2 Maximizing and Measuring Impact: Moving Upstream, Beyond the Recycling Rate

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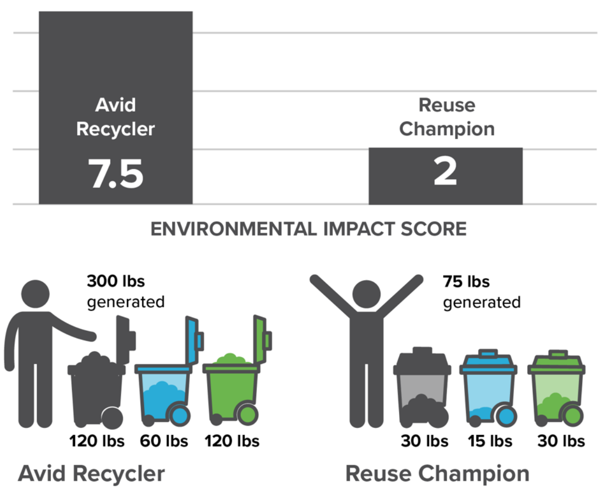
Chapter 2 Maximizing and Measuring Impact: Moving Upstream, Beyond the Recycling Rate

Overview

To reduce the environmental and health impacts of waste, Seattle Public Utilities (SPU) increasingly focuses on waste prevention. To show potential benefits from waste prevention, SPU worked with a consultant to calculate environmental impact scores of food packaging for two hypothetical Seattle consumers: "Avid Recycler" and "Reuse Champion." Each consumer diverts 60% of their food packaging waste, but Avid Recycler generates 300 pounds of food packaging waste per year, while Reuse Champion generates only 75 pounds. Considering greenhouse gas (GHG) emissions, public health, and ecosystem toxicity, Reuse Champion has a much smaller environmental footprint by preventing waste through reusing materials.

Figure 2.1 Environmental Impact of Food Packaging for an Avid Recycler versus a Reuse Champion



Source: Seattle Public Utilities and Cascadia Consulting Group, 2019.[1]

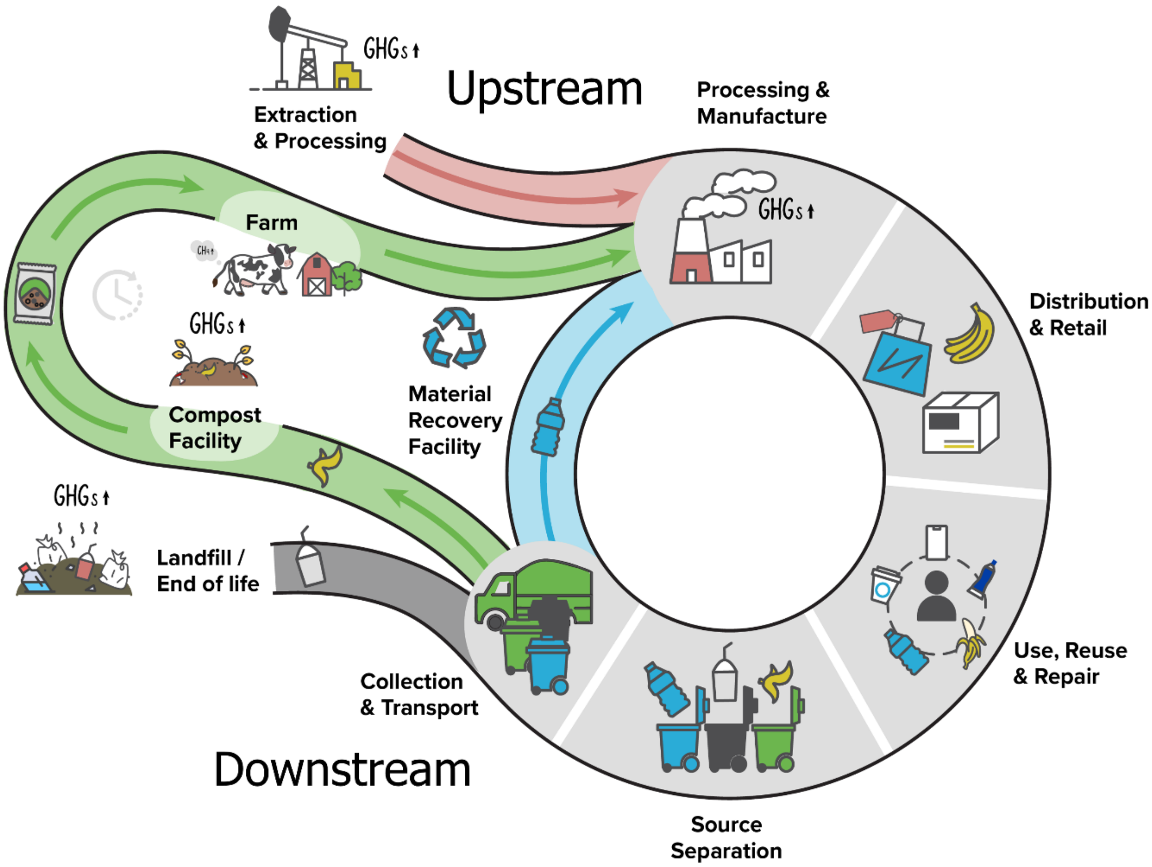
[1] The numbers associated with the footprints of food packaging for the Avid Recycler and the Reuse Champion are Environmental Impact Scores. These scores were calculated using life cycle assessment methods and consumer expenditure purchasing data to measure the impact that consumer choices have on (1) climate change, (2) public health, and (3) ecosystem toxicity.

