PREVENTION SOLUTIONS

ANNUAL DIVERSION POTENTIAL

2.6M TONS

ANNUAL ECONOMIC VALUE

$7.7B

INVESTMENT NEEDED OVER 10 YEARS

$6.2B

ANNUAL BUSINESS PROFIT POTENTIAL

$1.9B

ANNUAL GHGS REDUCED

9.7M TONS CO_2e

ANNUAL WATER CONSERVED

1.2T GALLONS

TOP SOLUTIONS BY DIVERSION POTENTIAL

CONSUMER EDUCATION CAMPAIGNS

WASTE TRACKING & ANALYTICS

STANDARDIZED DATE LABELING

MAIN BENEFICIARIES

CONSUMERS

BUSINESSES

ENVIRONMENT

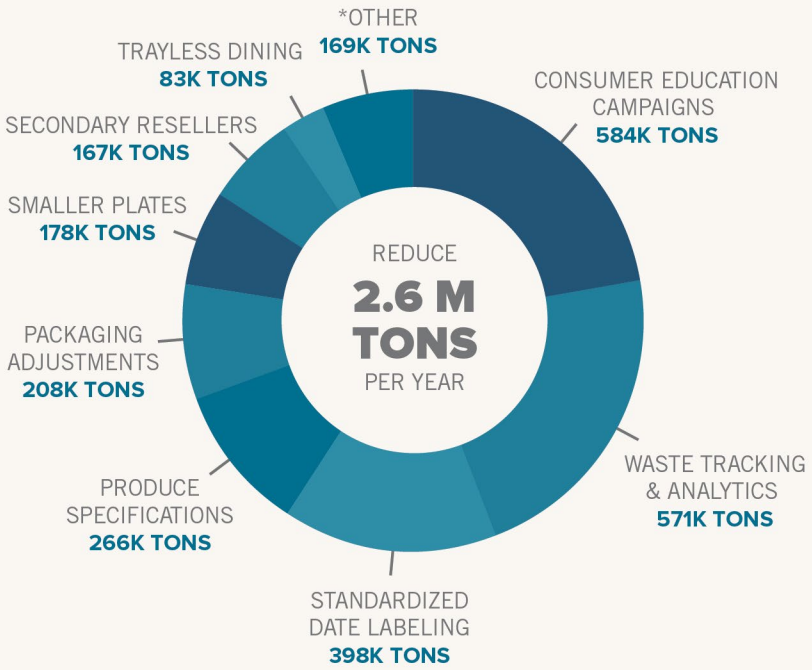
"AN OUNCE of prevention is worth a pound of cure." Whether in health care, energy, or criminal justice, the most efficient way to solve a critical social problem is often to invest in prevention. The same holds true with tackling food waste, where solutions that avoid waste offer the largest social, environmental, and economic benefits. Therefore, prevention should be the first priority for effective management of food waste.

PREVENTION: THE OPPORTUNITY

Prevention is applicable across the value chain — from farms to homes. The *Roadmap* shows that prevention creates three times the societal net Economic Value of recovery and recycling combined. The two most cost-effective solutions, **Consumer Education Campaigns** and **Standardized Date Labeling**, both require relatively low investment to provide new information to consumers to shift wasteful behavior. Meanwhile, they avoid large volumes of food from being wasted that is valued at expensive retail prices, leading to high relative savings for consumers.

Prevention solutions also provide nearly $1.9 billion of annual Business Profit Potential for consumer-facing businesses. For example, **Waste Tracking & Analytics** can help restaurants and foodservice providers generate over $1 billion dollars in additional profit through reduced food purchase costs.

PREVENTION SOLUTIONS DIVERSION POTENTIAL



***OTHER:** SPOILAGE PREVENTION PACKAGING **72K TONS/YR**; IMPROVED INVENTORY MANAGEMENT **59K TONS/YR**; MANUFACTURING LINE OPTIMIZATION **20K TONS/YR**; COLD CHAIN MANAGEMENT **18K TONS/YR**

KEY INSIGHTS

Solutions that prevent waste in businesses and homes have the greatest Economic Value per ton and net environmental benefit, diverting 2.6 million tons of annual waste.

- The top three solutions with the greatest Economic Value per ton all utilize prevention: **Standardized Date Labeling, Consumer Education Campaigns,** and **Packaging Adjustments**.
- Prevention solutions are generally capital-light; they involve changing behavior through packaging changes, software, and marketing.
- At retail, food is worth roughly $2.50 per pound, magnitudes higher than the value of food scraps for disposal, providing a large economic driver for prevention efforts.

