

Oregon DEQ Strategic Plan for Preventing the Wasting of Food

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Materials Management

700 NE Multnomah St.
Suite 600
Portland, OR 97232
Phone: 503-229-5696
800-452-4011
Fax: 503-229-5850
Contact:
www.oregon.gov/DEQ

DEQ is a leader in restoring, maintaining and enhancing the quality of Oregon's air, land and water.



State of Oregon
Department of
Environmental
Quality

This report prepared by:

Oregon Department of Environmental Quality
700 NE Multnomah Street, Suite 600
Portland, OR 97232
1-800-452-4011
www.oregon.gov/deq

Contact:
Elaine Blatt
503-229-6492

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Introduction

This Strategic Plan outlines a framework to direct the Oregon Department of Environmental Quality’s work over a five-year period to encourage reductions in the wasting of food across the supply chain to support *Materials Management in Oregon: 2050 Vision and Framework for Action*.¹

***Oregonians in 2050 produce and use materials responsibly
conserving resources • protecting the environment • living well***

Drawing on an eight-month long evaluation of the current landscape around preventing the wasting of food and an assessment of more than 80 potential projects, DEQ has identified nine projects that it believes will both “change the current conversation” around preventing the wasting of food and make significant, measurable contributions to the State’s waste reduction goals.

1. Background

Implementing Oregon’s *2050 Vision and Framework for Action* requires a transition from policies and programs designed primarily to minimize the impacts of solid waste, to materials management² policies

“Food waste” or “wasted food”?

Historically, the problem of food waste has been understood as a matter of acceptable disposal (often focused on diversion from landfills) rather than a problem of wasted resources and wasted nutrients. In this strategy, the term, “wasted food,” will be used in lieu of “food waste” because using “waste” as a verb calls attention to the act of discarding a valuable resource – food – in contrast to the noun, “food waste,” which tends to focus attention on disposal solutions.

and programs that seek to minimize impacts and conserve resources across the full life cycle of materials. This materials management approach prioritizes actions that allow for a more “upstream” focus on solutions that can result in better environmental outcomes.

From an environmental impact perspective, food is one of the most significant materials, and an estimated 25 to 40 percent of all food produced or imported for consumption in the United States is never eaten.³ Both the *2050 Vision* and the Oregon Global Warming Commission’s *Interim Roadmap to 2020*⁴ identify wasted food prevention as a priority for Oregon because of the combined environmental burdens of food production, distribution, refrigeration, preparation, and final disposal. Note that DEQ specifically distinguishes “prevention” (avoiding the

¹ Oregon’s 2050 Vision can be found at

<http://www.deq.state.or.us/lq/pubs/docs/sw/2050vision/MaterialsManagementinOregon.pdf>

² Materials management refers to minimizing the impacts and maximizing the value of products and materials, including food, across the full life cycle, from production through distribution, consumption, use and disposal, or recycling and reuse.

³ Venkat, 2011 and Hall, 2009

⁴ Available at:

https://www.oregon.gov/energy/GBLWRM/docs/Integrated_OGWC_Interim_Roadmap_to_2020.pdf

wasting of food in the first place) from “donation” or “rescue” (redistributing edible food that would otherwise go unharvested or be discarded) and “recovery” (managing discarded food, for example through composting).

When it comes to wasted food in the U.S.:

- Up to 40 percent of the food grown or imported for consumption is ultimately never eaten;⁵
- Approximately 1.3 percent of GDP, or \$218 billion, is spent growing, processing distributing, preparing food that is never eaten;⁶
- 25 percent of the fresh water supply in the US is used to produce food that is never eaten;⁷
- 2 percent of energy use in the US is dedicated to growing, manufacturing, transporting, refrigerating, and cooking food that is never eaten – or enough electricity to power 54 million homes for a year.⁸
- The average American consumer now wastes over 50 percent more food than the average American did in the 1970s,⁹ and nearly three-quarters of them think they waste less food than the average household.¹⁰
- One in seven people living in the US is food insecure.¹¹

Reversing these trends will require a long-term effort based on a better understanding of the roots of the problem, and effective means to change behavior.

A “State” of Wasted Food

[I]f all of our country’s wasted food was grown in one place, this mega-farm would cover roughly 80 million acres, over three-quarters of the state of California. Growing the food on this wasteful farm would consume all the water used in California, Texas, and Ohio combined. The farm would harvest enough food to fill a 40-ton tractor [trailer] every 20 seconds.

Many of those trailers would travel thousands of miles, distributing food to be kept cold in refrigerators and grocery stores for weeks. But instead of being purchased, prepared, and eaten, this perfectly good food would be loaded onto another line of trucks and hauled to a landfill, where it would emit a harmful stream of greenhouse gases as it decomposes. (*ReFED, 2015, p. 10*)

2. Changing the Conversation

With this strategic plan and its attention to the issue of wasted food, DEQ aims to “change the conversation” around this issue, from a focus on management of food waste, to a greater focus on preventing the generation of wasted food across the food supply chain.

2.1 Current conversation

In recent years, the wasting of food has featured prominently in public discourse. Showcased on the cover of *National Geographic*, highlighted by Pope Francis, and the subject of movies, international conferences and numerous news articles, the wasting of food has been widely discussed in both business and government circles as well as civil society. However, much of the response to the wasting of food has focused on waste management solutions, especially those designed to divert organic waste from landfills through composting or anaerobic digestion. The impacts of wasted food disposal are well documented

⁵ Hall, 2009

⁶ ReFED, 2015

⁷ Hall, 2009

⁸ Cuellar, 2010

⁹ Hall, 2009

¹⁰ Busby, 2014 and Neff, 2015

¹¹ Coleman-Jensen, et. al., 2016

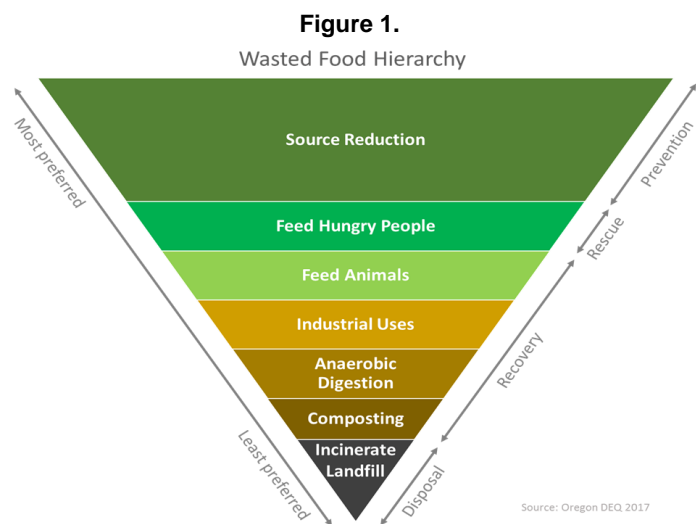
and have been highlighted by solid waste agencies as a significant cause for concern. As a result, these organizations develop policies and goals that emphasize keeping organic material out of landfills and incinerators by diverting it, either to compost, where its nutrient value can be recycled back into food production, or to anaerobic digestion, where, in addition to nutrient recovery, its remaining value can be realized in energy generation. While these efforts to keep organic material and food out of landfills are commendable, diversion goals have also, in many cases, inadvertently narrowed attention to technological recovery solutions as the primary answer to the problem of wasted food. Where attention is also paid to more “upstream” responses, efforts have largely focused on “rescue” of edible food for redistribution to food insecure populations (i.e. hunger relief). DEQ agrees that feeding hungry people is an important and valuable objective, but treating food “rescue” as a wasted food management solution can lead to less desirable outcomes, such as diversion of low-nutrient quality food (e.g., leftover French fries or cupcakes) to food banks and pantries, or inefficient redistribution efforts, such as picking up and transporting relatively small quantities of edible food for redistribution to food insecure populations at high per-pound costs.¹²

The focus on wasted food through the lens of solid waste management is about recovering as much value as possible from a material in its end of life phase. As a result, success (and therefore public benefit) is defined as diverting as many materials from landfills as possible for beneficial use, and not as reducing the amount of waste generated and conserving resources in the first place. This solid waste legacy is the result of a long history of waste management that started well before much was known about the lifecycle impacts of products and food.

2.2 What’s missing from this conversation?

What is largely missing from the traditional response to wasted food is a full consideration of the upstream environmental impacts embedded in that lost food and attention to a hierarchy that gives clear preference to source reduction over other options (see Figure 1). In other words, what is missing is consideration of food as a valued material, and therefore the wasting of food, from a materials management viewpoint.

To illustrate why using a materials management approach matters, take the example of a hothouse tomato. The life cycle impacts associated with production of this tomato might first include the fertilizer, pesticides, water, energy, heating equipment, and fuel required to nourish and grow the tomato in a greenhouse. Additional impacts would be generated at harvest and packing (so long as the tomato meets appropriate aesthetic standards – if not, it might never make it beyond the farm gate).¹³ Then, still more impacts would be generated in the form of the energy and fuel required to store, transport and ripen the tomato before distribution to markets.



