIN

The following graphic shows the flow of food through the retail supply chain, highlighting the opportunities to implement solutions to avoid and reduce waste.



STAKEHOLDERS WITHIN SUPPLY CHAIN

CORPORATE

- Procurement
- Distribution
- Transportation & Logistics
- Store Operations
- Merchandising
- Information Technology (IT)
- Food Safety & Quality Assurance
- Marketing
- Legal
- Finance/Tax
- Public Affairs/Policy
- Sustainability/Foundation

EXTERNAL STAKEHOLDERS

- Haulers
- Farms
- Local/State/Federal Governments
- Food Recovery Organizations
- Foundations
- Entrepreneurs & Researchers
- Nonprofits
- Local and State Health Departments
- Suppliers
- IT Vendors
- Transportation Vendors

SOLUTIONS ANALYSIS

Of the 27 solutions identified in the *Roadmap*, 18 are applicable to retail. In addition, we have identified nine new, retail-specific solutions, which we present in this *Guide*. For more detail on each of the solutions, see Appendix C.

The Retail Solution Matrix is designed to help retailers prioritize solutions based on two dimensions:

- **PROFIT POTENTIAL:** the net annual profit potential of a given solution, not including initial investment.
- **FEASIBILITY**: a combination of the level of effort (e.g., the behavior, systems, process changes, and partnerships required) and the initial financial capital needed to implement a solution. The lower the level of effort and financial capital requirements, the higher the feasibility.

Solutions are sorted into three priority groups, with the first priority solution in the top right box, indicating high profit potential and feasibility. The third priority solutions are on the bottom left of the graph, indicating low profit potential and feasibility but potential importance to retailers for nonfinancial reasons.

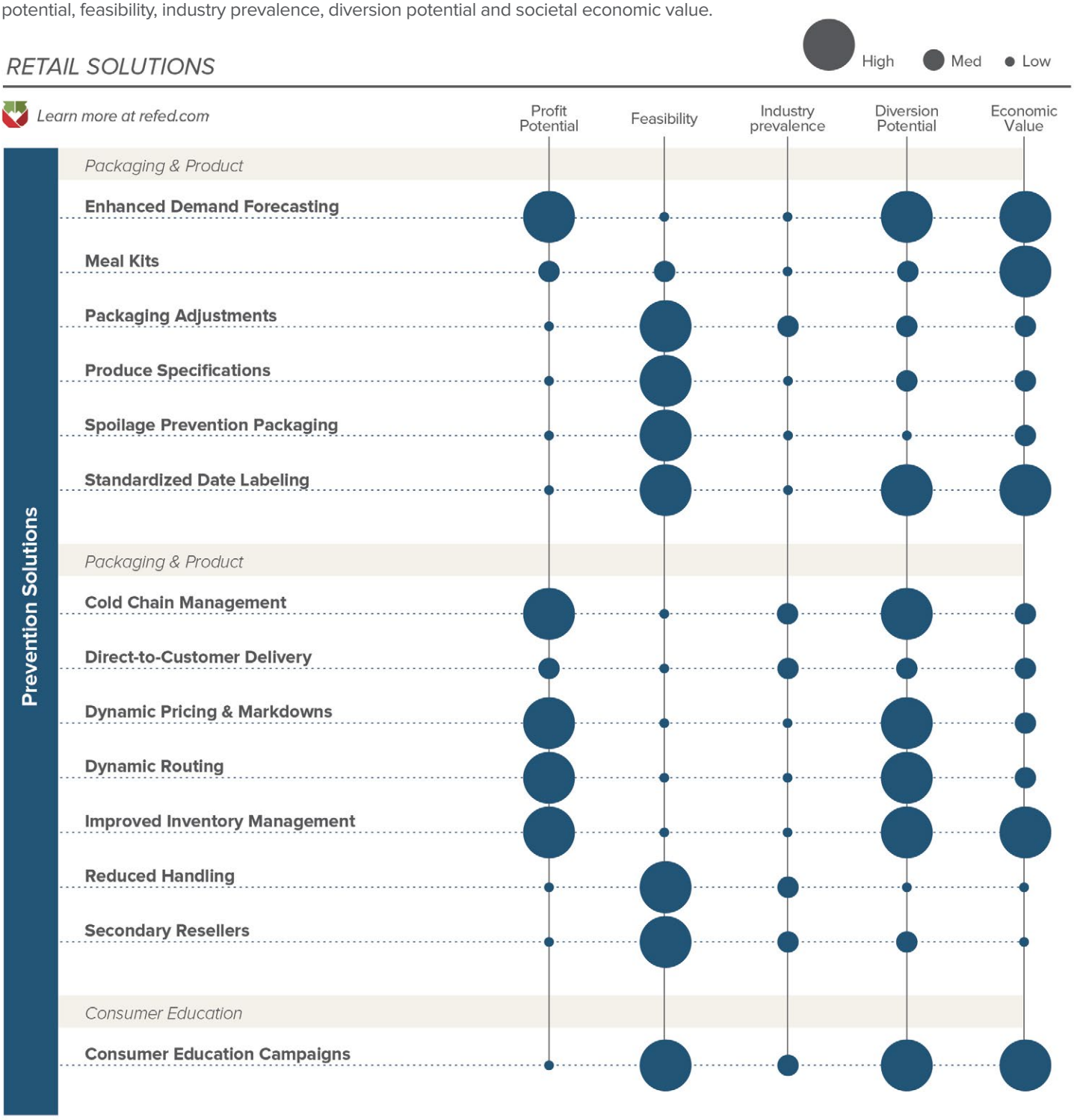
- The solutions with greatest profit potential for retailers are all Prevention solutions: **Improved Inventory Management**, **Cold Chain Management**, **Dynamic Routing**, **Enhanced Demand Forecasting**, and **Dynamic Pricing & Markdowns**.
- The most feasible solutions (meaning easiest to implement and requiring lowest capital investment, are **Consumer Education Campaigns**, **Standardized Donation Regulation**, **Donation Matching Software**, and **Reduced Handling**.

This analysis differs from the Marginal Food Waste Abatement Cost Curve originally presented in the ReFED Roadmap, which ranks solutions by landfill Diversion Potential and Economic Value across the food value chain. The full dataset for the Cost Curve and an interactive data visualization can be found at refed.com.[19]

This solutions matrix was developed using a combination of quantitative and qualitative data. It is designed to help retailers prioritize solutions based on business value, and does not reflect broader societal economic value. The matrix represents current landscape of the industry, and will evolve over time in response to shifts in: innovation, policy, and consumer preferences, and as better data becomes available. More details on each solution ranking can be found in Appendix B.

SOLUTION SUMMARY

The following graphic is a summary of retail solutions and their dimensions: profit potential, feasibility, industry prevalence, diversion potential and societal economic value.



PROFIT POTENTIAL: expected net annual profit, not including the upfront investment costs.

FEASIBILITY: A combination of implementation effort and initial capital requirement.

INDUSTRY PREVALENCE: estimated percentage of retail providers that have implemented a solution.

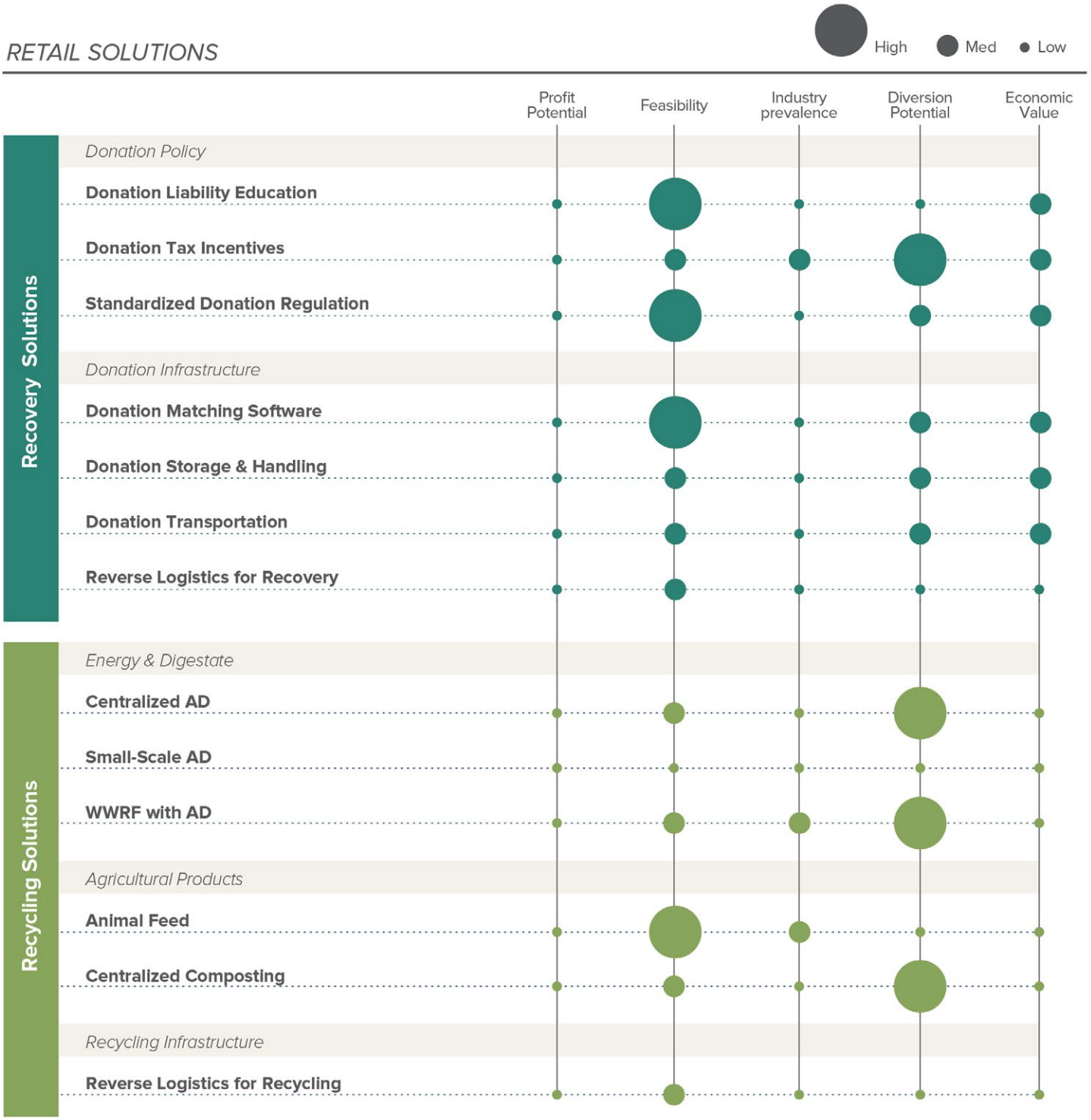
DIVERSION POTENTIAL*: portion of all food waste (by weight) that could be diverted from landfill through the implementation of a solution.