THE CURRENT LANDSCAPE

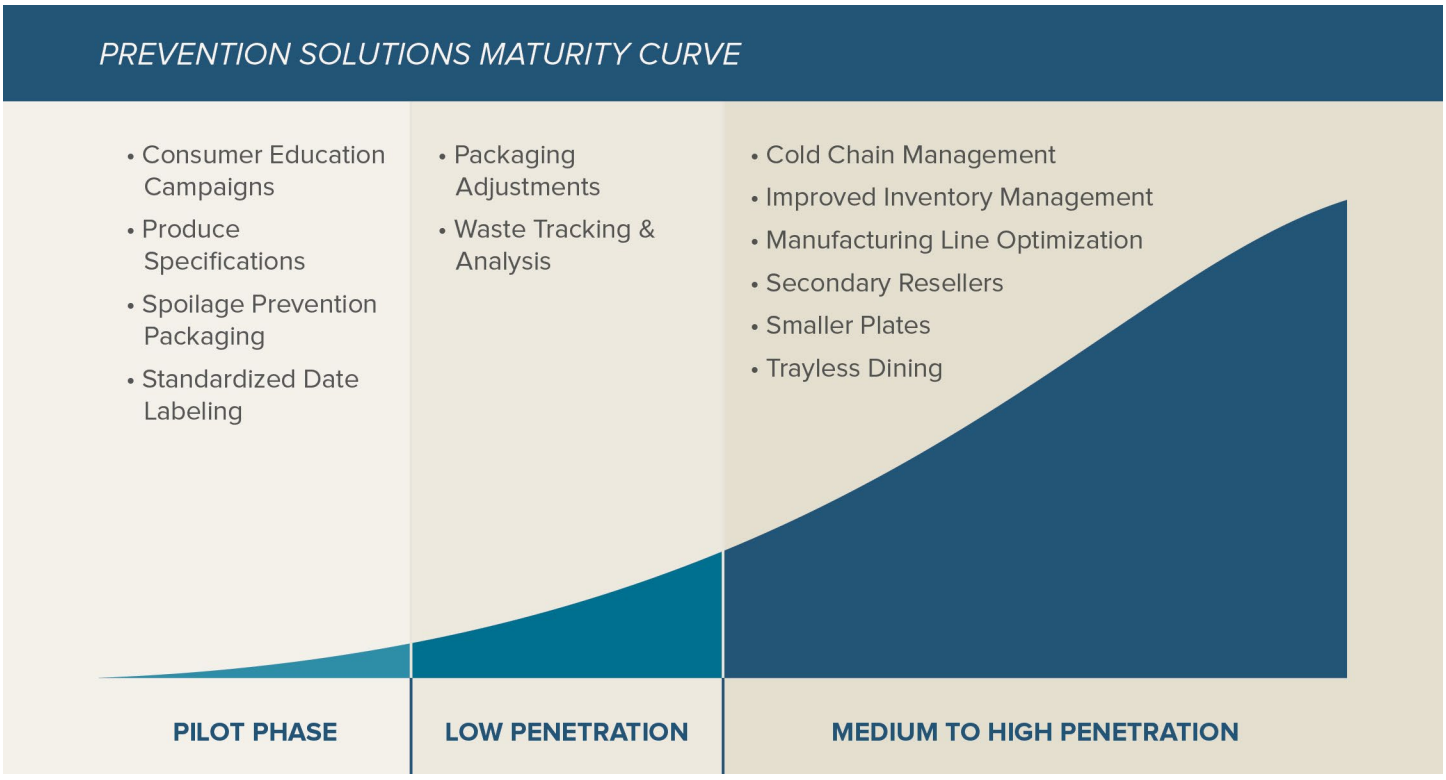
Prevention is largely nascent across the food value chain. For example, of the 12 prevention solutions ReFED analyzed, four are estimated to have less than 5% market penetration or to still be in the pilot phase. Two have an estimated 5% to 25% market penetration, and an additional six have a 25% or greater penetration. With the exception of manufacturers, most food businesses have accepted food waste as an unavoidable hit to their income statements.

Because food waste has often been viewed as a missed opportunity to alleviate hunger rather than as an environmental concern, many companies have not prioritized prevention. For instance, of the dozen retailers and restaurants that ReFED interviewed, all had food recovery programs, but only half were aggressively pursuing prevention. Additionally, when balancing concerns for food safety against waste, most consumers and food businesses choose to err on the side of wasting food rather than taking any health risks — real or perceived.[9]

New prevention technologies are emerging, including waste-tracking tools and packaging innovations. Interviews with ReFED Advisory Council members indicated that these technologies have reduced waste by 5% to 35% in initial pilots.[10] With retailer margins shrinking and consumer awareness growing, investment in prevention technologies is expected to grow.

At present, there is little in the policy landscape helping or hindering food waste prevention. Some solutions such as **Standardized Date Labeling** would benefit from a stronger policy environment, but the lack of policy in this space has not deterred stakeholders from proactively implementing change.

The maturity curve below shows the range of penetration of prevention solutions analyzed, highlighting a major opportunity to scale.



BARRIERS TO FOOD WASTE PREVENTION

Some overarching barriers to food waste prevention include:

MISALIGNMENT OF COSTS AND BENEFITS: There is limited reason for businesses to implement a new technology or process if another part of the supply chain receives the benefit. For example, businesses may find it hard to build a business case to invest in **Packaging Adjustments, Spoilage Prevention Packaging**, or

Standardized Date Labeling when consumers get most of the cost savings and the effect on enhanced brand equity is unclear.