¹² The issue of “rescue” will be addressed in further detail in Project 6 below.

¹³ So-called “ugly” produce is either not harvested, sold to alternative markets (i.e., juice or soup), sold for animal feed, or, donated to food banks and other organizations that help feed food insecure people. There is a growing movement to encourage consumers to buy (and retailers to offer) produce that is less than aesthetically perfect.

Finally, there are the impacts generated by the retail environment in which the tomato is sold and ultimately, home use. Unfortunately, data show that even after all the resources used and environmental impacts incurred to produce that hothouse tomato, there is still a nearly one in four chance that once purchased, that tomato will not be eaten.¹⁴ Its fate, at best, may be discard for composting or animal feed, or worse, disposal in a landfill.

Most of the life cycle impacts described above are “out of sight and out of mind” for most people. The most significant impacts of wasted food lie in what the consumer doesn't see, because the upstream consequences related to wasted food are largely invisible to the public relative to the more visible impacts of packaging and disposal at end-of-life. These upstream impacts exact both environmental and economic costs, costs that are significantly reduced by preventing wasting of food in the first place. Preventing one ton of food from being wasted, for example, results in 6 times larger lifecycle greenhouse gas (GHG) benefits, on average, than recycling one ton of food through composting. Compared with anaerobically digesting one ton of food, prevention results in 7 times larger GHG benefits (see Figure 3 and Appendix A).¹⁵ The economic benefits of reducing wasted food are equally important – one source estimates the economic value of a ton of unsold food at about \$5000 on average, as compared with the \$100 per ton disposal fee to compost it.¹⁶ Preventing the wasting of food therefore provides the greatest potential for cost savings and environmental benefits relative to approaches in the traditional wasted food hierarchy (on a ton for ton basis).

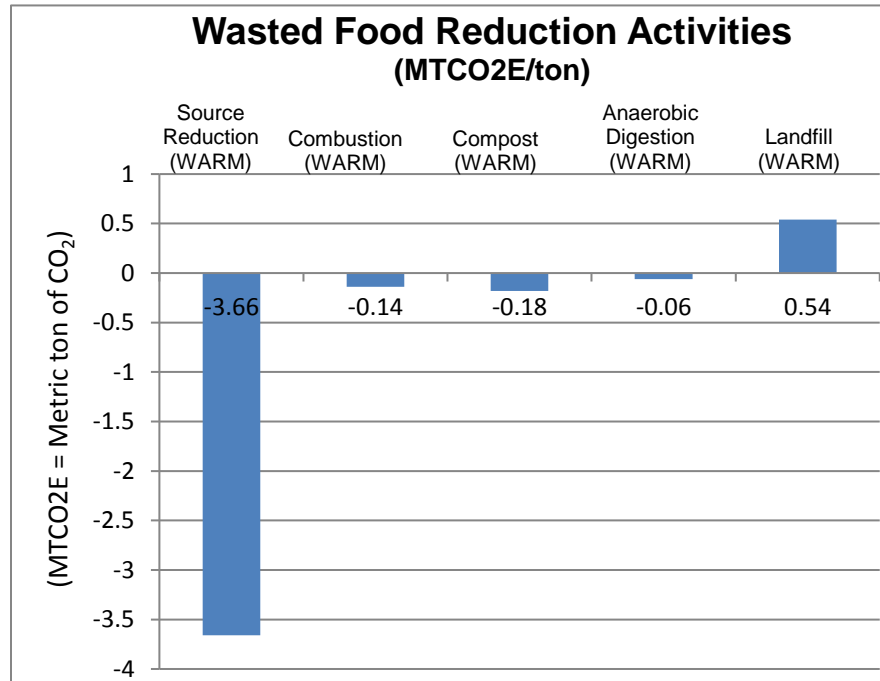


Figure 3: Average lifecycle impacts (CO2E/lb of food) from food waste reduction activities from US EPA Waste Reduction Model (WARM) background data

2.3 Where do we need to be?

If governments, academic institutions, and entrepreneurs achieved more balance between solid waste recovery (recycling) AND efforts to drive more sustainable patterns of production and consumption through source reduction, communities could waste less and feed more people without the need to convert

¹⁴ Buzby, Wells, and Hyman, 2014.

¹⁵US EPA, February 2016. EPA analyses summarized in Figure 3 illustrate that aerobic composting (-0.18 MTCO2e/MT) results in lower life cycle greenhouse gas emissions than anaerobic digestion (-0.06 MTCO2e/MT). A separate analysis commissioned by DEQ (Morris et. al.) comes to an opposite conclusion: anaerobic digestion (-0.17 MTCO2e/MT) has a lower carbon footprint than aerobic composting (-0.05 MTCO2e/MT). While these two sources draw different conclusions regarding the relative benefits of anaerobic digestion and aerobic composting of food waste, their general benefits are still small when compared to EPA's estimate of source reduction.

¹⁶ ReFED, p 21.

new lands into cultivation for the production of food. There is significant opportunity to rethink existing systems and approaches. However, because some choices depend, in part, on the way in which problems are stated, these sustainable production and consumption opportunities are overlooked when reducing wasted food is framed simply as conserving landfill space or reducing landfill methane generation. Therefore, while “source reduction” is an expressed priority in the wasted food hierarchy, it is rarely acted on.

Policies that give the impression that wasting food that could have been eaten is acceptable as long as it is composted or anaerobically digested are often not the best economic, environmental, or social solutions to the problem of wasted food, although these methods are clearly appropriate for managing a limited amount of “real” waste, such as trim, bones, and peels. A more appropriate message could be that the best thing to do with food is to eat it or share it, and to pay attention to what food gets discarded, even if it is composted. In many ways, preventing the wasting of food is like energy conservation, where the greenest kilowatt-hour is the one that isn’t used.

As described in the case of a hothouse tomato above, the true environmental cost of wasted food is 8 to 10 times that of disposal due to all of the energy and other resources needed to produce that food and bring it to market across the full lifecycle.¹⁷ As a strategy for reducing greenhouse gasses, downstream solutions like organics recycling and energy recovery do little to address the more than 80 percent of carbon emissions and other environmental impacts associated with producing the food.¹⁸ A materials management approach considers more than what to do with a tomato that is past its prime – it focuses on data-driven approaches and innovative solutions to minimizing impacts across the full life cycle including resource consumption, product use, and disposal or recovery.

Is preventing the wasting of food bad for agriculture?

Superficially, it would seem reasonable to conclude that if Oregonians are successful in wasting less food, they will reduce the amount of food they buy, which could have an adverse impact on Oregon farm incomes. This question, however, is more complicated than that. Oregon farmers, in total, export much of what they grow; most Oregon farm production is sold outside the state. Also, Oregon consumers are net importers of food, so most food consumed in Oregon comes from outside the state. Consequently, any reduced demand for food in Oregon resulting from reduced wasting of food is likely to have limited impact on Oregon farmers. Furthermore, rising populations and rising incomes in many parts of the world mean that overall demand for food is rising. Reducing the wasting of food is likely, therefore, mainly to slow the growth of agricultural production, and perhaps prevent farming on marginal lands where environmental impacts may be even higher, due to land conversion (e.g., tropical deforestation) and increased need for fertilizer, pesticides and irrigation on these lands.

2.4 How do we get there?

As part of its materials management approach, DEQ is working to achieve significant environmental benefits across the entire lifecycle of materials, which requires policy tools and framing beyond reducing disposal as well as different strategies to visualize and then minimize the currently hidden impacts of foods and other materials. This strategy aims to put the building blocks in place to develop new business cases and other tools that help achieve Oregon’s *2050 Vision*.

¹⁷ Hall, 2009

¹⁸ US EPA, WARM Version 14

3. DEQ History

While the development of the *2050 Vision* and the associated shift to a materials management focus has elevated the importance of preventing the wasting of food, DEQ's interest in wasted food and prevention is long standing.

Senate Bill 405 (1983) established a hierarchy of preferred methods for solid waste management, with prevention identified as the top-most priority. Despite the preference given to prevention over recovery, waste recovery (and disposal) was the primary focus of DEQ's Solid Waste Program throughout the 1980s and 1990s. However, a few projects addressed prevention, including two with a focus on food:

- A pilot project tested whether an “offer vs. serve” program could reduce wasting of food in schools. This pilot, implemented in three Washington County school cafeterias in 1994, generated a reduction of student wasted food by up to 47 percent. While the project was funded by Metro, DEQ provided technical assistance and also worked with the Oregon Department of Education to promote the results to other schools across the state. This project successfully connected nutrition with wasted food interventions and highlighted future opportunities for solid waste and environmental agencies to collaborate with public health agencies.
- A separate pilot project, conducted between 1998 and 2000, in partnership with the Oregon Grocery Industry Association, studied grocery shrink in six small to medium sized grocery stores in Yamhill County. This pilot was part of a larger “Resource Efficient Cities” program that DEQ supported in five communities across the state. “Grocery shrink” is an industry term that refers to unsold goods intended for sale. The study concluded that, “only under certain, and somewhat infrequent, circumstances is it worthwhile to provide an outside ‘shrink management’ service to independent, small- and medium-sized grocery stores. Circumstances that increase the potential for success include lack of existing shrink management . . . , purchasing and sales data that are readily available, and a willingness by store management to work with an outside service provider, track shrink, and make changes.” DEQ plans to build upon this study with participating grocers in 2017.