SOCIETAL ECONOMIC VALUE*: the annual aggregate financial benefit of a solution to society minus all investment and costs.

More details on each solution ranking can be found in Appendix B.

**Rankings are based on findings from The Roadmap. Any potential benefits would be considered society-wide, not just within the scope of the retail sector.*

RETAIL SOLUTIONS



More details on each solution ranking can be found in Appendix B.

PREVENTION SOLUTIONS

THE CURRENT LANDSCAPE

Prevention remains largely nascent across the food value chain. Despite recent attention to food waste, many retailers still accept it as an unavoidable cost. All of the 15 retailers ReFED interviewed had launched food recovery programs, yet only about half were aggressively pursuing prevention. This is largely due to the complexity of making changes in the supply chain and in stores that require collaboration across a retailer, as well as the need to balance other desired business outcomes such as in-stock rates, quality, etc. Another factor is that some prevention solutions (e.g., **Standardized Date Labeling** and **Packaging Adjustments**) benefit the consumer more than the retailer, providing the retailer with low incentives for adoption.

Retailers are pushing ahead on prevention solutions adoption, however, and gaining experience in the process. Here are a few examples:

Many retailers are experimenting with **Produce Specifications (Imperfect Produce)**. While it can be challenging to move this product through the supply chain due to lack of consistent availability, this solution can appeal to cost- and waste-conscious customers, and can serve as a consumer education tool. Working with Food Safety & Quality Assurance teams can ensure that imperfect produce is not rejected upon receipt due to a lack of understanding of changes in specifications.

EDUCATING CONSUMERS WITH IN-STORE PROMOTION OF IMPERFECT PRODUCE

Kroger is helping reduce food waste by promoting the option of buying "ugly food," off-spec, or **Imperfect Produce** that is still wholesome and safe to eat. Efforts to prominently display and sell slightly blemished, undersized, or misshapen produce at a reduced price also serve to educate consumers on food waste reduction.[21]

Standardized Date Labeling has advanced thanks to the joint efforts of ReFED and the Food Marketing Institute (FMI) and Grocery Manufacturing Association (GMA), trade associations representing the largest retail grocery and consumer packaged goods manufacturers. FMI and GMA have developed a voluntary national standard for date label language to be broadly implemented throughout the U.S. by summer 2018.[22] ReFED leads a multi-stakeholder date labeling working group to accelerate adoption of this new language and coordinate consumer education efforts. Contributing to this momentum, the Consumer Goods Forum announced that its members would adopt this same language, securing alignment globally.[23]

WORKING WITH SUPPLIERS TO CHANGE DATE LABELING

In 2015, Walmart and Sam's Club began a campaign to work directly with suppliers to convert to a "Best If Used By" date label terminology on the packaging of all privately branded products to provide clear and consistent information to customers. Today, over 92% of these products are in compliance with the standard date labeling language.[24]

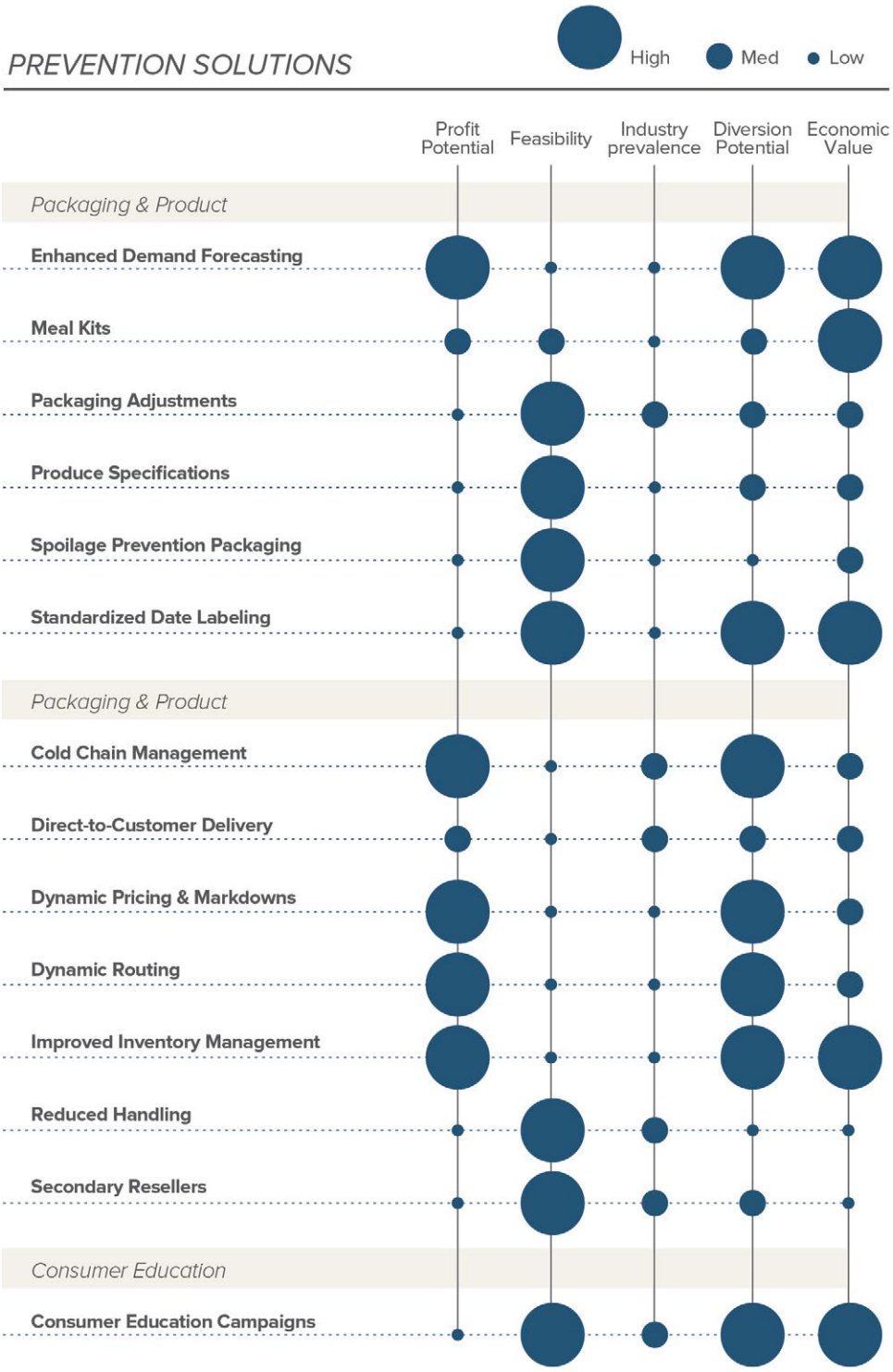
KEY INSIGHTS

Prevention is applicable across the retail value chain—from farms and manufacturing to customers' homes.

The *Roadmap* shows that prevention solutions create three times the societal net economic value of recovery and recycling solutions combined.[20] The Retailer Solution Matrix above also shows that prevention has the most potential to create profits for retailers: all of the five solutions identified as high profit potential are prevention solutions. Many prevention solutions require relatively low investment by retailers, enabling them to avoid wasting large volumes of food valued at higher retail prices.

- Mostly nascent, prevention solutions offer the highest returns to retailers and are growing the fastest, with new solutions emerging that build on existing technologies and digital capabilities.
- Solutions require significant internal collaboration across business functions as efforts to reduce waste in one department can create more waste further along the value chain.
- Industry partnerships such as ReFED and the Food Waste Reduction Alliance have made advances to mobilize food companies to spread the costs of prevention solutions such as Standardized Date Labeling that create benefits for consumers.

PREVENTION SOLUTIONS



THE OUTLOOK

The feasibility levels of prevention solutions vary. Many solutions are capital-light, if implemented over time, calling for behavior changes, packaging alterations, and in-store marketing efforts. Also, while significant internal collaboration may be necessary, few (if any) external partnerships are needed. Exceptions to this rule are the significant infrastructure and technology investments needed for **Cold Chain Management**, **Improved Inventory Management**, **Dynamic Routing**, and **Enhanced Demand Forecasting**.