LACK OF SOCIAL LICENSE: Consumer expectations for variety and cosmetic perfection constrain businesses from streamlining product selection, offering cosmetically imperfect food, reducing portion sizes, or even investing in proven approaches such as cold chain and inventory management. Food waste and its consequences are largely invisible to the public.

INFORMATION GAPS: There is uncertainty about where food waste occurs, how much is being wasted, and its associated value. During distribution, crates and packaging mask sight and smell so rapidly ripening produce cannot be separated out and moved to customers faster.

ORGANIZATIONAL SILOS: Implementing prevention solutions requires collaboration between different departments within participating businesses, including buyers, merchants, store managers, chefs, waste managers, and financial analysts. Employees in different parts of an organization may not be aware of the fully loaded cost implications of waste.

More information on the barriers to food waste prevention are available in NRDC's report "Wasted" [11] and from the Food Waste Reduction Alliance.

CASE STUDY: BON APPETIT MANAGEMENT COMPANY *www.bamco.com*

Bon Appetit Management Company (BAMCO), an on-site restaurant company that serves universities, corporations, and other institutional venues in 33 states, has embraced food waste as a key part of its sustainability efforts.

BAMCO has explored a number of solutions to address food waste in its supply chain, prevent waste in its cafes, and recover food for donation. For example, by removing trays in its all-you-can-eat facilities, BAMCO enabled diners to improve self-portioning and reduce post-consumer plate waste, which contributes 50% to 75% of overall foodservice waste volumes. BAMCO also successfully reduced pre-consumer food waste in its cafes by deploying waste analytics software to track, monitor, and analyze kitchen waste.

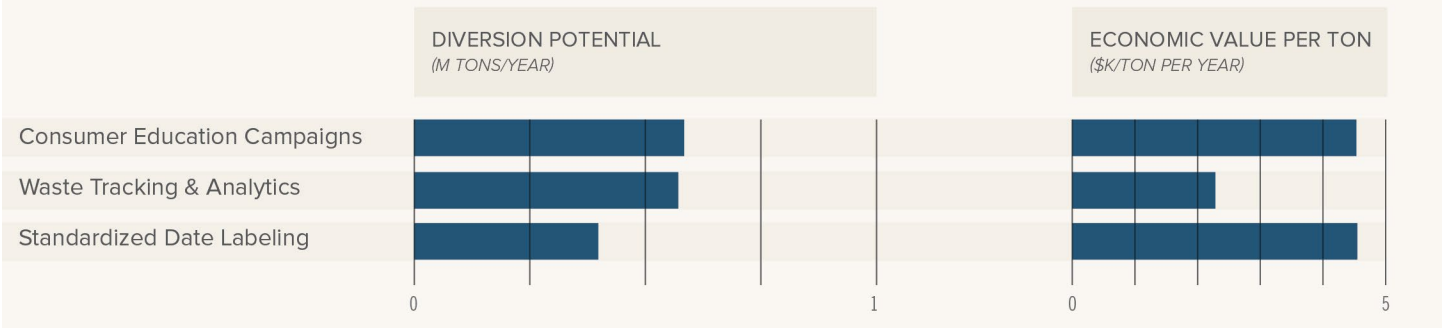
In 2013, BAMCO created a Waste Specialist position dedicated to addressing its toughest food waste challenges. A year later, it launched the Imperfectly Delicious Produce program to tackle the opportunity of "ugly food" on farms — blemished, misshapen, or visually imperfect produce that fails strict retail market standards, but is otherwise perfectly safe to eat. By engaging directly with farmers and distributors to procure imperfect produce and working with chefs to incorporate this supply into menu offerings, BAMCO pioneered a novel approach to waste reduction that it continues to expand today.

By taking a comprehensive approach, BAMCO has found improvement opportunities across its supply chain, from farms to kitchens to consumer behaviors. This sweeping approach has maximized the cost savings that BAMCO can achieve from food waste diversion, as well as enhanced its brand with customers.

PREVENTION SOLUTION DESCRIPTIONS

The top three solutions represent 60% of the total prevention diversion potential: **Consumer Education Campaigns**, **Waste Tracking & Analytics**, and **Standardized Date Labeling**. The solution descriptions on the following pages are sorted by diversion potential.

TOP THREE PREVENTION SOLUTIONS BY DIVERSION POTENTIAL



1. CONSUMER EDUCATION CAMPAIGNS

DEFINITION

Conducting large-scale advocacy campaigns to raise awareness of food waste and educate consumers about ways to save money and reduce wasted food

DIVERSION POTENTIAL

584K TONS

ECONOMIC VALUE

$2.65B

TIMEFRAME

MEDIUM TERM

PENETRATION

PILOT

WHO BENEFITS

CONSUMERS

WHO CAN TAKE ACTION

CONSUMER-FACING BUSINESSES

MUNICIPALITIES

NONPROFITS

OVERVIEW

According to the UN Food and Agriculture Organization (FAO), North American consumers lead the world in per-capita food waste. From making better use of leftovers to learning how to minimize spoilage by properly storing perishable foods, consumers have a direct hand in reducing waste in and outside the home. Increased awareness may also inspire consumers to demand that businesses operate more responsibly.