Expanding to a full life cycle view of materials, starting upstream with extraction and processing of raw materials, helps demonstrate why preventing waste in the first place has a much bigger environmental impact than recycling (Figure 2.2 on page 2.5). Consistent with this life cycle view, SPU is moving away from using the recycling rate to measure the success of Seattle's solid waste program to using metrics better suited to waste prevention goals. To better understand the evolution of SPU's solid waste management further upstream in the materials life cycle, this chapter discusses:

- The history of SPU's data-driven approach to solid waste planning and target-setting for overarching solid waste goals
- The origins, progress toward, and changes to Seattle's recycling rate goals
- Seattle's current waste disposal goals
- The limitations of the recycling rate on measuring the impacts of solid waste diversion and prevention programs
- Alternative metrics to measure upstream goals and the impact of SPU's services

This historical information provides context for the development of new overarching metrics and targets in Seattle's *2022 Solid Waste Plan Update* (*2022 Plan Update)* to measure the progress of SPU's work "upstream" in waste prevention and reuse and the environmental impacts of solid waste. The chapter includes two recommendations that will boost SPU's work on waste prevention and discusses options to measure upstream impacts and environmental impacts. Chapters on waste prevention (Chapter 4, *Waste Prevention and Reuse*) and outreach and education (Chapter 9, *Outreach, Education, Enforcement, and Compliance Support*) discussion metrics and targets to measure the performance of specific activities related to those issues.

Figure 2.2 Life Cycle of Materials and Products



Source: Seattle Public Utilities and Cascadia Consulting Group.

A Data-Driven Approach to Planning

Seattle's current waste management system was shaped by a crisis. When the last two Seattle-owned landfills closed in 1987, the City's disposal costs increased as it began to send garbage to a regional landfill. To find a cost-effective solution, the City adapted a four-step methodology used by Seattle's electric utility into a new data-driven approach for solid waste planning to:

1 **Forecast future solid waste generation:** Seattle built an analytical model called the *Recycling Potential Assessment* (RPA) to estimate future waste generation The RPA projections are based on forecasts for factors, such as population, employment, income, and number of households as well as on historic data for these factors compared to historic tons of waste generated. See Appendix E, *Recycling Potential Assessment and Environmental Benefits Analysis,* for a description of the RPA and results of the RPA analysis for many of the recommendations in the 2022 Plan Update.