In 1992, DEQ had started a solid waste recycling and planning grants program, and initially, most of these grants went to planning, recycling, and composting projects. In 2000, the Environmental Quality Commission adopted rules allowing DEQ to give priority in grants selection to projects intended to achieve specific environmental objectives.

Between 2000 and 2008, DEQ identified waste prevention and reuse as grant “focus areas.” This shifted the portfolio of solid waste grants toward prevention and reuse projects, and DEQ funded a number of projects related to edible food donation and rescue. From 2000-2008, DEQ provided 17 food rescue grants to help address food insecurity. During that time, Oregon had some of the highest rates of food insecurity in the nation and these grants helped address that need while at the same time rescuing otherwise edible food from decomposing in landfills. DEQ also awarded a grant to support efforts at Intel's corporate cafeteria in 2009 – 2010 that achieved a 47 percent reduction in pre-consumer wasted food through daily wasted food tracking. This project also demonstrated the large environmental benefits of preventing wasted food relative to recovery.

This shift to prevention and reuse was driven in part by growing awareness of the significant environmental impacts of materials “upstream” of disposal, and the associated importance of prevention

and reuse. Also in 2001, responding to increases in per-capita and total waste generation through the 1990s, the Oregon Legislature adopted a set of statutory waste generation goals for Oregon, in parallel to the state's waste recovery goals. (Generation is the sum of materials recovered and disposed; reducing waste generation is only accomplished through the “reduce” and “reuse” elements of “reduce, reuse, recycle.”)

By 2004, waste prevention was getting still more attention at DEQ, after a lifecycle assessment of e-commerce highlighted the significant potential environmental benefits of waste prevention, and Governor Kulongoski's *Advisory Group on Global Warming* focused on opportunities to mitigate greenhouse gases through waste prevention. The importance of prevention was also echoed in the Oregon Global Warming Commission's 2010 “Roadmap to 2020,” which built upon the 2004 analysis for Governor Kulongoski's Advisory Group. A follow-up analysis in 2012 of roughly 300 different greenhouse gas mitigation options commissioned by the Oregon Department of Energy found that waste prevention (broadly defined, including but not limited to food) offered very large greenhouse gas reduction potential and ranked in the top five percent of mitigation options for its cost effectiveness.¹⁹

In 2011, DEQ published Oregon's first consumption-based greenhouse gas emissions inventory. The first such inventory undertaken at a sub-national level in the U.S., the consumption-based inventory estimates the life-cycle greenhouse gas emissions, everywhere in the world, associated with satisfying consumption by Oregonians. Among the findings of this inventory was that food, as a major category of consumption, was the third largest driver of consumption-based emissions (after vehicles and appliances), and that the life-cycle emissions of food upstream of the consumer (in production) were almost 30 times larger than the emissions resulting from food disposal.²⁰

Building on these pilot projects, research efforts, legislative advances, and other activities, in 2011 and 2012 DEQ worked with a broad group of external stakeholders to develop *Materials Management in Oregon: 2050 Vision and Framework for Action*. Adopted by the Environmental Quality Commission in 2012, the *2050 Vision* formally launched DEQ's transition from a solid waste to a materials management program. Legislation in 2015 (Senate Bills 245 and 263) further advance this transition, the success of which is dependent on long-term strategic thinking, and collaboration between public, private and non-profit sectors to ultimately adopt more holistic approaches to address the massive opportunities and challenges of sustainable materials management, including ending wasted food and wasted resources in the US.

4. Goals for Preventing the Wasting of Food

With this Strategic Plan, DEQ is establishing three goals specific to preventing the wasting of food. Reaching these goals, which are aligned with Oregon's *2050 Vision*, will allow for new ways to look at wasted food issues more systemically. “Success” will be achieved by connecting these goals with actual ecological benefits and building more robust communities of practice that focus on waste prevention.

- **Develop the state of knowledge and building blocks to help reduce wasted food** in Oregon, and elsewhere, in the most cost-effective and environmentally beneficial manner.
- **Increase business and consumer actions to prevent wasted food**, consistent with the Oregon's *2050 Vision*.
- **Reduce GHG emissions, water use, energy use and wasted resources by reducing the generation of wasted uneaten food** by 15 percent by 2025 and 40 percent by 2050.

¹⁹ The Center for Climate Strategies, 2012.

²⁰ Stockholm Environment Institute, 2011

The goals of DEQ's strategy to prevent the wasting of food are directly tied to capacity building in Oregon, and elsewhere, though increased action at the business and consumer level, and goals to reduce the generation of wasted food, not just divert it from landfills. The third goal, which aims for a 15 percent reduction in the generation of wasted food by 2025 and 40 percent below 2012 levels by the year 2050, is aligned with Oregon's waste generation goals, updated in 2015 as part of Senate Bill 263.²¹ The passage of Senate Bill 263 not only modernizes Oregon's recycling laws but provides a solid foundation to realizing Oregon's *2050 Vision* through waste prevention and reuse of high impact materials.

To meet the three strategic goals outlined above, DEQ will implement a series of projects (see the Priority Activities section below) that also serve as building blocks for Oregon's *2050 Vision and Framework for Action* and for larger initiatives addressing sustainable production and consumption of materials. Anticipated project outcomes will result in significant environmental, economic, and social benefits, as well as shine a light on trade-offs between weak and strong sustainability solutions across and within the wasted food hierarchy. Weak prevention actions focus on improving efficiency, neglecting rebound effects²² and long term risks, while strong prevention actions acknowledge overall resource limitations and more sustainable patterns of consumption and production.²³

What is "generation" of wasted food?

People unfamiliar with Oregon's use of terminology are often confused by the term "waste generation." Oregon defines generation in a manner similar to the US EPA: the sum of all materials discarded either for disposal (such as in landfills) or recovery (such as for composting). Put simply, waste prevention and reuse, along with edible food rescue and home composting, reduce waste generation (given that Oregon doesn't count edible food rescue as part of recovery). Waste generation includes but is not the same as disposal. Recovery programs such as industrial composting or anaerobic digestion reduce disposal, but not generation. Oregon has separate statutory goals for both waste recovery and waste generation. Oregon's statutory goals for waste generation are not landfill reduction goals, but rather goals to shrink the amount of materials wasted and discarded in the first place.

5. Strategic Planning Process

A project team composed of six Materials Management staff has worked for several months to review and analyze potential projects that DEQ could implement to reduce the wasting of food over the next five years. The group started with a list in excess of 80 project ideas and has culled that list to the nine projects described below.

Before assessing these potential projects ideas, the team studied the current landscape surrounding the preventing of wasted food to gain an understanding of past and current efforts (particularly important, as many stakeholders are, and have been, engaged in addressing food waste issues), the current state of knowledge of the nature and scope of the problem, and gaps in knowledge or experience that DEQ activity could potentially fill.

²¹ Waste generation as defined in Oregon is only reduced through the "reduce" and "reuse" elements of the waste management hierarchy. Waste recovery (composting, anaerobic digestion) does not reduce waste generation, but simply shifts generated wastes from disposal to recovery. In addition to updating Oregon's waste generation goals, Senate Bill 263 also created a separate waste recovery goal specific to food waste: 25 percent recovery by 2020.

²² The "rebound effect" occurs when a consumer engages in a behavior that saves money, but then uses the savings in some other manner, with resulting environmental (and economic) impacts that may more than offset any environmental benefit gained from the initial behavior change.

²³ Mourad, 2016

The team then developed a set of selection criteria, through which potential projects were filtered. These criteria included:

- The project has the potential for significant environmental benefits (GHG reduction, water conservation, energy conservation, etc.).
- The project represents a cost-effective alignment of resources and support.
 - ✓ DEQ has the expertise and resources needed.
 - ✓ There is a high level of support from external stakeholders.
- The project draws on DEQ's core competencies.
- There is a unique, value-added role for DEQ that supports sustainable consumption more broadly.
 - ✓ This project addresses a research, funding, or regulatory gap or serves as a proof of concept.
 - ✓ This project provides a foundation for other sustainable consumption work.
- The project aligns with DEQ's statutory goals and *2050 Vision and Framework for Action*.
- The project offers an opportunity for collaborative and/or capacity building action.
- The action taken in the project can drive transformational change, i.e., the action will lead to a mindset or structural shift.
- The project allows for measurement of outcomes, to the extent possible.

In summary, DEQ focused on selecting projects that would fill important current knowledge gaps, begin progress towards achieving Oregon's 2050 Vision, and lay the foundation for future efforts.