CHALLENGES

- Households throw away food for any number of reasons, including poor planning, inability to consume food in a timely manner, and a lack of awareness.
- Overcoming apathy or indifference is the most significant hurdle to overcome. Surveys show that while consumers understand the importance of food waste reduction, they don't recognize their own role in solving the problem.[12]
- Consumer behavior change for any issue requires a long time horizon, which can inhibit investment and the ability to track impact.

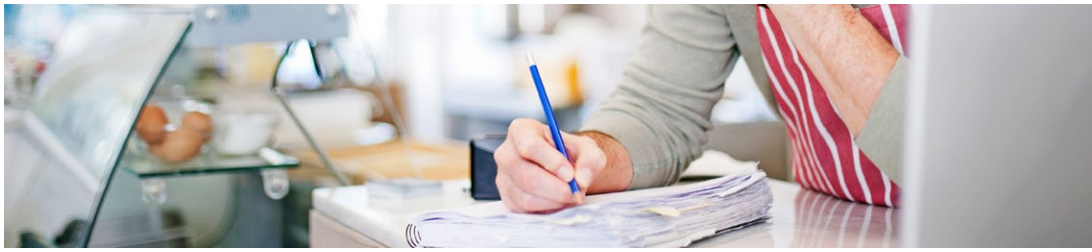
STAKEHOLDER ACTIONS

- Private and public stakeholders, supported by foundations, can collectively invest in consumer education efforts that increase awareness, offer tips for extending food shelf life and storing perishables properly, and promote a culture of active waste avoidance. Messaging should appeal to a wide variety of values, including reducing food bills.
- Nonprofits and local governments can extend the reach of a national advertising campaign to additional consumer segments. They can develop regionally relevant recipes and suggestions for repurposing leftovers, as well as simple toolkits for consumers to calculate the costs of throwing out food.
- Businesses can inform customers at the point-of-selection about ways to save money by wasting less. Retailer in-store media campaigns can provide information about products and packaging that have waste prevention attributes. Foodservice providers and restaurants may display waste-related messaging to customers. Consumer waste education is a branding opportunity for businesses to demonstrate their commitment to resource conservation.
- Campaigns can partner with nonprofits to track impact metrics to inform further targeted messaging. While studies have been conducted in the United Kingdom and elsewhere to measure the impact of consumer education, there has been minimal tracking in the U.S. to ensure that campaigns are effective.

EXAMPLES

- In 2015, Walmart ran a video campaign in checkout lanes across the country explaining ways shoppers could save money by reducing food waste at home.
- In 2016, NRDC, in partnership with the Ad Council, will launch a major three-year public service campaign targeted at "moms and millennials" to communicate the benefits of food waste reduction, including the cost savings opportunities. The media campaign can be expanded to other consumer segments, deepened in priority regions, and extended beyond three years.
- In the U.K., the Waste and Resources Action Programme (WRAP) launched "Love Food Hate Waste," a national consumer awareness campaign that included print and web materials. It successfully reduced consumer food waste by 21% in five years.[13]

2. WASTE TRACKING & ANALYTICS



DEFINITION

Providing restaurants and prepared-food providers with data on wasteful practices to inform behavior and operational changes

DIVERSION POTENTIAL

571K TONS

ECONOMIC VALUE

$1.3B

TIMEFRAME

NEAR TERM

PENETRATION

LOW

WHO BENEFITS

RESTAURANTS

FOODSERVICE AND INSTITUTIONS

WHO CAN TAKE ACTION

RESTAURANTS

FOODSERVICE AND INSTITUTIONS

NONPROFITS

ENTREPRENEURS

MUNICIPALITIES

OVERVIEW

Every business has heard the adage "what is measured gets managed," and this is true for food waste as well. Waste tracking and analytics tools include the publicly available Conserve program offered by the National Restaurant Association, private solutions such as LeanPath, and internally built business tools. Waste tracking varies in sophistication from using scales, cameras, and phone apps to basic paper and pen to collect and analyze data.

This data helps businesses identify the volumes and types of food that are tossed out during food preparation, informing operational changes and building the business case for investment in other solutions. There is a recent uptick in interest in waste tracking because it achieves two corporate priorities: increased profit margins and data reporting to show external stakeholders a path to lower overall waste levels.

CHALLENGES

- Many food facilities have no existing data to analyze waste.
- Restaurants and foodservice providers have not invested in this solution primarily because they are not aware of the potential cost savings at their facilities.
- Existing waste tracking tools may have the reputation for being either extremely expensive or cumbersome to use, although the cost and ease of use of tools is improving across the market.
- Tracking and analytics tools require an upfront investment of time and resources to realize a positive bottom-line impact.

STAKEHOLDER ACTIONS

- Restaurants and foodservice providers can deploy pilots in select facilities to demonstrate the positive return on investment. Waste tracking tools can improve employee engagement with staff who care about hunger and environmental issues.
- Strong corporate leadership is needed to overcome organizational silos because managers, chefs, and kitchen staff all need to buy into the benefits in order to coordinate implementation.
- Investors can fund entrepreneurs working to reduce operational costs and labor requirements for these technologies. This includes new camera or sensor technology to reduce the need for staff to manually input data.
- Nonprofits and municipalities can partner with technology providers to offer discounted rates and employee training. Nonprofits that purchase a lot of food, such as nursing homes, colleges, and food banks, can increase their impact by freeing up operational dollars that previously were spent on discarded food.