Most prevention solutions also have high value; at retail, food is worth roughly $2.50 per pound, or $5,000 per ton, which is magnitudes higher than the value of food scraps for disposal, providing a large economic driver for prevention efforts.[25]

*Some solutions from the Roadmap have proven to be much more promising than expected. New digital technologies are opening up expanded opportunities in **Cold Chain Management** (which reduces product loss during shipment to distribution centers via direct shipments and cold-chain-certified carriers) and **Improved Inventory Management** (improved systems that track an average product's remaining shelf-life and help reduce days on hand). As more retailers adopt these technologies and pilot these solutions, more data will become available about the full potential of these and other new solutions.*

BEST PRACTICES

1. COLLABORATE ACROSS ORGANIZATIONAL SILOS

Prevention solutions require collaboration between different departments within a business even though departments may not be aware of the full cost implications of waste across the organization. Retailers have found that distinct departments within a business function as a system when it comes to waste—changes to decrease waste at one point can increase waste at another point in the system. For example, improved **Cold Chain Management** results in more products arriving at the distribution center still sellable. If the resulting decrease in product loss is not reflected in ordering changes, however, there is a risk of distribution centers becoming overwhelmed with food that is now surplus. Retailers must measure and identify root causes of waste along the entire value chain, and functions must work to share resources and budgets—and to leverage the return on investment of waste reduction initiatives across the business.

2. ALIGN COSTS AND BENEFITS

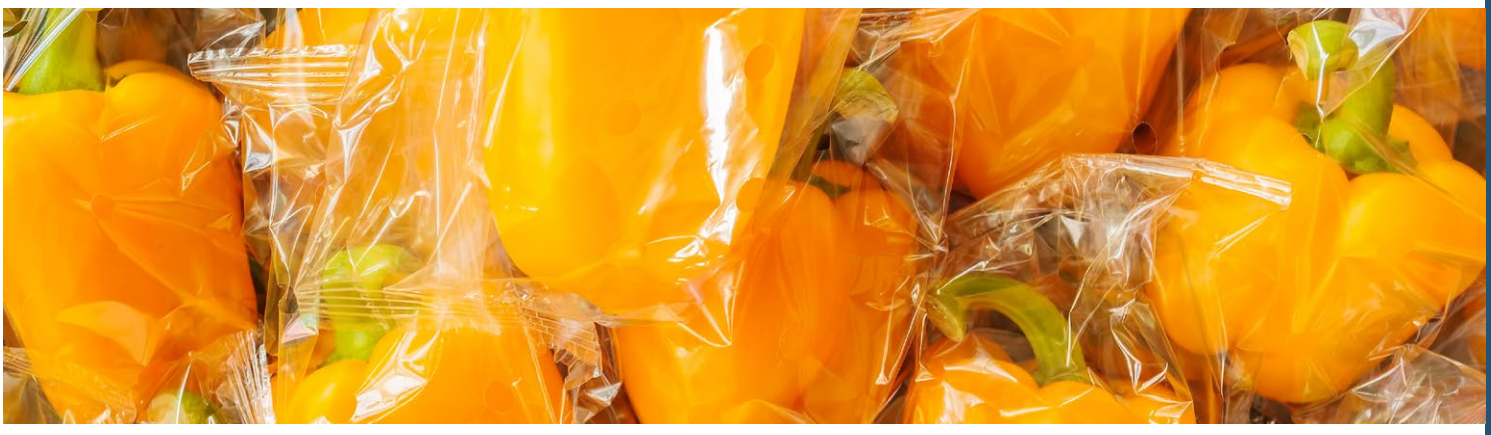
It is difficult for businesses to implement new technologies or processes if another part of the supply chain receives the benefit. It may be hard to build a business case to invest in **Packaging Adjustments**, for example, when consumers receive most of the cost savings. If the reputational enhancement aspect of such a strategy is understood though, retailers may decide the solution is worth the investment.

Engaging in industry collaborations on solutions such as **Consumer Education Campaigns** and **Standardized Date Labeling** that benefit consumers more than businesses can spread the already low costs further across the industry so no one retailer has to shoulder the burden. This also amplifies the impact on consumers through consistent messaging. There are many opportunities for retailers to join industry collaborations on shared food waste solutions such as ReFED, the Food Waste Reduction Alliance, and the Consumer Goods Forum.

3. ENGAGE WITH CUSTOMERS

Consumer expectations for variety and cosmetic perfection have kept businesses from streamlining product selection by offering cosmetically imperfect food, reducing portion sizes, or allowing stock outs. Consumer perceptions of the freshness and quality of food can be negatively affected by changes to products such as **Packaging Adjustments**. One example is retailers that have received consumer pushback after experimenting with vacuum-sealed meats (for easy freezing and individual defrosting) due to differences in product appearance and lack of consumer understanding of the benefits.

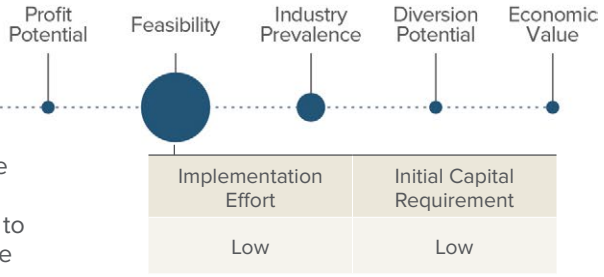
There is a shift happening, however, as consumers become more aware of food waste and its consequences. Retailers can build brand image by explaining to consumers through in-store signage how stock outs help keep prices low and ensure that only the highest-quality products are sold, or how packaging changes allow products to be frozen and thawed individually, reducing waste and saving money.



New Solutions

With price competition and tightening margins across the industry, retailers are searching for new opportunities to cut food waste-related costs. While investment and interest in the prevention approaches described below is growing, implementation of these new solutions is still at the pilot and low-maturity levels.

1. REDUCED HANDLING

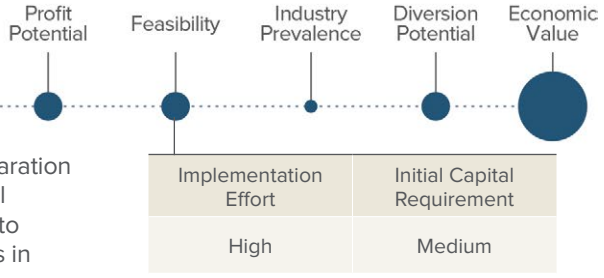


Reduced Handling has emerged as a low-cost prevention solution for produce among retailers. Less touching and movement of product during distribution reduces damage to fruits and vegetables and ensures that more product gets to stores in sellable condition. Retailers are also applying this approach to in-store merchandising: for example, more retailers are displaying produce in the box versus creating a pyramid display, and some stores post "don't touch/handle with care" messaging for shoppers.

BENEFITS INCLUDE

- Lower prices for customers as a result of reduced waste, while still ensuring product availability.

2. MEAL KITS

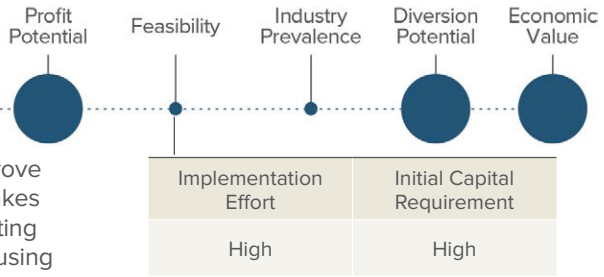


Meal Kits that provide pre-proportioned fresh ingredients for home meal preparation reduce over-buying by consumers and food waste in homes. While many meal kit services have been built as standalone companies that deliver kits directly to consumers' homes, retailers are starting to explore how to offer these services in stores as well as through direct-to-customer delivery (see below).

BENEFITS INCLUDE

- Increased revenue by providing a service of added convenience for customers.

3. ENHANCED DEMAND FORECASTING



Enhanced Demand Forecasting uses big data and advanced analytics to improve the sophistication of demand forecasting and buying. Enhanced forecasting takes into account store sales variability, seasonality of products and sales, and existing inventory on hand, coupled with external demand sensing. Examples include using social media data to track events, weather forecasts, and paycheck and food stamp timing to drive changes in demand.

BENEFITS INCLUDE

- Reduced overbuying and therefore reduced throws at distribution centers and stores flooded with product.
- Lower prices for customers as a result of reduced waste, while still ensuring product availability.

4. DYNAMIC ROUTING

Implementation Effort	Initial Capital Requirement
High	High

Dynamic Routing involves using sensors to collect data on product freshness so that food with a shorter-than-expected shelf life can be re-routed on the spot to closer distribution centers and stores.

BENEFITS INCLUDE

- Maximized shelf-life resulting in reduced throws at distribution centers and stores and lower costs.
- Improved product freshness, resulting in enhanced brand perception and increased sales.

5. DYNAMIC PRICING & MARKDOWNS

Implementation Effort	Initial Capital Requirement
High	High

Dynamic Pricing & Markdowns uses sensors to gather real-time data about the quantity and quality of inventory on hand and of incoming orders, enabling product price adjustments in stores.

BENEFITS INCLUDE

- Increased sales of reduced-price product, resulting in increased revenue.
- Reduced throws, which may lead to lower supply costs if customer demand is satisfied through the increased availability of reduced-price foods.

6. DIRECT-TO-CUSTOMER DELIVERY

Implementation Effort	Initial Capital Requirement
High	High

Direct-to-Customer Delivery increases product velocity by transporting food directly from distribution centers or stores to customers. This solution can also be used to move specialty product designed for food waste reduction, such as direct-to-customer delivery of boxes of imperfect produce.

BENEFITS INCLUDE

- Increased sales through fresher produce and added convenience for customers.
- Decreased product throws resulting in reduced costs.