6. Priority Activities

Nine projects have been identified as priorities for the next five years and are described below. The descriptions include a general timeframe for accomplishing the work, as well as a listing of potential collaborators for each project. The identification of collaborators is critical to DEQ's thinking about efforts around the wasting of food—the issues involved are complex and long-standing; realistic interventions will, of necessity, involve a wide range of actors, both inside and outside the state. A table summarizing the projects and showing their relationship to the Strategic Plan's goals, is provided at the end of this section.

6.1 Wasted Food Measurement Study (Project 1)

As noted above, it is estimated that somewhere between 25 and 40 percent of food produced in the United States is never eaten.²⁴ However, comparatively little is known about the composition of this waste – what percentage is trim, what percentage is spoiled leftovers, what percentage is food that would otherwise still be edible. Similarly, little is known about loss reasons – is the wastage due to inadequate menu planning, lack of food storage knowledge, overproduction for a buffet (in the case of commercial kitchens), forgotten leftovers, lack of cooking and efficient knife skills, structural barriers as a result of packaging or merchandising, or other causes? A better understanding of what food is wasted, in what quantities, and loss reasons for wasted food would help provide a foundation for developing more effective approaches to reducing the wasting of food. Many current actions are based largely on unvalidated assumptions without a complete understanding of the root sources of the complex problem of wasted food and potential long term solutions. Reasons for this complexity include:

²⁴ Buzby, Wells, and Hyman, 2014 and Hall, 2009.

1. “[F]ood waste is the result of multiple, interacting activities and this leads to separation between the activity and their consequences.”²⁵ For example, chefs or home cooks often prepare food that someone else cleans up. This could help explain why 73 percent of Americans think they waste less than the average household.²⁶
2. Some factors leading to wasted food are largely outside of people’s control, such as food prices and packaging, work patterns, family structure, or household traditions.
3. Behaviors in the home or commercial kitchen tend to be habitual and often include an emotional component. For example, the Ad Council found that striving to nourish families or be perceived as good hosts who provide more than enough food (and different types of food) leads to unintentional waste.
4. Behaviors in home and commercial kitchens are less visible to others, including neighbors or customers, which means norms around managing waste are also less visible compared to activities like composting or recycling.

The Natural Resources Defense Council (NRDC) initiated work in the fall of 2016 in Nashville, Denver, and New York to try to answer fundamental questions about what is being thrown away by households, and to try to identify waste from commercial and institutional kitchens that could have been donated.

This project will build on and expand the work initiated by the NRDC by conducting similar research in Oregon. In addition to characterizing wasted food and highlighting loss reasons, the Oregon study will include qualitative and quantitative surveys of attitudes and waste prevention practices, as well as look more deeply into industrial, commercial and institutional (ICI) wasted food. The study is intended to:

- Provide an understanding of the drivers (informational, psychological, social, economic, structural) leading to preventable wasted food;
- Develop baseline data on wasted edible food, quantities and reporting biases (this baseline could be used for evaluation purposes in the future);
- Develop business cases on the benefits of best practices²⁷ to prevent the wasting of food for businesses and institutions that serve or sell food; and
- Provide state and local governments with protocols and reliable methods for assessing progress in waste prevention and test interventions worth trying.

The study will be conducted using qualitative interviews and a baseline telephone survey of Oregon households, intensive “waste diaries” and residential waste sorts for a sample of Oregon households, and baseline data gathering and evaluation of the cost savings and environmental benefits of prevention actions and interventions in a convenience sample²⁸ of food-related businesses in Oregon. This foundational research will fill a gap in understanding the root causes and nature of wasted food generation and will help inform nearly all other proposed activities in this strategic plan.

²⁵ Quested, October 2013

²⁶ Neff, 2015

²⁷ These case studies will inform development of commercial best practices, discussed below (Commercial Sector, Project 5).

²⁸ Convenience sampling uses a readily sample group, rather than a probabilistic sampling method, in which every member of a population has a chance of being selected for a study.

Potential collaborators: Portland State University, NRDC, Food Waste Reduction Alliance members, University of California Berkeley, West Coast Climate and Materials Management Forum Measurement Workgroup, National Academies of Sciences, Environmental Protection Agency.

Timeframe: Begin late in 2016, fully completed by mid-2018.

6.2 Messaging (Project 2)

There is increasing interest in preventing wasted food in the US, and some development and implementation of messaging and associated campaigns intended to encourage consumers to reduce their wasting of food. Much of this messaging has been developed through limited qualitative research and message testing via focus groups. In addition, there has been some limited academic research²⁹ into consumer attitudes about the wasting of food. In these surveys, respondents tended to overstate their positive behavior and understate their negative behavior. Given the limitations of research to date, there is a need to engage in foundational quantitative research to specifically identify the value-based messaging most likely to drive consumers to take action.

In addition, DEQ needs guidance on how to motivate behaviors to prevent the wasting of food given that the public may already have deeply embedded opinions about effective responses to “food waste.” As noted above, prevention is far superior to recovery (organics recycling). But many Oregonians’ prior experience with food waste recovery programs (home composting, municipal food waste collection programs), coupled with a “solid waste” frame that has commonly been used to communicate about these issues, may be creating a perception or bias that makes it difficult for some to understand or embrace prevention. A recent study by Ohio State University provides evidence for this concern. That study found that the benefits of raising awareness about the impacts of wasted food on the environment (which resulted in cafeteria diners reducing wasted food by 77 percent) largely disappeared when the diners were told their wasted food would be composted.³⁰ Since DEQ supports both wasted food prevention and food waste recovery, while prioritizing the former over the latter, the research goals include developing messaging that does not undermine recovery, where appropriate.

This project is intended to fill an existing research gap by conducting quantitative research and developing a messaging hierarchy that will provide the foundation for wasted food prevention campaigns, developed and directly implemented by both DEQ and other government and non-governmental organizations, to which the research will be made available. Specifically, this messaging project (Project 2a) will involve the following three tasks:

1. Conducting research to identify the messages and language most likely to motivate Oregon residents to reduce wasting of food.
2. Analyzing survey data and developing a messaging hierarchy that can be used to inform the development of campaigns and other outreach material to encourage consumers and businesses to reduce wasting of food.
3. Working with a creative consultant (services to be procured separately) to implement messaging.

Results of the messaging research will be made available throughout the state to assist stakeholders in promoting reductions in avoidable and wasted inedible food scraps, in addition to informing DEQ’s future

²⁹ Neff, 2015 and Qi, 2016 are two recent examples.

³⁰ Qi, 2017

activity. The project includes plans to refresh messaging originally developed after about three years. This work could involve new research to identify changes in motivators that have occurred over time. In addition, the proposed messaging work includes efforts to update DEQ's website (Project 2b) to reflect current Agency knowledge about preventing wasted food (incorporating learning from both the measurement and messaging studies) and maintaining the website over time to reflect new information gathered through the measurement and messaging studies described above.

Potential collaborators: Metro regional government, Oregon local governments, Pacific Northwest Social Marketing Association

Timeframe: Begin early 2017, completed by end of Q2.

6.3 Consumer Outreach (Project 3)

Households account for about 43 percent of all food wasted in the US according to a recent ReFED report that analyzed existing data sets in the US.³¹ Approximately 20 percent of all food purchased through retail channels (both in-home and out-of-home consumption) goes uneaten, which the USDA estimates would cost a family of four about \$1500 per year.³² Changing consumer behavior by encouraging actions that reduce wasting of food is therefore critical to achieving Oregon's goals to reduce waste generation. Improved consumer outreach in the form of campaigns and other efforts is needed not only to motivate consumers to take action, but also to provide consumers with the information and tools they need to act on desires to decrease the wasting of food. This project will build on the messaging research in Project 2, as well as early results from the Measurement Studies described in Project 1, to create campaigns targeting consumers.

Senate Bill 263 (2015), in addition to modernizing Oregon's recycling laws, amended the Opportunity to Recycle Act by adding provisions requiring certain local government jurisdictions to implement waste prevention and reuse programs. These new requirements go into effect on Jan. 1, 2018, under administrative rules adopted to implement SB 263.³³ Among the options local jurisdictions may choose to implement are campaigns targeting consumers that would promote reduced generation of toxic or energy intensive materials. Food qualifies as an energy intensive material; development of consumer campaigns to encourage wasted food reduction will assist local governments in complying with these new requirements.

Campaigns will likely include diverse materials – among them print ads, scripts for radio promotions as well as recorded promotions, website and social media material, and fact sheets with infographics. In addition to the messaging research in Project 2a, DEQ anticipates drawing on existing local government outreach programs and experience



Kids line up at Echo Shaw Elementary School to play the more than a dozen roles needed to get ketchup to the store, including farmer, food scientist and truck driver.

<http://pamplinmedia.com/fgnt/36-news/306315-183590-waste-audit-at-echo-shaw-inspires-students>

³¹ ReFED, p. 13

³² J.C. Buzby et al., "The Value of Retail- and Consumer-Level Fruit and Vegetable Losses in the United States," The Journal of Consumer Affairs, Fall (2011):492-515.

³³ The new provisions can be found at Oregon Administrative Rules, OAR 340-090-0042.

with the [EPA Food Too Good to Waste toolkit](#) to support behavior change and the [Ad Council/NRDC Save the Food awareness campaign](#) as it develops these campaigns for Oregon residents.