EXAMPLES

- The National Foundation to End Senior Hunger's "What a Waste" program partnered with LeanPath to implement waste tracking for senior nutrition programs.
- Stony Brook University adopted a food waste reduction program called Trim Trax, developed by foodservice contractor Compass Group to help businesses track and measure food waste costs.[14,15]
- StopWaste, a public agency in Alameda, Calif., launched the "Smart Kitchen Initiative" with LeanPath to subsidize the adoption of waste tracking and analytics tools among businesses that perceive too much risk to implement on their own.[16]

3. STANDARDIZED DATE LABELING

DEFINITION

Standardizing food label dates and instructions, including eliminating “sell by” dates, to reduce consumer confusion

DIVERSION POTENTIAL

398K TONS

ECONOMIC VALUE

$1.8B

TIMEFRAME

MEDIUM TERM

PENETRATION

PILOT

WHO BENEFITS

CONSUMERS

WHO CAN TAKE ACTION

CONSUMER-FACING BUSINESSES

MUNICIPALITIES

NONPROFITS

OVERVIEW

Current date labeling practices on food packaging cause confusion with “sell by,” “best by,” “use by,” and “best before” dates, leading up to 90% of Americans to occasionally throw out still-fresh food. Confusion over the meaning of date labels is estimated to account for 20% of consumer waste of safe, edible food.[17] This equates to approximately $29 billion of wasted consumer spending each year — 5% to 10% of this is expected to be impacted by Standardized Date Labeling.

CHALLENGES

- There is no comprehensive national regulation or government agency with the direct mandate to regulate food date labeling for safety and perishability.[18]
- Consumers face a confusing array of labels and phrasing that differ widely based on varied state laws and manufacturer preferences.
- The cost of changing the date labels is negligible, but manufacturers have little incentive to change their practices because date label standardization would do little to lower costs, increase revenues, or reduce liability.
- Retailers could push for standardization from manufacturers but would need to collaborate with others to represent enough market share to drive manufacturers to change. There may be an opportunity for retailers to reduce operational and food costs associated with pulling near-expired product from shelves. Additional research is needed to quantify this potential benefit.
- Retailers and manufacturers consistently cite uncertainty regarding the design of standardized labels and wording as well as skepticism of its widespread impact on consumer behavior, as two reasons for not moving forward on a voluntary approach.
- Nineteen states restrict sale of products after the date on the label has passed even though the majority have no safety risk associated with the date. In addition to wasted food, this leads to fines when retailers have past-date products in their stores.

STAKEHOLDER ACTIONS

- Changes to date labels require little upfront investment from businesses and can be enacted unilaterally by large food companies to reduce consumer confusion. The best path forward is for a voluntary agreement of manufacturers to implement consistent language.
- If a voluntary agreement is not forthcoming, a multi-stakeholder approach is recommended to overcome inertia and achieve true standardization. This multi-stakeholder approach should aim to de-risk any industry concerns by working with consumer behavior experts to determine the best language for labels, develop a process for measuring if the implemented change is leading to the desired results, and fund consumer education to go alongside the change.
- In the absence of a voluntary commitment from industry, ReFED recommends that the federal government update existing FDA regulations to standardize date label wording. The federal government could also fund consumer education about these new date labeling practices in partnership with other private and public sector organizations.
- In addition, states should revoke restrictions on sale or donation after the date on the label. This could also be achieved through federal legislation.

EXAMPLES

- The Food Recovery Act, currently proposed and pending (as of February 2016) by Rep. Chellie Pingree, recommends standardizing labels with the phrase “best if used by," followed by “manufacturers suggestion only” and a standard “expires on” date required for the small number of items determined by the FDA to have food safety risks.[19]
- Some manufacturers have experimented with adding “freeze by” language onto packaging to encourage customers to take active steps to preserve food in the freezer instead of throwing it in the trash.

4. PRODUCE SPECIFICATIONS (IMPERFECT PRODUCE)

PENETRATION: **PILOT**
TIMEFRAME: **MEDIUM TERM**

DIVERSION POTENTIAL: 266K TONS | ECONOMIC VALUE: $277M

Who Benefits:

CONSUMER-FACING BUSINESSES, CONSUMERS

Who Can Take Action:

FARMERS, CONSUMER-FACING BUSINESSES, ENTREPRENEURS, STATE & FEDERAL GOVERNMENTS

DEFINITION

Accepting and integrating the sale of off-grade produce (short shelf life, different size/shape/color), also known as "ugly" produce, for use in foodservice and restaurant preparation and for retail sale

CHALLENGES

- Consumer-facing businesses are often unfamiliar with cost-saving opportunities from buying imperfect produce and are not offered it by their suppliers. Education is needed on how products could replace (foodservice) or supplement (retail) existing purchasing.
- Some retailers have concerns about the impact of imperfect produce on their brands; creativity is needed in menu planning for foodservice and institutions.
- Economics for farmers are unclear since cosmetically imperfect produce may partially cannibalize sales for top-tier, cosmetically perfect products.