RECOVERY SOLUTIONS

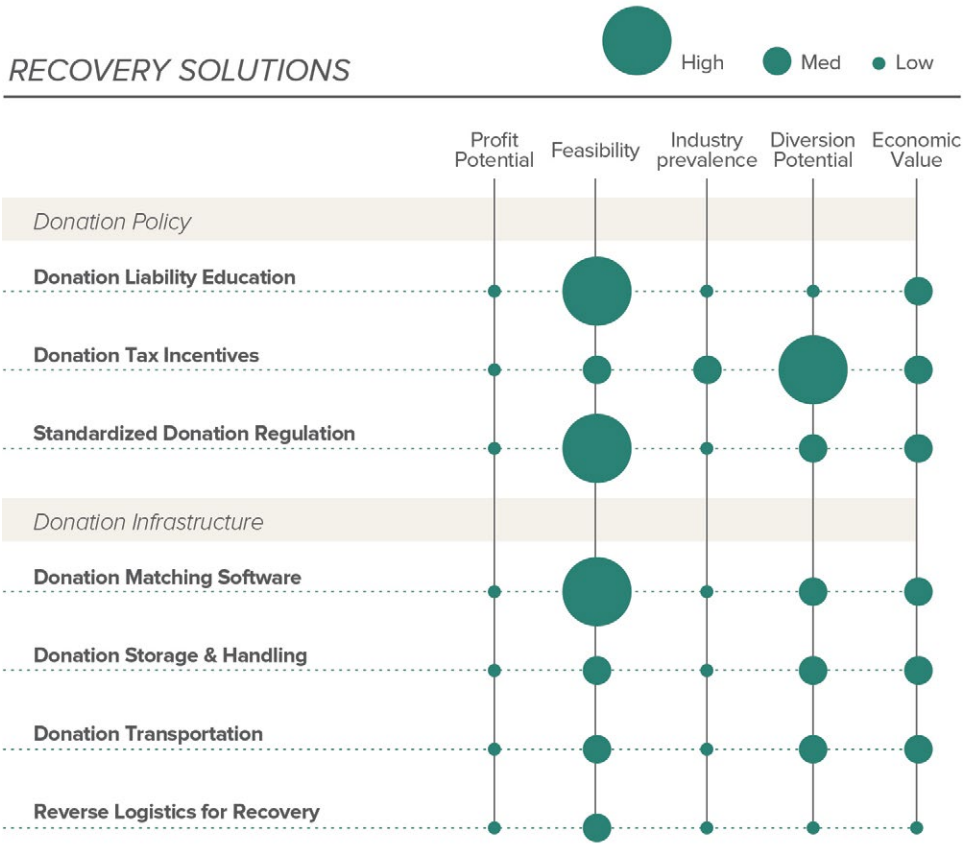
THE CURRENT LANDSCAPE

Recovery is more advanced than prevention among retailers, but there is still considerable opportunity for growth. According to the latest Food Waste Reduction Alliance survey, 18% of unsaleable food by weight is donated.[28] Retailers can improve the participation rate of stores and distribution centers, and even more so the performance of these facilities in recovery of unsaleable food, i.e., the donations capture rate.

Generally, retailers' approaches to recovery are quite local and based on local regulations, incentives, and relationships. National-level solutions such as **Standardized Donation Regulation** would drive over half the overall recovery opportunity outlined in the *Roadmap*.[29] Yet given the highly local nature of most recovery efforts, these solutions have been slow to gain traction.

Progress is being made, however, thanks to the passage of the Protecting Americans from Tax Hikes (PATH) Act in 2015, which expanded **Donation Tax Incentives** and made various new business entities eligible for food inventory enhanced deductions, which were previously accessible only to large C corporations on a permanent basis, and temporarily to non-C corporations. The enhanced deduction allows businesses to claim both the cost basis and half of potential profits of what the inventory could be or was sold at fair market value. With the expansion of the deduction in 2015, all businesses, regardless of size or incorporation status, can now take the enhanced tax deduction when donating food to a 501(c)(3) nonprofit.[30] The enhancements to the deduction offset some of the costs of labor needed to separate and store food for donation—along with time spent communicating with food donation recipient organizations—and for storage facilities at stores and donation centers. They help shift the economics to make donation more cost effective than paying hauling and tipping fees to send unsalable food to landfill.

Donation Matching Software is also gaining traction with the growth of platforms. More retailers are experimenting with these tools, and pilots are expanding due to increased availability of the platforms. There is opportunity for ongoing expansion in this area as retailers' real-time data about food availability and networks grow.



KEY INSIGHTS

Although food recovery initiatives already exist at the majority of retailers, there is still significant opportunity to increase donations through higher store and distribution center coverage and donations capture rates. ReFED analysis indicates the potential for grocery retailers to double food donations from current levels.[26] [27] Retailers play a critical role in increasing recovery:

- Retailers are critical to the policy changes needed for the solutions **Standardized Donation Regulation** and **Donation Tax Incentives** because of the importance of the retailer business voice to policymakers.
- Retailers play a lynchpin role in education, infrastructure, and logistics solutions as a primary source of unsold food that can be recovered to feed the hungry.

THE OUTLOOK

The majority of recovery solutions still have low to medium penetration. They differ from prevention solutions in that prevention strategies can be implemented as one-off solutions, while recovery requires an ecosystem approach supported by three pillars:

- Education for food businesses on donor liability protections through the Bill Emerson Good Samaritan Food Donation Act and safe food handling practices.
- Support for and advancement of policy that financially incentivizes donations from businesses while providing standardized and science-based food safety regulations.
- Efficient logistics and infrastructure to transport, process, and distribute excess food.[31]

Recovery solutions are complex, and often involve a geographic disconnect: unsold food is not always available where food insecurity is concentrated. This can impede national solution implementation across a business.

Recovery solutions require relatively minimal investment from retailers, mainly involving process changes and partnership management. Exceptions to this rule include significant infrastructure investment that may be needed for **Donation Transportation** and **Donation Storage & Handling**.

These solutions are also low value: costs, but also benefits, are spread across a large number of stakeholders, and a retailer will always generate more profit by selling than by donating food.

BEST PRACTICES

1. LOOK FOR WAYS TO OVERCOME LIABILITY CONCERNS

The federal Bill Emerson Good Samaritan Food Donation Act protects donors and recipients from civil or criminal liability short of gross negligence and intentional misconduct. However, this legislation remains unproven and untested in court, leaving retailers' legal departments without a precedent to follow. Brand protection is another important concern. As one retailer explained, "It doesn't matter if I can't be sued; it'd almost be worse to have the company's name on the front page of the Wall Street Journal in conjunction with someone dying from eating our food."[32]

Partnering with established food recovery organizations with stringent donation safety protocols and processes reduces the risks associated with donating and provides brand protection in the case of an adverse event.

2. TAILOR DONATIONS APPROACHES LOCALLY

Health regulations vary by city and state, arising from "home rule" authority in some localities and differing interpretations of the FDA Food Code, which only loosely defines basic requirements for food safety.[33] Lack of uniformity in these laws inhibits retailers from developing uniform food donation approaches across their organizations.

Leading retailers are working around this barrier by creating regulations databases in all the localities in which they have stores and distribution centers, and by supporting local staff in adapting practices to meet local regulations. (For more information, see the ReFED Policy Finder - ***refed.com/policy***.)

3. MANAGE THE COMPLEXITY

The existing food recovery system is vast, including hundreds of regional and statewide food banks serving over 60,000 food recovery and hunger agencies.[34] In this complex web of overlapping local networks, scale and transaction costs matter immensely.

For example, large batches of food (e.g., several dozen tons of potatoes) need significant transport, storage, and nonprofit labor and processing resources to be utilized before spoiling. Conversely, if one store wants to donate a single bag of 50 peaches, it can be hard to justify the labor and infrastructure costs needed to transport it to a donor recipient.

New prevention solutions such as **Enhanced Demand Forecasting** and **Dynamic Routing** allow retailers to reduce some of this complexity by better forecasting food that will be available for donation. This gives food recovery organizations more time to prepare the storage, handling, and transportation necessary to recover food.

Leading retailers have also found ways to embrace this complexity by allowing more frequent pick-ups from more food recovery organizations to ensure that unsold food is recovered despite variability in availability.

EXPANDING FOOD DONATION PARTNERSHIPS LOCALLY

When food goes unpurchased by consumers, Walmart works to maximize its use and get good food that is still edible to people and places that need it most. Through Walmart's food donation program in partnership with Feeding America, food banks and agencies pick up food that cannot be sold from Walmart stores and clubs in the United States. Since 2005, Walmart has donated 3.3 billion+ pounds of food to people in need. A recent analysis of Walmart's donation program showed that getting the pickup process right locally is important for an effective program. Specifically, Walmart found that having pick up three or more times a week enables more fresh food donations. While the donation program launched with food banks as the primary partner, over the years the program has expanded to include food banks' local community partners (such as pantries) in the stores' pick-up process, which ultimately improved program efficiency.[35]

Walmart
Save money. Live better.

4. FORGE PARTNERSHIPS WITH TAX DEPARTMENTS

Partnerships are critical to get beyond the "right thing to do" approach to donations and open up more investment of capital and labor. Tax departments can help with data collection on donations and ensure that financial benefits of donation are realized—more valuable now in the wake of the PATH Act. Senior-level finance leaders can help get tax departments engaged when relationships within a company are new.

5. BUILD IN-STORE EMPLOYEE ENGAGEMENT

Recovery opportunities appeal to employees as individuals and members of their communities. In-store employees can help formulate innovative approaches to identify and recover food for donation.