2 **Model the cost and recycling rates in different waste management scenarios:** The RPA models results for different combinations of recycling programs (for example, curbside recycling, disposal bans) and disposal options (for example, near or far landfilling, mixed-solid-waste processing, or a waste-to-energy plant). The RPA assesses the costs of disposal, program implementation, as well as avoided costs (for example, when materials are recycled instead of being sent to the landfill). The RPA also assesses the recycling rate, tonnages recycled, and tonnages disposed by material type for each scenario.
3 **Estimate environmental and social impacts of each scenario:** A separate model, the *Measuring Environmental Benefits Calculator*, or MEBCalc, described in Appendix E, *Recycling Potential Assessment and Environmental Benefits Analysis*. MEBCalc was developed by a consultant to estimate the cost of pollution on human health and other environmental indicators for tonnages disposed and recycled estimated by the RPA.
4 **Evaluate the results to select the "best" option:** The cost, tonnage, and impact modeling results are combined with a qualitative assessment of the scenarios to select the "best" program options using criteria such as cost effectiveness, overall benefits, and feasibility.

This data-driven approach was a landmark achievement, a concrete example of resiliency planning, and the new cornerstone of Seattle's solid waste management planning. Modeling different waste management scenarios allowed Seattle to show unequivocally that recycling is cost-effective. This analysis, as well as stakeholder input, led Seattle to create a citywide curbside recycling and yard waste collection program in 1988.

A year later, Seattle adopted its first solid waste management plan independent of King County, the *1989 Integrated Solid Waste Management Plan, On the Road to Recovery*. Using the data-driven approach to evaluate different scenarios for managing solid waste, Seattle's plan concluded that recycling 60% of the generated waste and landfilling the remaining 40% was the most cost-effective of all the feasible waste management options. For a detailed overview of solid waste planning history in Seattle since 1989, see Appendix A*, Planning History and Progress on Prior Recommendations.*

Evolving Recycling Rate Goals for Commercial, Residential, and Self-Haul Waste

The approach used to develop the *1989 Plan* positioned the weight-based recycling rate as the primary metric to evaluate solid waste performance. At that time, Seattle focused on improving the low recycling rate of 24% in 1987. Seattle initially set a recycling rate target of 60% for commercial, residential, and self-haul waste by 1998. This ambitious target would require that 77% of Seattle residents and businesses to recycle 77% of all their waste.

By 1998, the recycling rate had grown to 46%, a tremendous increase, but still 14 percentage points short of the target. Subsequent solid waste management plans and resolutions reaffirmed the 60% goal, while incrementally delaying it to 2008, 2010, 2012, and 2015. Table 2.1 outlines how the 60% recycling rate target date has shifted over time and compares it with actual performance at each target year.

Table 2.1 60% Recycling Rate Target and Performance for Commercial, Residential, and Self-Haul Waste

TARGET-SETTING DOCUMENT	TARGET YEAR	PERFORMANCE AT TARGET YEAR
1989 Integrated Solid Waste Management Plan	1998	46%
1998 Solid Waste Management Plan	2008	54%
2004 Solid Waste Plan Amendment	2010	54%
2007 Zero Waste Resolution (#30990)	2012	56%
2011 Solid Waste Plan Revision	2015	58%

While delaying the 60% recycling rate target, Seattle's City Council introduced an even more ambitious recycling rate target of 70% in the *2007 Zero Waste Resolution*.[2] The *Zero Waste Resolution* initially set 2025 as target year to reach a 70% recycling rate, and the *2011 Solid Waste Plan Revision* (*2011 Plan Revision*) accelerated it to 2022 (Table 2.2) for reasons discussed further below.