STAKEHOLDER ACTIONS

- Businesses can set up pilots to partner with individual farmers and distributors to assess the economics and culinary dynamics of utilizing imperfect produce.
- Entrepreneurs and existing produce suppliers can support sourcing, differentiated marketing and branding, and innovative processing for imperfect produce.
- Foundations and USDA grants can support marketing and educational efforts to farmers and consumers to stimulate adequate supply and demand for imperfect produce.
- State and federal governments can include stipulations in purchasing contracts to support the purchase of cosmetically imperfect products.

EXAMPLES

- See Bon Appetit Management Case Study, page 30.

CASE STUDY: WALMART *www.walmart.com*

As the largest U.S. food retailer, Walmart captures roughly 25% of all grocery market share — more than twice that of the next largest competitor. True to its mission to save money for its customers, Walmart is trying to find savings in food waste. With its size and buying power, Walmart has already piloted a number of waste prevention solutions.

In its perishables supply chain, Walmart recently experimented with smart labeling technology — electronic devices attached to produce shipping containers and crates to monitor spoilage. Despite significant implementation costs, ranging from RFID tags to handheld reader devices, Walmart developed the business case for this technology investment based on long-term expectations of reduced inventory loss.

To help its customers, Walmart also began a campaign to work directly with its suppliers to standardize date labels on the packaging of all of its privately branded products to provide clear and consistent information to customers. As an early adopter of date label standardization, Walmart has set a precedent for other retailers and manufacturers to follow.

With several pilots in progress, Walmart provides a signal to the broader retail industry that food waste prevention is a critical step to managing costs and staying competitive in the sector.

5. PACKAGING ADJUSTMENTS

PENETRATION: **LOW**
TIMEFRAME: **MEDIUM TERM**

DIVERSION POTENTIAL: 208K TONS	ECONOMIC VALUE: $715M
Who Benefits: **CONSUMERS (PRIMARILY) AND RETAILERS**	*Who Can Take Action:* **RESEARCHERS, MANUFACTURERS, CONSUMER-FACING BUSINESSES, ENTREPRENEURS**

DEFINITION
Optimizing food packaging size and design to ensure complete consumption by consumers and avoid residual container waste

CHALLENGES
- A large range of packaging sizes and configurations exists, requiring many individual solutions.
- Although easy grab-n-go snack packs are widely available, most other standard packaging has not been changed to minimize waste.
- Large bulk packaging can market lower net unit costs, often encouraging consumers to over purchase in the hopes of achieving net savings.
- Packaging that reduces food waste may have other environmental trade-offs, such as higher net packaging volume or use of materials that are more challenging to recycle.
- Smaller packaging sizes can have unintended consequences by increasing SKUs and inventory needs.

STAKEHOLDER ACTIONS
- Nonprofits, academia, manufacturers, and trade associations can conduct research on packaging configurations and their impact on waste levels.
- Universities and accelerators can launch competitions to identify packaging innovations.
- Manufacturers and other food businesses can support entrepreneurs as pilot customers.

EXAMPLES
- In the U.K., bread was identified as one of the most thrown away items. In response, manufacturer Kingsmill recently introduced the "Little Big Loaf" to decrease the amount of bread wasted.[20]
- MIT engineers developed LiquiGlide, a nontoxic food packaging coating that increases the consumer's ability to get all of the food out of containers like ketchup bottles.[21]

6. SMALLER PLATES

PENETRATION: **MEDIUM-HIGH**
TIMEFRAME: **NEAR TERM**

DIVERSION POTENTIAL: 178K TONS	ECONOMIC VALUE: $382M
Who Benefits: **FOODSERVICE, INSTITUTIONS, RESTAURANTS**	*Who Can Take Action:* **FOODSERVICE, INSTITUTIONS, RESTAURANTS**

DEFINITION
Providing consumers with smaller plates in self-serve, all-you-can-eat dining settings to reduce consumer waste

CHALLENGES
- There are upfront switching costs needed to purchase new plates.
- It is uncertain whether smaller plates impact customer satisfaction by requiring more frequent trips for refills.

STAKEHOLDER ACTIONS
- Nonprofits and academia can study the brand impact of smaller plates to address concerns about negative impacts on customer loyalty.
- Businesses can experiment with alternative plate sizes to gauge consumer reaction and measure business impacts.
- Corporate financing is needed to implement across entire organizations.

EXAMPLES
- Cornell Professor Brian Wansink's research on food psychology found that consumers given larger bowls took (and consumed) 16% more cereal than those with smaller bowls. Consumers generally find a 70% fill rate to be "visually pleasing," so smaller plates reduce the amount of food consumers serve themselves.[22]

7. SECONDARY RESELLERS

PENETRATION: **MEDIUM-HIGH**
TIMEFRAME: **MEDIUM TERM**

DIVERSION POTENTIAL: 167K TONS	ECONOMIC VALUE: $37M
Who Benefits: **RETAILERS, CONSUMERS**	*Who Can Take Action:* **RETAILERS, NONPROFITS**

DEFINITION

Businesses that purchase unwanted processed food and produce direct from manufacturers/ distributors for discounted retail sale to consumers

CHALLENGES

- Businesses benefit from reliable product procurement and must understand trends in manufacturing and distribution to anticipate changes in market supply.
- Discount grocery stores have low margins and require efficient operations to achieve a profit.
- The buildout of a retail store and initial losses during the first year of launch typically require a multi-million dollar investment per store.