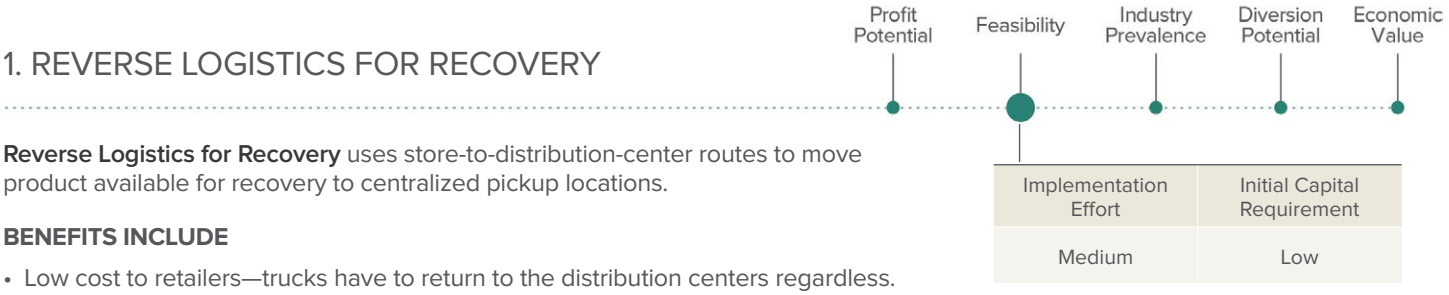
The need for employee engagement and training is particularly high in **Donation Liability Education**, which remains at low penetration. Liability concerns are seen as a real barrier to front-line employees engaging in recovery. One way of encouraging employee engagement is through store competitions and by passing a portion of the tax benefits back to stores.

INCENTIVIZING EMPLOYEES TO SUPPORT DONATIONS

Sprouts gives quarterly awards to stores that have the highest donations (and have hit their shrink-reduction targets).[36]

New Solution

1. REVERSE LOGISTICS FOR RECOVERY



Reverse Logistics for Recovery uses store-to-distribution-center routes to move product available for recovery to centralized pickup locations.

BENEFITS INCLUDE

- Low cost to retailers—trucks have to return to the distribution centers regardless.
- Excess storage capacity is more likely to be found at distribution centers than at stores.
- May extend overall shelf life of food by enabling faster pick-up, although the time until pick-up by a food recovery organization could also be extended.

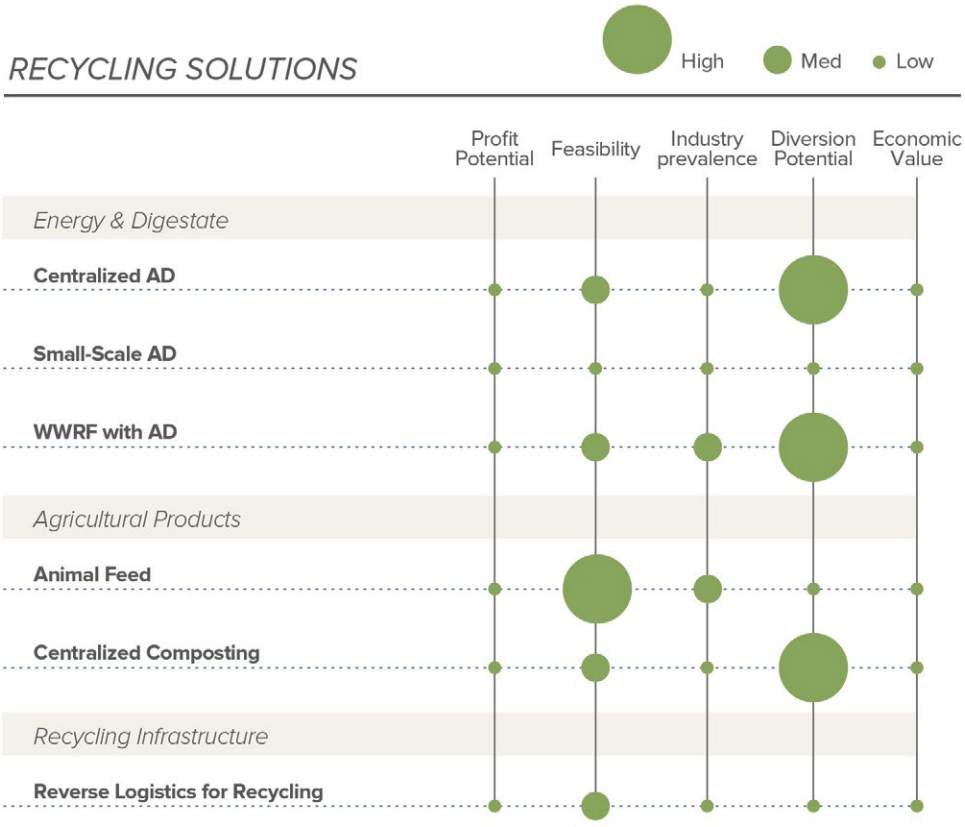
RECYCLING SOLUTIONS

THE CURRENT LANDSCAPE

Recycling solutions in retail are at relatively low maturity levels, with current recycling rates only at an estimated 10%.[38] Recycling rates of food scraps—which are high in water content and costly to transport without corresponding revenue—have lagged behind rates achieved for other materials.[39] Once at scale though, recycling haulers are expected to become the predominant waste provider, reducing general trash collection services to once or twice per month.[40]

The majority of recycling solutions still have low penetration in retail, with the exception of **Animal Feed** and **WWRF with AD**:

1. **Animal Feed** has a higher penetration, but more so with manufacturers, where material being sent to feed is consistent and nutritional value can be understood. Manufacturer food waste tends to be more single product (e.g., a shipment of potato skins), making nutritional content assessment easier. Retailer food waste, in contrast, is a mix of many types of food, making nutritional assessment more difficult and the waste less suitable as animal feed. Retailer food waste also requires store labor for depackaging, which can negatively impact the economics and volume of material diverted for feed.
2. **WRRF with AD** is also more mature, but requires delivery of waste by truck or through existing sink disposal pipes to a municipal WRRF, where it is treated with anaerobic digestion. Both the labor of sink disposal and the labor and fuel associated with delivery can be expensive for retailers.



KEY INSIGHTS

While lowest on the EPA hierarchy, recycling solutions offer the greatest potential to reduce the volume of food waste nationally. Adoption of the *Roadmap*'s four retail-applicable recycling solutions—**Centralized AD**, **Centralized Composting**, **WRRF with AD**, and **Animal Feed**—would divert over 8.6 million tons of food waste from landfill annually. This is almost three times the diversion potential of all retail-applicable prevention and recovery solutions combined.[37]

In trying to strike a balance between prevention and recovery of unsalable food on the one hand, and offering consumers availability and assortment of products on the other, food waste is difficult to eliminate completely. This is especially true of fresh food that is no longer safe for consumption.

Today, this wasted food ends up in landfills, where it costs retailers millions of dollars per year in hauling and tipping fees. Retailers that shift their mindset from seeing food waste as a cost of business to seeing it as an untapped resource that can be recovered through recycling can create competitive cost advantages.

THE OUTLOOK

Recycling feasibility is low, as most recycling solutions require upfront labor to separate and prepare food for recycling, existing local infrastructure, and partnerships to provide hauling, all of which can make the costs of recycling higher than sending food waste to landfill. Recycling solutions, similar to recovery solutions, require a complete ecosystem—haulers, infrastructure, depackaging technology suppliers, etc.—and depend on three pillars to drive successful implementation:

- The risk of penalty or incentives to motivate retailers to separate food scraps from other waste streams.
- Higher profits for haulers for collecting food scraps and taking them to organics recycling facilities versus landfills.
- Infrastructure in place to process the organics.[41]

Recycling solutions are low value for retailers: when food is thrown away as scraps, its value has dropped by 10 to 50 times to under $100 per ton.[42] The five retail-appropriate solutions all have low profit potential and overall economic value. In addition, when investing in their own infrastructure, retailers often need to use cash flows to service infrastructure project finance, but realize relatively slim profit margins from avoided disposal fees and the sale of energy and compost.[43]

Recycling is also highly regional in nature. The economics of recycling are highly sensitive to the local prices of labor, property, disposal fees, compost values, and energy prices. The Northeast, Northwest, and Midwest offer the most economic value from recycling due to high landfill disposal fees and high compost and energy market prices. For **Centralized Composting**, the Northeast, Midwest, and Northwest show the most economic promise due to the favorable combination of higher disposal fees and high market prices for compost. The Northeast and Northwest are the most promising regions for **Centralized Anaerobic Digestion** facilities due to the economics of local electricity, transport, and heating sectors.[44]

BEST PRACTICES

1. EMBRACE REGIONALISM

Though it is easier for retailers to establish national-level recycling policies and processes, the economics often vary too much between regions for that to be viable. When investigating local and state variables, consider:

- Infrastructure availability: Only about 500 composting facilities across the country accept food scraps, out of a highly fragmented market of roughly 5,000 facilities. Most of these facilities are just a few acres in size and lack the efficiencies of larger, industrial facilities that are able to purchase mechanized equipment such as turners and depackaging technology. Siting and permitting for new facilities continue to be highly restricted in different areas of the country.[45]
- Landfill disposal rates: Tipping fees have remained exceptionally low in the U.S. Since tipping fees are usually the largest revenue stream for recycling processing facilities, this has hurt the business case to expand organics recycling infrastructure.[46]
- Transportation and logistics costs (e.g., hauling): In efficient programs, the incremental vehicle, labor, and fuel costs from recycling generally add a 5% to 10% net increase in collection costs versus landfill-only programs. But when commercial food businesses are spread out, lack of route density and inefficient scheduling of pickups can lead to higher labor and fuel cost per volume collected.[47]

Retailers need to examine the economics of recycling versus landfilling on a regional basis to take into account differences in input costs and output values. Leading retailers are building databases that hold data on infrastructure availability, landfill tipping and hauling fees, recycling fees, etc. to enable distribution center and store-level analyses.