In addition to developing consumer campaigns, DEQ also will encourage local Master Recycler programs (Project 3b) to revise curricula to incorporate new messaging and other learnings associated with reducing the wasting of food at its source. This curriculum could build upon existing Master Recycler activities, such as an exercise conducted with school children to help them understand what it takes to get a bottle of ketchup from farm to store and why it doesn't make sense to waste it.

Potential collaborators: A number of local governments have already developed robust campaigns, among them the Cities of Beaverton, Eugene, Gresham, Washington County, Clackamas County and Marion County. Other potential collaborators include Oregon Metro, The West Coast Climate and Materials Management Forum, NRDC, and the operators of Mater Recycler programs across the state. DEQ will also consult with potential users of campaign materials during development.

Timeframe: Campaigns must be completed by September 2017 to allow for local government compliance with the new waste prevention requirements discussed above. Work to revise Master Recycler curricula is planned to be completed by the end of 2017.

6.4 Schools (Project 4)

Schools offer opportunities to encourage preventing the wasting of food, both through education programs for students and programs designed to directly reduce wasting of food in school cafeterias. As part of its efforts, DEQ intends to engage with schools on both of these tracks.

Oregon Ballot Measure 99 (approved by voters on November 8, 2016) will provide up to \$22 million annually from lottery funds to support a new outdoor school fund, to be administered by the Oregon State University Extension Service. This money will fully fund outdoor school education for all 5th and 6th graders in Oregon (currently only half have access). Outdoor School, with its emphasis on ecology and human impacts on the environment, offers a unique learning environment in which to introduce students to the impacts of food production and the importance of preventing wasted food. DEQ hopes to work with Oregon State University to incorporate material about the impacts of wasted food and the need to reduce the wasting of food into new Outdoor School curricula (Project 4a), as opportunities allow.

Like other commercial kitchens, school cafeterias present significant opportunities for reducing the wasting of food. Many of their challenges parallel the challenges discussed for commercial kitchens, below (Project 5). In addition, implementing reduction efforts in school kitchens could provide an additional opportunity to teach students about the impacts of wasted food, if they were involved in the efforts of their school cafeterias. DEQ intends to work with a limited number of “demonstration” school kitchens to implement best practices around reducing the wasting of food (Project 4b). Some of these best practices are similar to the best practices that will be developed for commercial kitchens more generally and described below. As with commercial kitchens, better understanding the amount of avoidable wasted food, food that could have been eaten, and loss reasons will provide a foundation for upstream action and better bottom line benefits than can be achieved through composting food that could have eaten or was overproduced. In Alameda County for example, over 70 percent of the food thrown away during lunch in several elementary schools was completely avoidable waste.³⁴

³⁴ Stop Waste school food waste study is slated for publication in 2017. Alameda County Stop Waste staff reported this finding to DEQ on November 9, 2016. <http://www.stopwaste.org/recycling/schools/4rs-student-action-project>

Potential collaborators: OSU for the Outdoor School curriculum and interested school districts (e.g. Gresham-Barlow) for the school cafeteria work, as well as Oregon Metro, other local governments, and the Oregon Green Schools Association, which have developed, implemented and supported extensive school programs.

Timeframe: DEQ will consult with OSU in 2017 and assist as necessary with curriculum development in 2017 and 2018. Work on school kitchen strategies will be initiated in the latter half of 2017, with completion dates to be determined.

6.5 Commercial Sector (Project 5)

Commercial and institutional kitchens, along with grocery stores, account for an estimated 40 percent of wasted food, according to an analysis of existing data included in the ReFED Roadmap.³⁵ Based on this volume alone, this sector of the food supply chain presents significant opportunities for reducing the wasting of food. In addition, while a significant number of innovations are being suggested and implemented in this sector – among them services to help measure waste generated (to assist kitchens in identifying opportunities to reduce waste)³⁶, “ugly” food campaigns to promote use of “off-spec” produce, and discussions around changing merchandising practices in grocery stores – comparatively little work has been done to assess commercial best practices for preventing the wasting of food to help focus efforts on the most effective approaches. Also, relatively little has been done to date to systematically promote wasted food prevention in the commercial sector, in part because it is harder to measure than waste diverted from landfills. DEQ therefore intends to follow two paths to promote wasted food reduction: 1) implement campaigns that can be used by food businesses to help food service workers reduce waste from commercial kitchens, and 2) develop and disseminate information on best practices.

Provisions of SB 263 discussed above also offer local governments the opportunity to comply through the implementation of campaigns to promote reductions in wasting of food in commercial kitchens. Similar to the discussion of consumer campaigns above, DEQ plans to develop campaigns for use by local governments to comply with new waste prevention and reuse requirements of SB 263 (Project 5a). Like the consumer-targeted campaigns, these campaigns are likely to comprise diverse collateral, including website and social media material, and educational brochures. The campaign collateral will be designed to help raise awareness and provide a clear call to action coupled with information on how to effectively reduce wasting of food. Development of these campaigns will draw on the results of the measurement and messaging studies described above, and like the consumer outreach, will include sufficient materials to meet the campaign refresh requirements of SB 263.

Commercial sector engagement will include developing and disseminating information on best practices for reducing the wasting of food in commercial and institutional kitchens (Project 5b). DEQ plans to study results from programs implemented by other organizations, such as Lean Path, and also will draw heavily on the results of the Project 1 Measurement Study, which includes specific research on wasting of food in commercial kitchens and evaluation of the cost-effectiveness and environmental benefits of up to seven interventions in food service and retail merchandising environments.

Potential collaborators: Organizations already engaged in work in the commercial sector, such as Lean Path, Oregon Restaurant and Lodging Association, food service companies and educational institutions that operate food services.

³⁵ ReFED p. 13

³⁶ ReFED p. 5. Restaurants and foodservice providers could gain a substantial business profit improvement — estimated at over \$1.6 billion annually — by adopting waste tracking and analytics, smaller plates, and other solutions.

Timeframe: Campaigns must be completed by September 2017 to allow for local government compliance with provisions of SB 263. Work on commercial best practices will begin in early 2018 to allow DEQ to build on the results of the measurement study, Project 1. Work on commercial best practices is anticipated to continue through 2021.

6.6 Edible Food Rescue (Project 6)

As discussed in the introduction and background sections above, a key objective for DEQ in implementing projects around preventing the wasting of food is to “change the conversation” about wasted food, much of which has focused on the need to keep organic materials out of landfills and which minimizes consideration of food as a resource worth conserving. To date, significant attention and resources have been devoted to keeping wasted food out of landfills, either through composting or donation of surplus food fit for human consumption to people in need. While DEQ agrees that composting and donation can be beneficial, a focus on end-of-life (or disposal) solutions prevents attention to the very real and larger upstream impacts that are generally hidden from the public.

That being said, there is still a need for some activity related to efforts nearer to the end of pipe, given the relatively high priority of “feeding hungry people” in the Wasted Food Hierarchy. One of these areas is understanding the relative value and impact of diverting food from farms directly to food banks versus diverting food from restaurants and grocers to food banks. Some food bank data suggest that the cost of a pound of food donated directly from farms is much lower for food banks than the cost of a pound of food from other sources (e.g., restaurants). In addition, questions have been raised about the nutritional value of some prepared food from restaurants or grocers, which sometimes (such as in the case of foods like leftover French fries from a restaurant or cakes and cookies from grocers that are approaching their freshness expiration dates) are of questionable value to food insecure populations. Finally, there appears to be little research specifically addressing the economic, nutritional and environmental tradeoffs associated with prepared food donation (which might include impacts of trucks used to pick up and redistribute food, for example). Other prevention strategies noted above may be more effective for this kitchen-prepared wasted food.

To help definitively answer questions related to the sources of food rescued for consumption by food insecure people, DEQ proposes to conduct research to fill information gaps (Project 6a). This research is intended to help inform the development and implementation of food rescue programs by:

1. Estimating the relative life cycle environmental impacts of different rescue approaches,
2. Estimating tradeoffs in the nutritional value of food rescued from farms versus from restaurants and grocers,
3. Estimating the relative economic impact of farm vs. restaurant/grocery rescue of food.

The Oregon Food Bank supports this research as it is in line with their interests in collecting food that is nutritionally sound and feeds hungry Oregonians in the most cost effective way.

In a related effort, DEQ plans to evaluate whether to continue to provide grant funds for projects aimed at rescuing and redistributing food to feed people in need (Project 6b). In the past, DEQ has funded the purchase of refrigerated trucks and other projects to support such programs. Given the Materials Management program’s focus on upstream prevention of waste and that the program is among the few organizations focused on preventing the wasting of food, this evaluation will specifically assess whether it is appropriate for DEQ to continue funding of these types of projects in the future. As a general matter,

DEQ believes that food rescue efforts are best supported by organizations, like food banks, that are specialists in this kind of service delivery.

Potential collaborators: Oregon Food Bank and other food rescue organizations, which have an interest in educating the public about the relative value of different sources of food donations; local governments and applicable non-profits, on the issue of grant funding.