STAKEHOLDER ACTIONS

- Stores can scale slowly to improve their understanding of consumer demand and local needs to identify how to efficiently grow.
- Government and foundation loans can help secondary resellers expand to lower-income neighborhoods with less access to fresh foods thus helping to address higher food insecurity; nonprofits can lend expertise in analyzing these regions.

EXAMPLES

- Grocery Outlet's 225 retail stores, based primarily on the West Coast, work with manufacturers to understand their particular waste issues (the top reason is short-coded products near expiration) and come up with a custom distribution path.[23]
- Daily Table, located in Dorchester, Mass., is a not-for-profit retail store offering fresh, healthy "grab-n-go" meals and other grocery items at a bargain prices. These deals are available because Daily Table works closely with a large network of growers, supermarkets, manufacturers, and other suppliers who donate their excess healthy food and provide special buying opportunities.

8. TRAYLESS DINING

PENETRATION: **MEDIUM-HIGH**
TIMEFRAME: **NEAR TERM**

DIVERSION POTENTIAL: 83K TONS	ECONOMIC VALUE: $187M
Who Benefits: **FOODSERVICE, RESTAURANTS**	*Who Can Take Action:* **FOODSERVICE AND INSTITUTIONS, RESTAURANTS, STUDENTS, NONPROFITS**

DEFINITION

Eliminating tray dining in all-you-can-eat dining establishments to reduce consumer waste

CHALLENGES

- Retrofits to tray and plate returns are often needed if consumers are required to walk far distances or climb stairs while balancing plates. These can cost $10,000 to $25,000 per facility, but many institutions lack upfront capital to pay for them.
- Because trayless dining has been widely adopted by larger facilities, the remaining opportunity requires change within smaller facilities or those more resistant to change, including 10% of self-serve buffet restaurants and 40% of cafeterias and dining halls.

STAKEHOLDER ACTIONS

- Education to consumers must be paired with any switch to trayless dining to reduce consumer complaints about the switch.
- Foodservice companies can develop a loan fund, similar to revolving energy efficiency loan funds, to help pay for the upfront costs from institutions; loans will be repaid through cost savings.
- Student campaigns at universities can ask foodservice managers to remove trays from dining halls to promote the benefits of food waste reduction.

EXAMPLES

- University of Massachusetts Amherst dining halls removed trays from all dining halls in 2009 and reduced post-consumer food waste by 30%.[24]

9. SPOILAGE PREVENTION PACKAGING

PENETRATION: **PILOT**
TIMEFRAME: **MEDIUM TERM**

DIVERSION POTENTIAL: 72K TONS	ECONOMIC VALUE: $167M
Who Benefits: **CONSUMERS (PRIMARILY) AND RETAILERS**	*Who Can Take Action:* **CONSUMER-FACING BUSINESSES, ENTREPRENEURS, RESEARCHERS**

DEFINITION

Using active intelligent packaging to prolong product freshness and slow down spoilage of perishable fruit and meat

CHALLENGES

- Enhanced shelf life and the associated reduction in food waste from spoilage prevention packaging is highly variable for each food type. To prove that the impact is broad, pilots need to be conducted across many product categories.
- Businesses must pay for the product enhancement, but they may not see the direct savings if shelf life is only extended for consumers.
- The extent to which consumers will pay more for products with longer shelf life is untested, which may require the extra cost to be borne by the retailer.

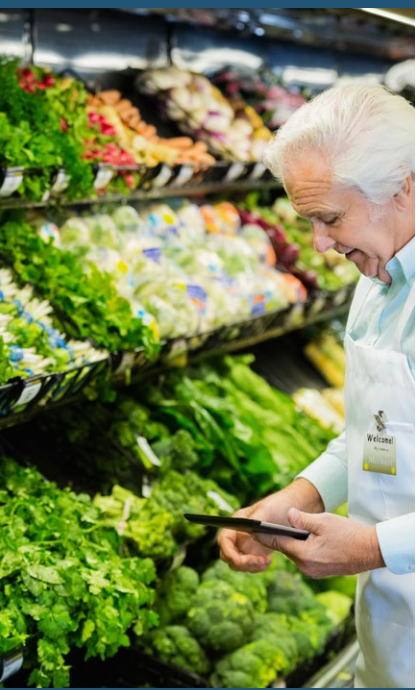
STAKEHOLDER ACTIONS

- Retailers and manufacturers can use pilots to test consumer willingness to pay higher prices for this packaging along with the cost benefits from extended shelf life.
- Investors can fund technology innovators to bring down costs and invest in consumer marketing to spur demand.