Retailers should also look for opportunities to improve the regional economics of recycling where they may not currently be favorable. For example, leading retailers are partnering with one another and with waste management companies, investors, and industry collaborations such as ReFED to identify innovations and financing that can create a favorable case for new infrastructure, shared transportation options, etc. There has also been an increase in organics recycling policies at municipal and state levels in 2017 that help support infrastructure development. (For more information, see the ReFED Policy Finder - *refed.com/policy*.)

2. FOCUS ON RECYCLING OUTPUTS

The value of recycling outputs—namely digestate and energy from AD and compost—varies widely. In some regions, the value of outputs can shift the economics favorably. The cost of energy in the Northeast and Northwest, for example, makes **Centralized AD** more attractive.[48] **Centralized AD** has also begun to expand as some retailers vertically integrate supply chains for specific products, creating a feedstock and a use for the digestate output. The profit potential of **Centralized Composting** may rise as new value-added products to mitigate storm water runoff and enhance agricultural production mature.

These solutions present new market and business model opportunities for retailers. The question becomes: Does appropriate valuation of recycling outputs tip the equation in favor of food waste recycling?

3. INVEST IN INNOVATIONS

Innovation is critical to advancing the viability and adoption of recycling solutions, although it can be difficult for retailers to pilot emerging technologies.

- For **Centralized AD**, some retailers are looking at smaller-scale depackaging technologies to enable systems at their facilities.
- For **Centralized Composting**, advances in compostable packaging are needed to create options that are on par with conventional price and performance, particularly in maintaining fresh food quality.[49]

Investing in new packaging and depackaging technologies can help overcome material supply assurance (quantity) and contamination (quality) barriers to recycling. Retailers can create a dedicated innovation fund to support pilots of technologies that will, over time, reduce labor costs associated with recycling.

ReFED RESOURCE

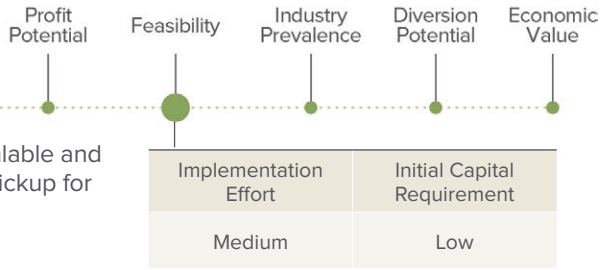
*Visit **refed.com/policy** to learn more about food waste policy.*

USING AD TO GENERATE ELECTRICITY AND FERTILIZER

The Kroger Recovery System—an anaerobic digester (AD)—opened at the Ralphs/Food 4 Less Distribution Center in Compton, CA, in 2013. Today, this AD can process nearly 55,000 tons of unsold organics a year, helping Kroger reduce the amount of food waste it sends to landfill. The system also generated more than 1.8 million kilowatt hours of renewable power in 2016, helping meet the energy needs of the 49-acre Ralphs campus. The digestion system also produces a concentration of minerals and nutrients that are turned into an organic fertilizer product.[51] Based on the success in Compton, Kroger recently powered up a second AD, an anaerobic wastewater treatment system, at its KB Specialty Foods manufacturing facility in Greensburg, IN. The system will turn food production byproducts into energy and improve air quality in the area.

New Solutions

1. REVERSE LOGISTICS FOR RECYCLING



Implementation Effort	Initial Capital Requirement
Medium	Low

Reverse Logistics for Recycling uses store-to-distribution routes to move unsalable and unsafe-for-consumption food to a centralized location for recycling onsite or pickup for recycling offsite.

BENEFITS INCLUDE

- Low cost to retailers—trucks have to return to the distribution centers regardless.
- Potential for greater storage capacity at distribution centers compared to stores.
- Lowered fees for hauling to recycling facilities as a result of reduced number of pickup locations.

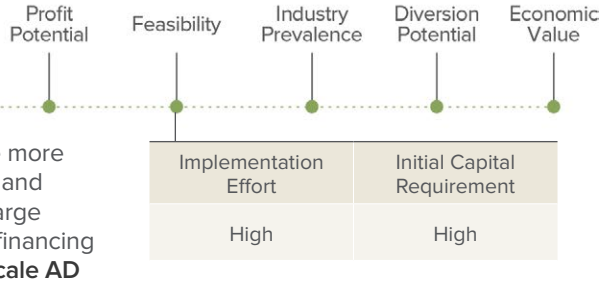
USING REVERSE LOGISTICS TO PROVIDE ENERGY TO A RETAIL CHAIN

In 2014, Ahold USA's Stop & Shop New England teamed up with Divert, Inc. to launch an on-site, end-of-life organics waste management system to provide energy to the chain's Central Distribution center servicing 212 stores. Using **Reverse Logistics for Recycling**, the Green Energy Facility processes organic waste from 208 retail Stop & Shop northeastern locations and can generate enough energy to power up to 40% of the retail chain's Distribution Center as well as produce a nutrient-dense compost additive.

KEY LEARNINGS

- Identify green energy partners within your community that will benefit from outputs of a digester, such as compost producers looking for solid digestate to produce high-quality compost.
- Mixing food waste with complementary feedstock, e.g., farm waste or outputs from wastewater treatment facilities, can increase energy output from a digester.
- Partner with your municipal or state government to navigate permits and other potential regulatory roadblocks, as well as to identify rebates and financial incentives.[50]

2. SMALL-SCALE ANAEROBIC DIGESTION (AD)



Small-Scale Anaerobic Digestion (AD) uses new AD technologies that require more limited amounts of biomass feedstock and smaller footprints to create energy and digestate. Deployed most often on farms, this solution could also be used at large stores or distribution centers (depending on feedstock availability) with lower financing requirements and easier installation and startup than **Centralized AD**. **Small-scale AD** eliminates the need for transportation, reducing costs and potentially increasing the economic viability of AD.

SETTING THE STRATEGY AND APPROACH

Food waste reduction solutions require significant customization—there is no "one-size-fits-all" fix. Integrating **Imperfect Produce** into inventory may work for a retailer with customers who seek more affordable prices, but be more challenging for a retailer known for consistently superior quality at higher prices. Retailers with their own fleet of trucks, meanwhile, will find **Cold Chain Management** easier to implement than those relying on third party logistics (3PL) providers.

Successful implementation of food waste solutions requires a strong base of support in people, processes, and technologies.

STRATEGY

Food waste reduction efforts should be based on a defined strategy that outlines goals, activities, and responsibilities backed by senior-level commitment.

- The most successful strategies directly connect action on food waste to corporate and business objectives—reducing costs, building supplier relationships, improving fresh perceptions, etc. Such food waste reduction programs are not perceived as "nice to have," but as critical to achieving corporate goals, and therefore worth the effort and investment.
- Food waste reduction goals should be quantitative, tied to business metrics such as cost, revenue, or growth, and time-bound. Leading retailers, for example, are setting absolute and net-zero waste goals and reporting externally on their food waste.
- A defined approach to identifying and testing emerging technologies and innovations is important to adopt when so many food waste solutions rely on new and innovative tools. This includes a well-defined pilot process, and, ideally, access to dedicated funding.

GOVERNANCE

Governance is critical to food waste reduction efforts that rely on engagement from all parts of an organization, from the C-suite to store employees. In addition to clear leadership and incentives to encourage change, good governance should include:

- A senior-level food waste leader in charge of waste reduction "end-to-end" across the business. This point person should engage business leaders and external stakeholders, e.g., industry collaborations and NGOs, and report to the corporate suite to ensure adequate resourcing and support.
- Structures and practices that facilitate cross-functional collaboration. Departments such as Procurement, Merchandising, Supply Chain, Logistics/Distribution, and Store Operations are all vital to successful implementation of a food waste reduction strategy, but may not have experience collaborating. In some cases, these functions may inadvertently be incentivized to create waste in other parts of the company. Overarching executive support and governance structures can bring these various departments to the table to increase understanding of how waste occurs across the business and resolve conflicts in incentives.
- Mechanisms that reward corporate-level managers and department heads. Many retailers have had success with making reduction part of annual performance goals for business function leaders and store managers and tying bonuses to corporate-level food waste performance.

FINANCING

Appropriate funding is instrumental to achieving food waste reduction goals. Investments in solution implementation should be closely tracked to ensure they create value and to help justify continued funding.

In addition to a dedicated fund to invest in piloting new or emerging reduction technologies, retailers can consider funding mechanisms including:

- Financial metrics besides return on investment such as internal rate of return, hurdle rate, and net profit potential.
- Non-financial key performance indicators, e.g., greenhouse gas emissions and water use.
- The use of utility and government rebates and incentives for capital improvement projects.
- Public-private partnerships to gain access to government funds for large infrastructure or other projects.

MEASUREMENT AND COMMUNICATIONS

Measuring food waste may involve significant effort for retailers, yet is crucial for establishing a baseline, setting goals, identifying priority hot-spots, and tracking progress.