Timeline: Work on the food rescue research is planned for 2017. Evaluation of the grants program may take place in 2017, if staffing resources permit.

6.7 Labeling (Project 7)

Sometimes food is wasted due to either a real or perceived food safety risk, for example, when food is thrown away due to quality or safety date labels. Date labeling (“use by,” “best by,” and “sell by” labels on food) has been shown to be confusing to consumers. Often, consumers do not understand what these labels mean, and this confusion leads consumers to discard food that would otherwise still be edible.³⁷ According to one survey conducted by the Food Marketing Institute, 91 percent of consumers reported at least occasionally discarding food past its “sell by” date.³⁸ A separate survey conducted by USDA in 2007 found that more than half of those surveyed incorrectly identified a peak quality date, “use by,” as a date recommended for safe consumption of a product.³⁹

There are a number of efforts underway to try to address this problem:

1. The *Food Date Labeling Act*, introduced in Congress in May 2016 aims to reduce consumer confusion, simplify regulatory compliance for companies, and cut supply-chain and consumer waste of food and money. To date, no action has been taken on this bill. Efforts prior to 2016 included the introduction of the *Food Recovery Act* of 2015 (HR 4185), which, in addition to providing funding for donation and recovery infrastructure, would have made changes to “best by” date labels, had it been enacted.
2. Similar legislation was proposed in the State of California (AB 2725) in 2016, but also was not enacted. Assembly member David Chiu, who introduced the bill, notified the Grocery Manufacturers Association (GMA) that the California Assembly would check in on the development of a voluntary national standard later in 2016 (see 3 below).⁴⁰
3. GMA and FMI, in response to calls for more clarity on labels, introduced a new voluntary standard in February 2017. Under this new standard, “use by” will be used for highly perishable foods or where there is a safety concern associated with the food. “Best if used by” will indicate quality (freshness).⁴¹
4. ReFED, GMA and FMI plan to implement campaigns in 2018 to educate consumers on these changes.

DEQ plans to track these developments, with the intent of taking future action, should it become necessary, either because current efforts fail, or if efforts are unsuccessful in reducing consumer confusion. As part of its tracking, DEQ will engage in research to determine:

³⁷ Harvard Food Law, 2013, p. 21

³⁸ Labuza & Szybist, 2001, *supra* note 23, at p. 92.

³⁹ Kosa et al., 2007.

⁴⁰ Appendix C, Chiu Letter to GMA

⁴¹ Dewey, 2017

1. The extent to which new voluntary standards are being implemented in Oregon, and
2. Whether new labels are clearer for consumers than existing labels.

DEQ will collect baseline data on consumer perceptions (via the “Measurement Study” described earlier) and will separately collect baseline data on the sell-by/use-by/best-by dates currently found on foods in Oregon grocery stores. This data will be used to determine whether food producers and retailers are voluntarily implementing the new labels to be developed by GMA.

Once the GMA and FMI’s new date labeling system is in place, DEQ may, if it seems necessary, disseminate information to help inform consumers about new labels. DEQ may also conduct research to determine whether voluntary standards are clearer for consumers than current labels. Finally, in the event that effective labels fail to be implemented after a reasonable period of time, DEQ may determine that it is necessary to support state legislation to create clearer food labels.

Potential collaborators: Harvard Food Law and Policy Clinic, GMA date labeling workgroup, King County, WA, State of California, Californians Against Waste, Oregon Department of Agriculture.

Timeframe: Baseline data on food labels in Oregon to be collected in 2017, with tracking of new standards and dissemination of outreach materials related to new standards to begin in 2018. In 2019, DEQ will begin assessing the current impact of date labeling on food waste generation and determine what, if any, additional efforts are needed.

6.8 Coalition of Interested Regional Parties (Project 8)

DEQ will play a lead role in convening interested parties in a multi-state coalition to advance reducing the wasting of food. This convening will be undertaken through the Pacific Coast Collaborative, a governor-sponsored coalition of the States of California, Oregon, and Washington, and the Province of British Columbia that has been initiated to help these West Coast jurisdictions work together to reduce greenhouse gas emissions. The [Pacific North America Climate Leadership Agreement](#), signed in June 2016 by the PCC members and mayors of six large cities, including Portland, commits Oregon and other partners to collaborate on wasted food prevention and recovery.

DEQ is hosting a summit for PCC in spring 2017 with participating states, British Columbia and large cities to discuss potential opportunities to collaborate on wasted food prevention and recovery (organics recycling) research and/or implementation needs. Specific future activity on the part of DEQ will be determined after that meeting.

Potential collaborators: Applicable staff from participating PCC jurisdictions and other Pacific North America Climate Leadership Agreement signatories.

Timeframe: Initial meeting is planned for April 2017. Additional activity and the timing of that activity is to be determined based on the outcomes of the April meeting.

6.9 Research Not Included Elsewhere (Project 9)

While several of the projects described above include research components, DEQ has identified additional research that would provide information that could be used to help guide future DEQ, local government, nongovernmental and private sector projects, both during the five year time frame covered by this

strategic plan and for continuing and new efforts beyond this plan. These additional pieces of research add to the foundation of knowledge and fill important current gaps in knowledge about the wasting of food, thereby allowing for informed and defensible action across the entire wasted food hierarchy. These research projects include:

- A comparative analysis of actions to prevent the wasting of food to identify actions with the highest impact (Project 9a). This work will build on results of the measurement study (Project 1) and the work of others developing and implementing interventions. Many organizations are implementing a wide range of interventions with consumers and commercial and institutional kitchens. For this study, data will be collected on the efficacy of a range of actions and analyzed to determine which interventions appear to have a greater impact on the generation of wasted food. Results from this study will help inform future work to increase business and consumer action to reduce the wasting of food.
- A comparative analysis of the environmental impacts/benefits of prevention, donation, and recovery to determine the relative efficacy of these approaches in reducing life cycle impacts of food (Project 9b).
- A study of the economics of food waste reduction to determine impacts, if any, on farm incomes and other businesses involved in the production and distribution of food (Project 9c). A fundamental assumption behind DEQ's emphasis on reducing the wasting of food upstream is that if the 25 to 40 percent of food currently wasted were not wasted, production of food and its associated environmental impacts would decrease. As discussed above, there is reason to believe that Oregon farmers would be unlikely to be adversely affected by reduced demand for food that could result from effective prevention of waste. This research project would seek to confirm or disprove that thinking by looking at the impact achieving wasted food reduction goals might have on farm incomes and other food related industries, including addressing the question of what the likely impact on food production might be, given the global nature of supply chains and growing global demand for food.
- A study of the impact of packaging, the details of which will be determined following completion of a separate DEQ study currently underway with the University of Michigan to review the literature addressing the life cycle impacts of food packaging and the possible trade-offs between packaging and wasted food (Project 9d). There has been a significant focus on the role of packaging as a contributor to the environmental impact of food, but some studies suggest that the impact of packaging is small relative to other life cycle stages. Other research suggests packaging itself may reduce wasted food generation by protecting food from spoilage and damage. In addition, there is some work underway to try to develop improved packaging explicitly designed to help prevent the wasting of food (either by reducing spoilage or by alerting consumers to food that is nearing spoilage).

Potential collaborators: OSU and other Oregon universities as appropriate, University of Michigan and other academic leaders outside the state.

Timeframe: Much of this work will start later in the five year period covered by this strategic plan (2019 and beyond). One exception is the analysis of prevention actions, for which some early data collection is planned to begin in 2017.

Table 1. Relationship of Projects to Strategic Plan Goals

Project (Reference number)	Goals		
	Develop state of knowledge/building blocks	Increase business and consumer actions	Reduce GHG emissions and resource use
Measurement Study (1)	•	•	•
Messaging Research (2a)	•		
Messaging Refresh (2b)	•		
Consumer Campaign (3a)	•	•	•
Master Recycler Curriculum (3b)	•	•	•
Outdoor School Curriculum (4a)	•	•	•
School Kitchen Strategies (4b)	•	•	•
Commercial Campaign (5a)	•	•	•
Commercial Best Practices (5b)	•	•	•
Food Rescue Research (6a)	•		•
Food Rescue Grants (6b)		•	•
Labeling (7)	•	•	•
Coalition of Interested Parties (8)	•	•	•
Research: analysis of prevention actions (9a)	•		
Research: comparison of prevention, donation, recovery (9b)	•		
Research: economics of food waste reduction (9c)	•		
Research: packaging impacts (9d)	•		

6.10 Guiding Principles for Project Implementation

As DEQ moves forward to implement the projects described above, it will keep in mind the following guiding principles:

- Engage stakeholders in planning and where appropriate, execution. There are many actors involved in preventing wasted food, including local governments, NGOs and national organizations. In each project description above, we have highlighted potential collaborators, and DEQ is committed to engaging with these and other groups as we move forward to implement this Strategic Plan.
- Respect the work of others. This Strategic Plan has made the case for prevention above other interventions to address the wasting of food, but there is significant and valid work occurring in more downstream portions of the food life cycle, specifically in food rescue and recovery. DEQ will plan and implement its projects in a way that recognizes interfaces with these approaches.
- Learn from experience. While there is significant interest and activity around preventing the wasting of food, this is still an emerging area. Thus, there are relatively few proven models to

follow in implementing priority projects. DEQ will continuously evaluate progress as we conduct our work and make adjustments where needed to incorporate lessons learned. We also will share our experience – both successes and areas for improvement – with others in the field.