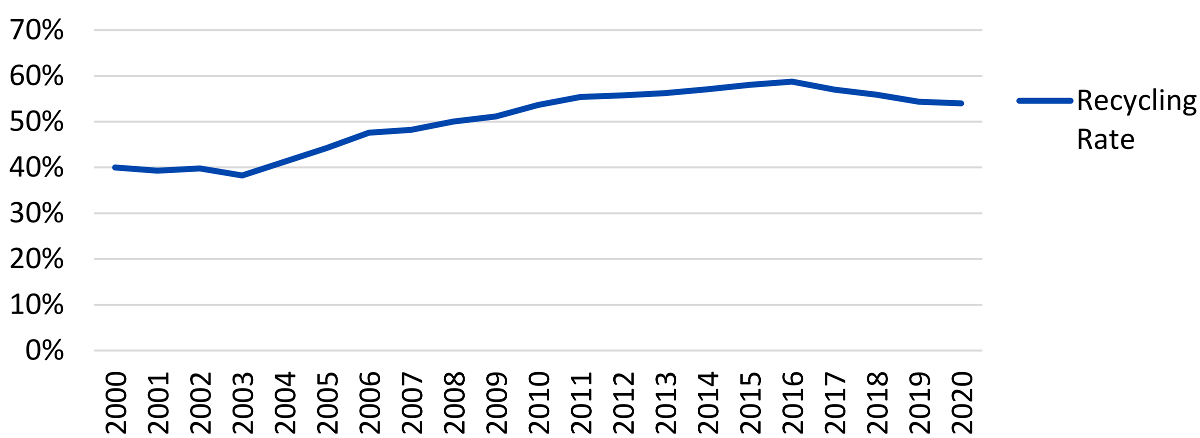
[2] http://www.seattle.gov/documents/Departments/SPU/Documents/SolidWastePlanApdxBZWResolution30990.pdf

Table 2.2 70% Recycling Rate Target for Commercial, Residential, and Self-Haul Waste

TARGET-SETTING DOCUMENT	METRIC	TARGET	TARGET YEAR
2007 Zero Waste Resolution (#30990)	Recycling rate for commercial, residential, and self-haul waste	70%	2025
2011 Solid Waste Plan Revision	Recycling rate for commercial, residential, and self-haul waste	70%	2022

Driven by these aggressive recycling rate targets, Seattle has made significant progress, particularly considering the staggering rate of population growth in the period 2010-2020.[3] The recycling rate has steadily increased throughout the last three decades until 2016, when it reached an all-time high of nearly 59% (Figure 2.3). Further discussion of recycling rate trends and some of the key factors that influence recycling rates occurs in Chapter 3, *Seattle Waste Data and Trends*.

Figure 2.3 Seattle Overall Recycling Rate for Commercial, Residential, and Self-Haul Waste



Source: Seattle Public Utilities, "2020 Annual Waste Prevention & Recycling Report."

[3] Gene Balk / FYI Guy. " Surprise! Seattle was the fastest-growing big U.S. city in 2020." Seattle Times, 27 May 2021, https://www.seattletimes.com/seattle-news/data/surprise-seattle-was-the-fastest-growing-big-u-s-city-in-2020.

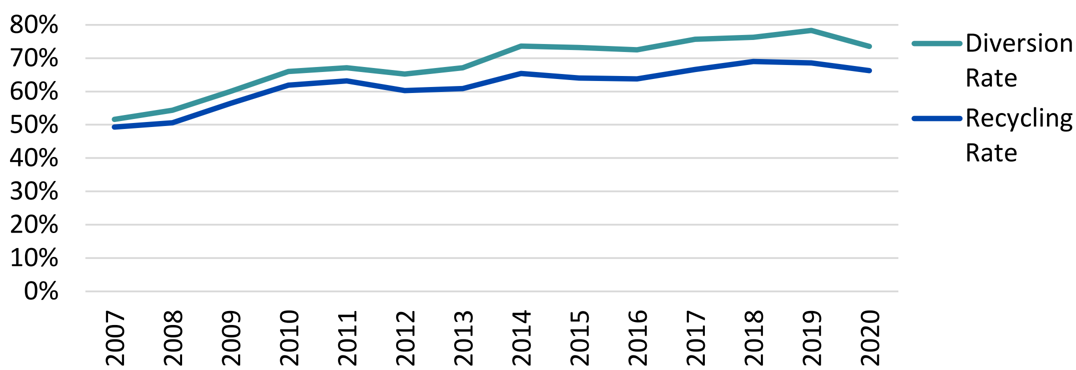
Seattle's Annual Waste Prevention & Recycling Report