- Data collection on food waste across the value chain is key to opening the doors of many solutions and investments. All retailers should consider using the Food Loss and Waste Accounting and Reporting Standard, developed by the Food Loss & Waste Protocol, to ensure consistency and transparency in data collection and reporting.[52]
- A best practice is to use automated tools linked to IT systems to track food waste metrics and generate performance reports. These tools integrate food waste data with sales data, foot traffic, and other operational data, enabling advanced analytics and real-time tracking of freshness and food waste for supply chain and operational decision making.
- Measurement also enables internal and external communications on food waste reductions.
  - Measurement efforts can provide internal location-specific food waste scorecards to compare performance over time and across facilities as a way of spurring employee action. Food waste performance metrics should also be built into supplier scorecards for use in discussions on improvement opportunities.
  - Retailers can gain reputational benefits by integrating measurement results into external reporting (e.g., corporate responsibility and sustainability reports, annual reports, and media stories).

STAKEHOLDER EDUCATION

Because retailers can reduce food waste along the entire value chain, from supplier to consumer, there is an enormous opportunity to multiply impact through stakeholder education.

Employee Education

Inspiring and motivating employees, particularly in stores, can make the difference in whether a waste reduction program succeeds or not.

- Employees are often excited to learn about food waste reduction opportunities and efforts, as food insecurity is present in so many communities and is a very relatable issue. Retailers can enable action by integrating well-defined waste management procedures into employee manuals and holding regular training sessions and awareness-raising activities (e.g., an annual Food Waste Week).
- Employees may also be motivated to implement food waste reduction efforts by incentives that reward stores and distribution centers with food waste reduction achievements (e.g., linked to waste tracking) (see above). Retailers can also establish a formal suggestions structure or other mechanisms for staff to give feedback on waste reduction up the management chain.

Customer Engagement

Because of the regular interactions that occur with their customers, retailers are in a unique position to educate and motivate consumers on food waste. **Consumer Education Campaigns** is one of the top diversion potential and economic value solutions identified in the *Roadmap*.[53]

- Retailers can promote waste reduction activities consistently through signage and promotional materials throughout the stores. This approach is often most impactful when done as part of implementing another solution—putting up signs to explain stock outs of fresh product for example, or to explain marked down products, can help build a retailer's brand for environmental and social responsibility in customer interactions that could otherwise be perceived negatively.
- Employee training on food waste reduction activities can also spur engagement with customers and education about the retailers' efforts. For example, produce department staff should be trained to engage with customers about "ugly" food offerings, why they look different from other produce, and how they can benefit the customer while helping to reduce waste.

THE PATH AHEAD

This *Guide* presents practical solutions for retailers to take action on reducing food waste. Activity on the three fronts of prevention, recovery, and recycling can be achieved by developing a top-down food waste reduction culture that flows from the executive suite to store employees and permeates every department in support of a defined strategy and goals. By delving into new prevention solutions enabled by emerging digital technologies, taking advantage of the PATH Act to improve the economics of recovery, and utilizing new tools and the outputs of recycling, retailers can create competitive cost advantages and build revenues.

There is a major opportunity for the retail industry to lead national food waste reduction initiatives. *The Retail Food Waste Action Guide* calls upon every retail business in the U.S. to rise to the challenge and take part in turning food waste from a costly burden into a valuable resource.

Together, we can reduce food waste by 20 percent in the next decade

For more details and to join ReFED, please contact us at info@refed.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APPENDIX A: *Retail Solution Dimensions*

Each solution has been evaluated along six dimensions: profit potential, implementation effort, extent of upfront capital investment required, industry prevalence, diversion potential, and societal economic value.

PROFIT POTENTIAL
Expected net annual profit, not including the upfront investment costs.

- **High**: net annual profit >2.5% of total food costs
- **Medium**: net annual profit of 0.5%-2.5% of total food costs
- **Low**: net annual profit of <0.5% of total food costs

FEASIBILITY
A combination of implementation effort and upfront capital requirement.

Implementation Effort
The extent of procedural updates, staff training, and systems needed to implement a solution.

- **High**: The change can be made with procedural updates and ongoing training, combined with new systems.
- **Medium**: The change can be made with procedural updates and initial training, combined with new systems.
- **Low**: The change can be made with only minor procedural updates and training, but no new systems.

Initial Capital Requirement
The estimated amount of upfront financial capital is needed to implement a solution.

- **High**: Upfront capital investment >5% of total annual food costs
- **Medium**: Upfront capital investment is 1%-5% of total annual food costs
- **Low:** Upfront capital investment <1% of total annual food costs

INDUSTRY PREVALENCE
Estimated percentage of the retail industry that has implemented the solution.

- **High**: Prevalence within industry >50%
- **Medium**: 25%-50% Prevalence within industry
- **Low**: Prevalence within industry <25%

DIVERSION POTENTIAL*
Portion of all food waste (by weight) that could be diverted from landfill through the implementation of a solution.

- **High** diversion potential means that the solution, if successfully implemented, could divert over 0.5% of all food waste from landfill.
- **Medium** diversion potential means that, if successfully implemented, between 0.1% and 0.5% of food waste could be diverted from landfill.
- **Low** diversion potential means that, if successfully implemented, less than 0.1% of food waste could be diverted from landfill.

SOCIETAL ECONOMIC VALUE*
Annual aggregate financial benefit of a solution to society minus all investment and costs.

- **High** economic value means that the solution, if successfully implemented, could create over $1B of total annual economic value.
- **Medium** economic value means that the solution, if successfully implemented, could create between $100M and $1B of total annual economic value.
- **Low** economic value means that the solution, if successfully implemented, could create less than $100M of total annual economic value.

**Rankings are based on findings from The Roadmap. Any potential benefits would be considered society-wide, not just within the scope of the retail sector.*

APPENDIX B: *Retail Solution Matrix Detail*

SOLUTION	PROFIT POTENTIAL	FEASIBILITY		INDUSTRY PREVALENCE	ROADMAP DATA	
					DIVERSION POTENTIAL	ECONOMIC VALUE
Consumer Education Campaigns	Low	High	Implementation Effort: Low Initial Capital Intensity: Low	Medium	High	High
Enhanced Demand Forecasting	High	Low	Implementation Effort: High Initial Capital Intensity: High	Low	High	High
Standardized Date Labeling	Low	High	Implementation Effort: Medium Initial Capital Intensity: Low	Low	High	High
Reduced Handling	Low	High	Implementation Effort: Low Initial Capital Intensity: Low	Medium	Low	Low
Secondary Resellers	Low	High	Implementation Effort: Medium Initial Capital Intensity: Low	Medium	Medium	Low
Spoilage Prevention Packaging	Low	High	Implementation Effort: Medium Initial Capital Intensity: Low	Low	Low	Medium
Direct-to-Customer Delivery	Medium	Low	Implementation Effort: High Initial Capital Intensity: High	Medium	Medium	Medium
Dynamic Pricing & Markdowns	High	Low	Implementation Effort: High Initial Capital Intensity: High	Low	High	Medium
Dynamic Routing	High	Low	Implementation Effort: High Initial Capital Intensity: High	Low	High	Medium
Produce Specifications	Low	High	Implementation Effort: Medium Initial Capital Intensity: Low	Low	Medium	Medium
Cold Chain Management	High	Low	Implementation Effort: High Initial Capital Intensity: High	Medium	High	Medium
Improved Inventory Management	High	Low	Implementation Effort: High Initial Capital Intensity: High	Low	High	High
Meal Kits	Medium	Medium	Implementation Effort: High Initial Capital Intensity: Medium	Low	Medium	High
Packaging Adjustments	Low	High	Implementation Effort: Medium Initial Capital Intensity: Low	Medium	Medium	Medium

SOLUTION	PROFIT POTENTIAL	FEASIBILITY		INDUSTRY PREVALENCE	ROADMAP DATA	
					DIVERSION POTENTIAL	ECONOMIC VALUE
Reverse Logistics for Recovery	Low	Medium	Implementation Effort: Medium Initial Capital Intensity: Low	Low	Low	Low
Donation Liability Education	Low	High	Implementation Effort: Medium Initial Capital Intensity: Low	Low	Low	Medium
Donation Matching Software	Low	High	Implementation Effort: Low Initial Capital Intensity: Low	Low	Medium	Medium
Donation Storage & Handling	Low	Medium	Implementation Effort: Medium Initial Capital Intensity: Low	Low	Medium	Medium
Donation Tax Incentives	Low	Medium	Implementation Effort: Medium Initial Capital Intensity: Low	Medium	High	Medium
Donation Transportation	Low	Medium	Implementation Effort: Medium Initial Capital Intensity: Low	Low	Medium	Medium
Standardized Donation Regulation	Low	High	Implementation Effort: Low Initial Capital Intensity: Low	Low	Medium	Medium
Animal Feed	Low	High	Implementation Effort: Medium Initial Capital Intensity: Low	Medium	Low	Low
Centralized AD	Low	Medium	Implementation Effort: Medium Initial Capital Intensity: Medium	Low	High	Low
Centralized Composting	Low	Medium	Implementation Effort: Medium Initial Capital Intensity: Medium	Low	High	Low
Reverse Logistics for Recycling	Low	Medium	Implementation Effort: Medium Initial Capital Intensity: Low	Low	Low	Low
WWRF with AD	Low	Medium	Implementation Effort: Medium Initial Capital Intensity: Medium	Medium	High	Low
Small-Scale AD	Low	Low	Implementation Effort: High Initial Capital Intensity: High	Low	Low	Low