- Change course when necessary. The projects described above are based on our current understanding of the landscape in which food is wasted and in which that waste can be prevented. That landscape may change, as well as our understanding of it. Many priority projects are foundational research efforts intended to fill critical knowledge gaps. When that research or other sources of information provide new understanding that suggests changes to our current plans, we will make those changes.

7. Where do we hope to be in five years?

This strategic plan encompasses the work DEQ plans to take on in the next five years. As discussed above, many of the projects DEQ proposes to pursue lay the foundation for future work or fill gaps in current knowledge that could be used to design and implement future efforts to address the wasting of food. If the projects listed above are successful, DEQ envisions an environment five years from now where:

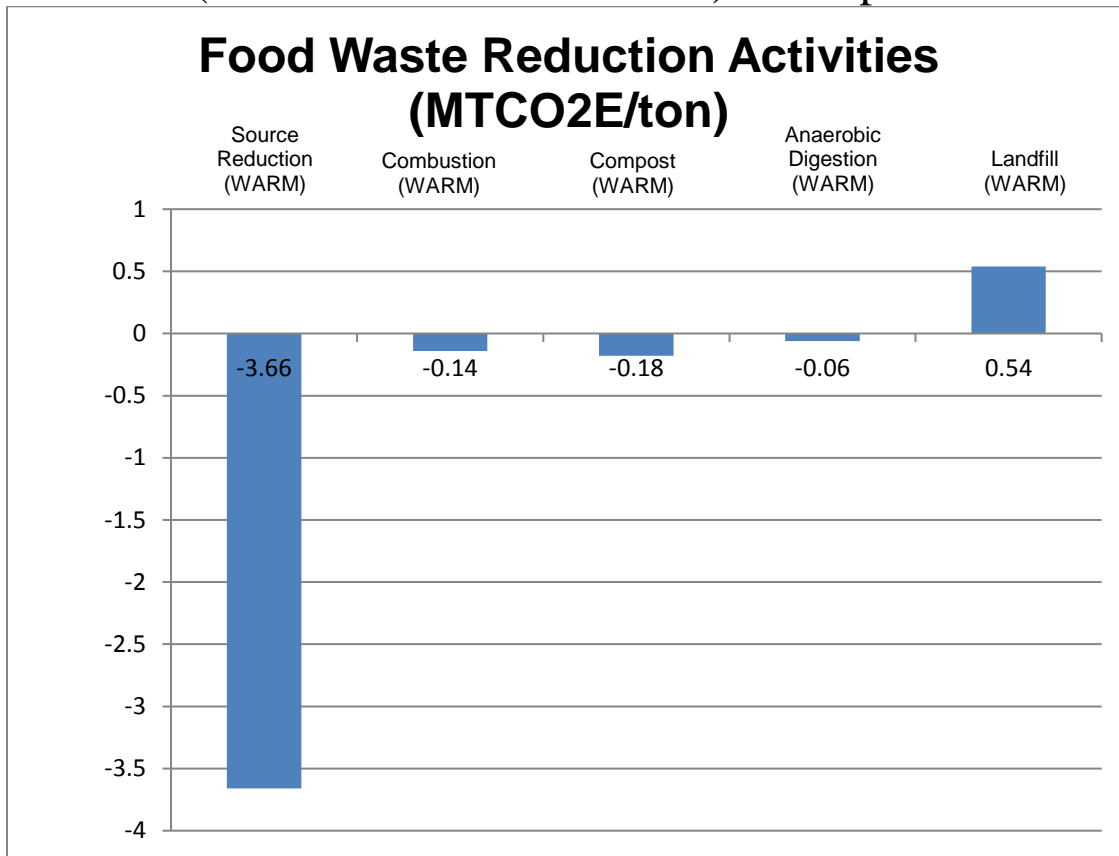
1. Households and businesses generate less wasted food by making shifts in how they purchase, store, and prepare food. Food consumption is sufficient for people's dietary needs and not driven by factors like the availability of inexpensive, plentiful food or lifestyles that make it difficult to manage food purchases and consumption in a non-wasteful way.
2. Measurable progress has been made in reducing the wasting of food in Oregon and inedible food scraps are recovered to the extent possible.⁴²
3. The research gaps highlighted in this strategy have been filled, results have been shared, and program implementation has been updated to incorporate new research findings.
4. DEQ's research and projects have built a foundation for stakeholders in Oregon and elsewhere to prioritize preventing the wasting of food before actions to divert edible and inedible food from landfills.
5. New communities of practice have been established to support common environmental and public health goals around the wasting of food in public and private sector organizations.
6. DEQ and stakeholders understand the economic, social and environmental trade-offs associated with different food donation and rescue pathways.
7. DEQ and stakeholders better understand the economic, psychological, social, and structural drivers leading to wasted food in households, institutions and businesses.
8. More effective date labeling standards have been implemented in Oregon and consumers throw away less food prematurely due to date label education efforts by governments and industry.
9. The conversation has been shifted, such that policies intended to address the wasting of food in Oregon can be discussed with a full understanding of the implications of interventions all along the life cycle of food.

⁴² DEQ is also developing a food recovery (recycling) strategy to support the State's goal of recovering 25 percent of wasted food by 2020. That effort will include an assessment of current wasted food recovery and a stakeholder engagement process. DEQ plans to publish the final strategy in early 2018.

The work, however, will not be done. While Oregon will be closer to its goals of reducing wasting of food by 15 and 40 percent by 2025 and 2050 respectively, there will continue to be a need for further efforts. In its selection of projects and the manner in which those projects will be implemented, DEQ aims to contribute to the development of collaborative momentum among stakeholders across the state that will result in real and lasting change with regard to the wasting of food.

Appendix A

Figure 3: Average lifecycle impacts from food waste reduction activities (MTCO₂E/Ton food waste) assumptions



Documentation for greenhouse gas emission and energy factors for organic materials used in EPA's Waste Reduction Model (WARM) includes Exhibit 1-10 below and background information below, which is available at: https://www.epa.gov/sites/production/files/2016-03/documents/warm_v14_organic_materials.pdf

Calculations used to determine the relative benefits of source reduction compared to composting and AD:

$(\text{landfill} - \text{source reduction}) / (\text{landfill} - \text{composting}) = \text{relative benefits of source reduction: Composting}$

$$(0.54 - (-3.66)) / (0.54 - (-0.18)) = 4.2 / 0.72 = 5.8$$

Therefore, **source reduction has ~6x the GHG benefits as composting the same ton of food**

$(\text{landfill} - \text{source reduction}) / (\text{landfill} - \text{AD}) = \text{relative benefits of source reduction: AD}$

$$(0.54 - (-3.66)) / (0.54 - (-0.06)) = 4.2 / 0.6 = 7$$

Therefore, **source reduction has ~7x the GHG benefits as anaerobically digesting same ton of food.**

These findings are consistent with the [ReFED roadmap](#) data set, which results in 3.7 tons GHG reduced/ton prevented (average across all prevention solutions considered) and 0.5 tons GHG reduced per

ton diverted (average across all recycling solutions considered) – or 7x more GHG benefits from prevention as from composting or AD (recycling solutions).

Exhibit 1-10: Net Emissions for Food Waste and Mixed Organics under Each Materials Management Option (MTCO₂E/Short Ton)

Material	Net Source Reduction Emissions	Net Recycling Emissions	Net Composting Emissions	Net Combustion Emissions	Net Landfilling Emissions	Net Anaerobic Digestion Emissions*
Food Waste	-3.66	NA	-0.18	-0.14	0.54	-0.05
Food Waste (non-meat)	-0.76	NA	-0.18	-0.14	0.54	-0.05
Food Waste (meat only)	-15.10	NA	-0.18	-0.14	0.54	-0.05
Beef	-30.05	NA	-0.18	-0.14	0.54	-0.05
Poultry	-2.47	NA	-0.18	-0.14	0.54	-0.05
Grains	-0.62	NA	-0.18	-0.14	0.54	-0.05
Bread	-0.67	NA	-0.18	-0.14	0.54	-0.05
Fruits and Vegetables	-0.44	NA	-0.18	-0.14	0.54	-0.05
Dairy Products	-1.74	NA	-0.18	-0.14	0.54	-0.05
Mixed Organics	NA	NA	-0.16	-0.16	0.20	-0.07

Note: Negative values denote net GHG emission reductions or carbon storage from a materials management practice.

NA = Not applicable.