SPU has traditionally monitored achievement toward the weight-based recycling rate through Seattle's *Annual Waste Prevention & Recycling Report*.[4] With SPU's shift in emphasis upstream to waste prevention, the report has increasingly focused on waste generation and disposal trends over the past few years, including results for each customer sector.[5] Consistent with historical practice, the report also includes weight-based recycling rate results. It also discusses service and program highlights for the prior year, as well as near-term actions planned for the following year.

Construction and Demolition Debris Recycling Rate Goals

The *2011 Plan Revision* also set goals for reducing tons disposed (see page 2.11) and recycling construction and demolition (C&D) debris. Based on RPA modeling, the *2011 Plan Revision* set a 70% recycling rate goal for C&D debris by 2020. Seattle has made significant progress by increasing the recycling rate for C&D debris from about 49% in 2007 to nearly 66% in 2020 (Figure 2.4). The 2020 diversion rate was 74% when considering C&D debris diverted to beneficial uses, such as wood waste used as industrial boiler fuel.

Figure 2.4 Seattle Recycling and Diversion Rates for Construction & Demolition Debris



Source: Seattle Public Utilities, "2020 Annual Waste Prevention & Recycling Report."

[4] http://www.seattle.gov/utilities/about/reports/solid-waste-reports#annual
[5] Seattle Public Utilities, "2020 Annual Waste Prevention & Recycling Report," October 2021, https://www.seattle.gov/Documents/Departments/SPU/Documents/Recycling_Rate_Report_2020.pdf.

2011 Plan Revision Recycling Rate Goals

In the *2011 Plan Revision*, Seattle used its data-driven approach to assess options for achieving the 70% recycling rate goals of the *Zero Waste Resolution*. Seattle examined the benefits and costs of over 30 different scenarios to find the most cost-effective approach, ultimately choosing a scenario that contained 116 individual recommendations. At that time, the RPA model estimated that Seattle could reach a 70% recycling rate for commercial, residential, and self-haul waste by 2022—three years earlier than called for in the *Zero Waste Resolution*—and a 70% C&D recycling rate by 2020. Reaching these recycling targets would require all assumptions of the model to hold true over time. For example, reaching the targets meant that SPU would implement all 116 programs, that each program would perform exactly as anticipated in the modeling exercise, that materials such as packaging would remain the same over time, and that Seattle's waste would be generated exactly as anticipated.

Despite considerable success implementing this ambitious, best-case scenario (see Chapter 1, *Development of the 2022 Solid Waste Plan Update* for highlights as well as Appendix A, *Planning History and Progress on Prior Recommendations,* with progress on recommendations from the *2011 Plan Revision*), Seattle was not able to implement several of the programs recommended in the *2011 Plan Revision*, and some implemented programs have not performed as well as anticipated. Decisions to not implement individual programs recommended in the *2011 Plan Revision* were made incrementally based on a variety of factors, but together those decisions scaled back the scenario that was originally modeled and adopted. Such changes thus impacted the net benefits (and recycling rate) that Seattle could achieve.

While Seattle implemented most of the 116 programs in the *2011 Plan Revision*, several programs that were modeled to have substantial impacts on recycling or cost savings were either canceled, delayed, or studied but not fully implemented for reasons ranging from lack of markets or financial feasibility to equity concerns. For example, after identifying equity concerns during the 2012 pilot project, SPU decided not to change single-family garbage collection to every other week, which was projected to save millions of dollars to fund other recommendations, such as pet waste and diaper composting. Limited recycling markets delayed recommendations related to carpet, plastic film wrap, and textiles.