APPENDIX C: *Solution Details*

RETAIL FOOD WASTE PREVENTION SOLUTIONS				
SOLUTION CATEGORY	**SOLUTION**	**DESCRIPTION**	**STAKEHOLDERS**	
			INTERNAL	**EXTERNAL**
PACKAGING & PRODUCT	**Enhanced Demand Forecasting**	Use big data and advanced analytics to improve the sophistication of demand forecasting and buying, specifically by taking into account store sales variability, seasonality of products and sales, and existing inventory on hand, coupled with external demand sensing	Procurement, Store Operations, Merchandising, IT	Suppliers, IT Vendors, Entrepreneurs
	Produce Specifications*	Accept and integrate the sale of off-grade produce (short shelf life, different size/ shape/ color), also known as "ugly" produce, for retail sale	Procurement, Food Safety / Quality Assurance, Store Operations, Marketing, Merchandising	Suppliers, Foundations, State & Federal Governments
	Meal Kits	Provide pre-proportioned fresh ingredients in kits for home meal preparation to reduce over-buying by consumers and food waste in homes	Procurement, Food Safety / Quality Assurance, Store Operations, Marketing, Merchandising	Suppliers
	Standardized Date Labeling*	Standardize food label dates and instructions as outlined by the Food Marketing Institute and Grocery Manufacturers Association to reduce consumer confusion	Procurement, Food Safety / Quality Assurance, Legal, Store Operations, Merchandising	Suppliers, Nonprofits
	Packaging Adjustments*	Optimize private label food packaging size and design to enable full product use and avoid waste	Procurement, Distribution, Marketing, Store Operations, Food Safety / Quality Assurance, Merchandising	Suppliers, Researchers, Entrepreneurs
	Spoilage Prevention Packaging*	Use active intelligent packaging to prolong product freshness and slow spoilage of perishable fruit and meat	Procurement, Distribution, Food Safety / Quality Assurance, Store Operations, Merchandising	Suppliers, Entrepreneurs, Researchers
OPERATIONAL & SUPPLY CHAIN EFFICIENCY	**Cold Chain Management***	Reduce product loss during shipment to retail distribution centers by using direct shipments and cold-chain-certified carriers	Procurement, Distribution, Food Safety / Quality Assurance, Transportation & Logistics, Store Operations	Entrepreneurs, Suppliers
	Dynamic Routing	Use sensors to collect data on product freshness and nearly expired food so that food with a shorter-than-expected shelf life can be re-routed on the spot to closer distribution centers and stores.	Procurement, Distribution, Food Safety / Quality Assurance, Transportation & Logistics Store Operations, IT	Entrepreneurs, Suppliers, IT Vendors
	Reduced Handling	Change distribution and in-store merchandising practices to reduce the frequency of produce handling and decrease damage. Encourage customers to avoid produce handling through signage, etc.	Distribution, Food Safety / Quality Assurance, Transportation & Logistics, Store Operations	
	Direct-to-Customer Delivery	Transport food directly from distribution centers or stores to customers to improve product velocity and freshness	Procurement, Distribution, Transportation & Logistics, Store Operations, IT, Marketing	Entrepreneurs, Suppliers, IT Vendors, Transportation Vendors
	Improved Inventory Management*	Improve the ability of retail inventory management systems to track an average product's remaining shelf life and inform efforts to reduce the length of time an item has gone unsold	Procurement, Distribution, Food Safety / Quality Assurance, Store Operations, Merchandising	Entrepreneurs, Suppliers
	Dynamic Pricing & Markdowns	Use sensors to gather real-time data about quantity and quality of inventory on hand and incoming orders to enable product price adjustments in stores	Procurement, Store Operations, IT	Entrepreneurs, Suppliers, IT Vendors
	Secondary Resellers*	Sell excess product to businesses that purchase unwanted processed food and produce direct from manufacturers/distributors for discounted retail sale to consumers	Distribution, Transportation & Logistics, Legal, Store Operations	Nonprofits
CONSUMER EDUCATION	**Consumer Education Campaigns***	Participate in large-scale consumer advocacy campaigns to raise awareness of food waste and educate consumers on ways to save money and reduce wasted food	Marketing, Merchandising, Store Operations	Nonprofits, Foundations, Local / state / federal governments

RETAIL FOOD SURPLUS RECOVERY SOLUTIONS

SOLUTION CATEGORY	SOLUTION	DESCRIPTION	STAKEHOLDERS	
			INTERNAL	EXTERNAL
DONATION POLICY	**Donation Tax Incentives**	Advocate for expansion of federal tax benefits for food donations to all businesses and simplification of donation reporting for tax deductions. Work with finance / tax departments to take advantage of tax incentives	Finance / Tax, Public Affairs / Policy, Legal, Sustainability / Foundation	State & Federal Governments, Foundations, Food Recovery Organizations
	Standardized Donation Regulation	Advocate for standardization of local and state health department regulations for safe handling and donation of food through federal policy	Public Affairs / Policy, Legal	Federal Government, Food Recovery Organizations, Local & State Health Departments, Foundations
	Donation Liability Education	Educate retail store and distribution center employees on donation liability laws	Store Operations, Distribution , Food Safety / Quality Assurance, Legal	Nonprofits, Federal Government
DONATION INFRASTRUCTURE	**Donation Matching Software**	Use a technology platform to connect retail stores and distribution centers with excess food for donation with recipient organizations to reach smaller-scale food donations	Store Operations, Distribution, Sustainability / Foundation	Entrepreneurs, Food Recovery Organizations
	Donation Storage & Handling	Expand temperature-controlled food distribution infrastructure (e.g., refrigeration, warehouses); add labor needed to process and package additional donation volumes	Store Operations, Distribution, Transportation & Logistics, Legal	Suppliers, Food Recovery Organizations, Entrepreneurs, Foundations
	Donation Transportation	Provide small-scale transportation infrastructure for local recovery and long-haul transport capabilities	Transportation & Logistics, Legal	Food Recovery Organizations, Foundations, Local / state / federal governments
	Reverse Logistics for Recovery	Use store-to-distribution center routes to move product available for recovery to centralized pickup locations	Transportation & Logistics, Legal, Sustainability / Foundation	Food Recovery, Organizations, Local / state / federal governments

RETAIL FOOD WASTE RECYCLING SOLUTIONS

SOLUTION CATEGORY	SOLUTION	DESCRIPTION	STAKEHOLDERS	
			INTERNAL	EXTERNAL
ENERGY & DIGESTATE	**Centralized Anaerobic Digestion (AD)***	Transport food waste to a centralized facility where microorganisms transform it into biogas and digestate. Different AD technologies include wet and dry versions, the latter better suited to food waste mixed with yard waste.	Store Operations, Distribution, Waste Management	Local / state / federal governments, Operators, Haulers
	Small-Scale Anaerobic Digestions (AD)	Use new AD technologies at large stores or distribution centers that require more limited amounts of biomass feedstock and smaller footprints to create energy and digestate	Store Operations, Distribution, Waste Management, Finance, Legal	Local / state / federal governments
	Water Resource Recovery Facility with AD	Deliver food waste by truck or through existing sink disposal pipes to a municipal WRRF, where it is treated with anaerobic digestion; the biosolids can be applied to land for beneficial reuse	Store Operations, Distribution, Waste Management	Haulers, Local governments
AGRICULTURAL PRODUCTS	**Centralized Composting**	Transport food waste to a centralized facility where it is transformed into compost	Store Operations, Distribution, Waste Management	Local / state / federal governments, Operators, Haulers
	Animal Feed*	Provide food waste to famers to feed animals after it is heat-treated and dehydrated; either mixed with dry feed or directly fed	Store Operations, Distribution, Waste Management, Legal	Farmers
RECYCLING INFRASTRUCTURE	**Reverse Logistics for Recycling**	Use store-to-distribution routes to move unsalable and unsafe-for-consumption food to a centralized location for recycling onsite or pickup for recycling offsite	Store Operations, Distribution, Waste Management, Legal	Local / state / federal governments, Haulers

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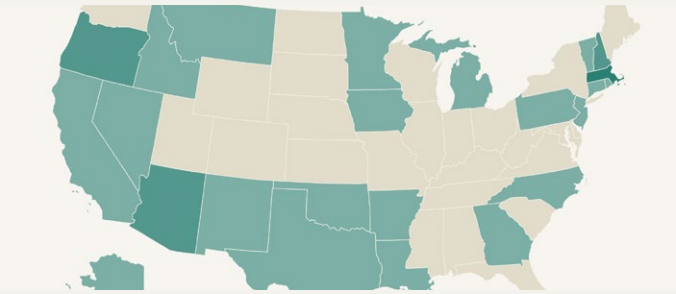
ReFED RESOURCES

U.S. FOOD WASTE POLICY FINDER



refed.com/policy

INNOVATOR DATABASE

refed.com/innovators

OTHER RESOURCES

PREVENTION

A Strategic Guide on Using Data to Drive Food Loss and Waste Reductions
bit.ly/2vRmtUD

EPA Food Waste Cost Calculator
bit.ly/2xhLQ2S

EPA Food Waste and Packaging Tracking Tool
bit.ly/2yMudfc

EPA Guide on How to Conduct and Analyze Food Waste Characterization
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Unilever's "Wise Up on Waste" App
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Food Loss and Waste Accounting and Reporting Standard
flwprotocol.org

RECOVERY

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412foodrescue.org

Copia
gocopia.com

Fact Sheet from the Harvard Food Law and Policy Clinic
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Feeding America
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Food Donation Connection
foodtodonate.com

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Food Recovery Network
foodrecoverynetwork.org

Food Recovery Verified
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Information on the Bill Emerson Good Samaritan Food Donation Act
bit.ly/2fo7ptj

Iowa Hunger Directory
iowahungersummit.org/en/the_iowa_hunger_directory

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bit.ly/2gsU6GB

RECYCLING

BioCycle's Find a Composter
findacomposter.com

Keeping Food Out of the Landfill: Policy Ideas for States and Localities
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