* Emission factors for dry digestion with curing of digestate before land application

Current WARM Tool - Version 14

[This version of WARM](#) (1 page, 3 MB), released in March 2016, contains a new material management pathway and revisions to existing numbers and methodology. The majority of the updates in WARM version 14 concern the addition of the anaerobic digestion materials management pathway. EPA added energy and emission for anaerobic digestion of organic materials, including food waste, yard trimmings, and mixed organics. These emission factors include:

- the energy and emissions associated with transporting materials,
- operating the digester,
- avoided utility emissions from biogas combustion,
- avoided fertilizer application and
- fugitive emissions and soil carbon storage resulting from application of digestate to agricultural soils.

The anaerobic digestion pathway in WARM includes options for the user to model both a wet and dry digester system. WARM also allows the user to model application of digestate to agricultural soils with and without curing. Additionally, EPA revised the method for calculating energy and emissions from transportation of materials to landfills, combustors, composting facilities, and anaerobic digesters. Each of these pathways now use a consistent source for transportation impacts per mile and ton of waste transportation.

In addition, EPA made regular updates to various factors in the model using current data sources. The latest 2014 statistics on the carbon content of fuels, landfill methane generation distribution (by type of landfill), and landfill gas recovery and flaring rates have been incorporated from EPA's Inventory of U.S. Greenhouse Gas (GHG) Emissions and Sinks: 1990-2014. The non-biogenic carbon content of mixed municipal solid waste (MSW) was updated using annual waste disposal data from EPA's Municipal Solid Waste in the United States, Facts and Figures. Various aspects of the U.S. average electricity mix were updated based on the U.S. Department of Energy (DOE) Energy Information Administration's (EIA's) 2015 Monthly Energy Review while state electricity grid emission factors were updated based on the 2015 update to the eGRID database. EPA updated material properties for biodegradable materials used in modeling anaerobic digestion and landfilling based on recent papers and research. These properties include carbon content, carbon storage factors, and methane yield. These updates resulted in changes to the majority of emission factors in WARM.

Appendix B

Research Agenda and “Orphan” Projects

I. Applied Research Needs - “Orphan” projects that other stakeholders could support or lead

The strategic process of culling proposed projects also highlighted projects that, while not prioritized for DEQ implementation at this time, represented worthy endeavors that DEQ might want to actively encourage another stakeholder to engage in or lead. Some of these so-called “orphan projects” include:

- Additional research addressing:
 - ✓ **“Pay as you throw” models**
 - ✓ **Smart labels**
 - ✓ **Packaging innovation to extend shelf life**
 - ✓ **Comprehensive study of wasted food in K-12 schools** (loss reason, quantity and type of food that could have been eaten)
 - ✓ **Transparent terminology to discuss wasted food and associated reduction strategies.** For example, in Oregon the term recovery refers to organics recycling, while at EPA and in other states the term recovery refers to edible food donation.
 - ✓ **Financial Innovation to optimize economic and environmental benefits** by, for example, investing a portion of revenue saved from source reduction efforts into efficient community feeding programs with direct sourcing
 - ✓ **Methods to estimate the social impact of wasted food prevention**
 - ✓ **Evaluation of social norms as indicators for behavior change**
 - ✓ **Economic analysis of domestic and foreign markets for ugly fruit and vegetables,** given existing marketing orders and USDA grading standards
 - ✓ **Disclosure requirements for food waste data and supply chain transparency**⁴³
 - ✓ Opportunities to promote public health through wasted food reduction⁴⁴
 - ✓ **Sector (Institutional, Commercial, and Industrial) specific metrics,** including root causes of wasted food
 - ✓ **Analysis of processing capacity** opportunities during peak harvest seasons, including slack infrastructure
 - ✓ **Trans-border food movement policies and impact of wasted food** (ex. Borderlands Food Bank)
 - ✓ Analysis of real and perceived food safety issues and opportunities to mitigate unintended impacts on wasted food and loss.
 - ✓ **Analysis of food rescue models that could increase the generation of wasted food** (current estimates are based on anecdotally evidence from grocers and food service operators)
 - ✓ **Models to rescue unharvested food** and create jobs for low-income farm workers
 - ✓ **New models for food rescue and skills training** (similar to DC food kitchen)

⁴³ Trillium 2016

⁴⁴ Neff, Kanter and Vandevijvere, 2015

- ✓ **Analysis of optimal incentives for farm to food bank programs**
- ✓ **Wasted food analytics** for commercial and home kitchens
- ✓ **Merchandizing models** that minimize wasted food generation
- ✓ **Business fears of disappointing customers** through changes that minimize waste
- Tool development:
 - ✓ **Toolkit for food rescue, including opportunities and challenges unique to each food rescue model (farm to food bank, grocery donation, food service donation, etc.)**
 - ✓ **Messaging on the benefits of local and seasonal eating**
 - ✓ **Waste audit and waste reduction tools for food processors**
 - ✓ **K-12 student curriculum on preventing wasted food** with holistic ties to donation, composting and community gardening
 - ✓ **K-12 food service toolkit to prevent the wasting of food**
 - ✓ **Food availability map** of food waste generation and recoverable food by quantity, quality, and geographic distribution with data layers for food banks, affordable retail (ex. Daily Table or Panera Cares), and feeding programs

II. DEQ-Sponsored Research Agenda from 2017-2021

DEQ has also committed to lead or fund to several foundational research efforts that will inform efforts to reduce wasted food across the supply chain and how success is measured. DEQ-sponsored research includes:

- Foundational Research addressing:
 - ✓ **Comprehensive Wasted Food Measurement Study** to determine amounts of wasted edible food by quantity, type, and loss reason to develop baselines and better practices to reduce waste from commercial, institutional and household kitchens in Oregon
 - ✓ **Quantitative messaging research** to identify the value-based messaging most likely to drive consumers to take action in preventing wasted food, beyond food recovery
 - ✓ Estimate **economic, nutritional, and environmental tradeoffs of different food rescue methods** such as farm to food bank or prepared food donation models
 - ✓ **Analysis of food rescue grants and existing infrastructure**
 - ✓ **Analysis of voluntary (GMA) date labeling standard implementation** in Oregon
 - ✓ **Comparative analysis of actions to prevent the wasting of food** to identify actions with the highest impact
 - ✓ **Comparative analysis of the environmental impacts/benefits of prevention, donation, and recovery**
 - ✓ **Economic analysis of wasted food prevention** to determine impacts, if any, on farm incomes and other businesses
 - ✓ **Study of the relative impact of packaging** compared to wasted food

- Tool development:
 - ✓ **Wasted food prevention campaign for households** in Oregon
 - ✓ **Wasted food prevention campaign for food service workers** in Oregon
 - ✓ **Outdoor School curriculum** on impacts of wasted food
 - ✓ **Business cases for wasted food prevention strategies, such as smaller plates, variety in portion sizes**, consumer outreach, wasted food analytics, default service or display practices, etc.
 - ✓ **Better practices for school kitchens**
 - ✓ **Better practices for commercial kitchens**

Appendix C – Chiu Letter

STATE CAPITOL
P.O. BOX 942849
SACRAMENTO, CA 94249-0017
(916) 319-2017
FAX (916) 319-2117
DISTRICT OFFICE
455 GOLDEN GATE AVENUE, ROOM 14300
SAN FRANCISCO, CA 94102
(415) 557-3013
FAX (415) 557-3015

Assembly
California Legislature

DAVID CHIU
邱信福
ASSEMBLYMEMBER, SEVENTEENTH DISTRICT



COMMITTEES
CHAIR: HOUSING AND COMMUNITY
DEVELOPMENT
BUDGET
HEALTH
JUDICIARY
LOCAL GOVERNMENT
SUBCOMMITTEES
BUDGET SUBCOMMITTEE NO. 1 ON
HEALTH AND HUMAN SERVICES

April 19, 2016

John Hewitt
Grocery Manufacturers Association
1350 I Street, Suite 300
Washington, DC 20005

Dear Mr. Hewitt,

We are glad to hear that industry has committed to address inconsistent and confusing date labels and expect the association to implement reforms on the timeline identified during the hearing in the Assembly Health Committee. We are committed to working with you to implement the standard that you identify through legislation in next year's session.

At least 54% of consumers believe that eating food past its "Sell By" or "Use By" date is a health risk. Some terminology, such as "Use By" is used interchangeably for both quality and safety, leading consumers to treat all date labels as safety dates and discard edible food prematurely. This is clearly unacceptable. In order to effectively educate consumers on the meanings and types of date labels, standardization is needed to ensure uniform and consistent labeling.

As you are probably aware, disposing of uneaten food and other organic waste into landfills releases more than 8.3 million tons of greenhouse gases each year in California, contributing 20 percent of California's methane emissions. Four percent of the total energy budget, about 12 percent of the land, and 23 percent of all freshwater consumed in the United States is used to grow food that goes uneaten. Meanwhile, 50 million Americans are food insecure.

We look forward to reviewing the recommendations that the association will develop, and hope to continue discussions with you as your efforts progress throughout this year. We remain committed to adopting a consistent and standardized set of date labels that will be informed by your efforts.

Sincerely,

DAVID CHIU
17th Assembly District



Printed on Recycled Paper

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