EXAMPLES

- It's Fresh! uses an ethylene-removal technology that can be inserted during packaging of produce to help extend the shelf life. [25]
- BluWrap uses a controlled atmosphere technology solution to reduce oxygen in protein packages during transit to extend shelf life.[26]

10. IMPROVED INVENTORY MANAGEMENT



PENETRATION: **MEDIUM-HIGH**
TIMEFRAME: **NEAR TERM**

DIVERSION POTENTIAL: 59K TONS	ECONOMIC VALUE: $71M
Who Benefits: **RETAILERS**	*Who Can Take Action:* **RETAILERS, ENTREPRENEURS**

DEFINITION

Improvements in the ability of retail inventory management systems to track an average product's remaining shelf-life (time left to sell an item) and inform efforts to reduce days on hand (how long an item has gone unsold)

CHALLENGES

- Current systems are optimized for minimizing stock-outs, not measuring and managing food waste. Therefore, managers optimize to ensure food is left over on the shelf.
- Although larger retailers and national chains typically use inventory management systems, it has not been seen as cost-effective among smaller retailers.

STAKEHOLDER ACTIONS

- Retailers can increase the effectiveness of inventory management systems by adding data on food donation levels as well as the quantity of any food waste and reasons for being disposed.
- Retailers can use inventory systems to help set corporate and individual buyer and store manager goals to reduce waste levels.
- Retailers can develop better forecasting and share the data transparently throughout the supply chain to better match supply and demand.

EXAMPLES

- Applied Data Corporation uses enhanced analytics to manage the stages of fresh food items for grocery and supermarkets throughout their life cycle, from ingredients ordering to display management and decision-making.[27]

11. MANUFACTURING LINE OPTIMIZATION

PENETRATION: **MEDIUM-HIGH**
TIMEFRAME: **NEAR TERM**

DIVERSION POTENTIAL: 20K TONS	ECONOMIC VALUE: $35M
Who Benefits: **MANUFACTURERS**	*Who Can Take Action:* **MANUFACTURERS**

DEFINITION

Targeting systemic and sporadic waste generation by optimizing equipment operating conditions (e.g. determining the most efficient run settings), addressing production line design flaws, modifying production schedules to minimize changeovers, and identifying novel ways to repurpose discarded food for sale

CHALLENGES

- Each plant and product line is unique with different opportunities for waste reduction, leading to difficulties identifying widespread solutions.
- Many of the most obvious waste prevention opportunities have already been implemented as cost-savings initiatives.

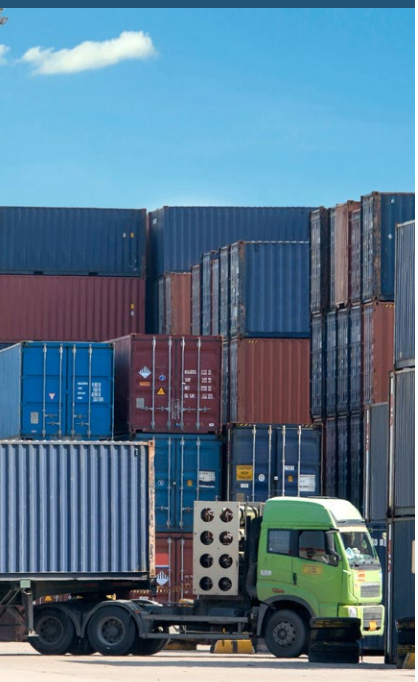
STAKEHOLDER ACTIONS

- Internal action teams can identify waste reduction opportunities, including holding competitions among facilities that incentivize workers to reduce waste.
- Employers can enhance existing worker training programs to include a food waste identification component and develop programs to reward proactive employee behavior.

EXAMPLES

- ConAgra changed the way it transitioned between pudding flavors to create blended flavors that could be sold at a lower value.[28]

12. COLD CHAIN MANAGEMENT



PENETRATION: **MEDIUM-HIGH**
TIMEFRAME: **MEDIUM TERM**

DIVERSION POTENTIAL: 18K TONS	ECONOMIC VALUE: $32M
Who Benefits: **RETAILERS**	*Who Can Take Action:* **DISTRIBUTORS, RETAILERS, NONPROFITS**

DEFINITION

Reducing product loss during shipment to retail distribution centers by using direct shipments and cold-chain-certified carriers

CHALLENGES

- The food logistics industry is highly fragmented.
- Retailers lack a financial incentive to act since they typically can pass the cost of rejected food as a loss back to the shipper or supplier.
- Smaller suppliers and distributors are motivated to reduce losses but lack the scale, financial capacity, and time to implement new practices.

STAKEHOLDER ACTIONS

- Retailers and manufacturers can develop performance standards.
- Large retailers can create demand for better cold chain practices among the fragmented logistics industry by using their buying power to encourage suppliers to change practices.
- Academic studies can analyze the business case for how point-to-point food shipments minimize temperature-related losses during transit.
- Nonprofits or industry players can develop a cold chain certification system that outlines best practices and holds businesses accountable for avoiding preventable waste.

EXAMPLES

- Tesco increased the shelf life of several fruits and vegetables by two days by cutting their time in transit through direct shipments from suppliers to stores.[29]
- The Global Food Safety Initiative is a new certification system example that includes cold chain management practices.