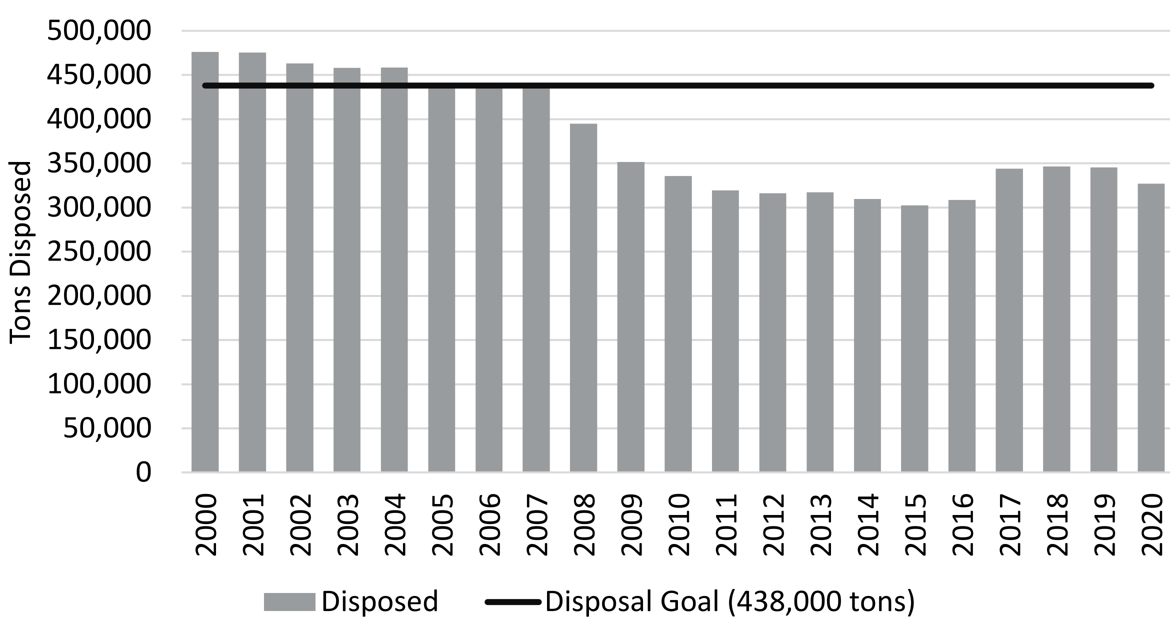
Additionally, SPU's experience managing Seattle's solid waste system for the past 10 years has demonstrated some limitations of the RPA model. Although powerful, the RPA model cannot predict every factor that may influence recycling rates, such as changes in consumer habits, new lighter-weight product packaging, or lack of markets for recyclable materials such as plastic film. As with any forecasting model, the RPA cannot predict all economic, environmental, and social factors that influence whether recommended programs are implemented. The model must rely on assumptions about factors such as program participation, efficiency, cost, and implementation timeline. While not perfect, RPA modeling results represent the best information available for Seattle's data-driven approach to solid waste planning.

Disposal Reduction Goals

Although Seattle's recycling rate goals typically receive the most attention, the City started looking beyond them to measure waste prevention by adopting a formal goal for disposal reduction in the *Zero Waste Resolution*. In addition to setting Seattle's recycling rate goals, the *Zero Waste Resolution* established waste reduction targets of keeping landfilled material below 438,000 tons per year, per the baseline year of 2006, and to reduce landfilled waste by 1% annually between the years 2008 and 2012.

According to the most recent data from 2020 (Figure 2.5), Seattle has kept landfill disposal of residential, commercial, and self-haul waste less than 438,000 tons per year since 2008, despite strong population and employment growth. During that time, newspapers declined, and plastic and other lightweight packaging proliferated. Additionally, Seattle reduced landfill tonnage by more than 1% annual on average between 2008 and 2012, meeting the target in the *Zero Waste Resolution*. A new target for landfill disposal reduction is discussed later in this chapter.

Figure 2.5 Seattle Commercial, Residential, and Self-Haul Waste Disposed



Source: Seattle Public Utilities, "2020 Annual Waste Prevention & Recycling Report."

Advantages and Limitations of the Recycling Rate

The weight-based recycling rate, the historic metric that SPU has used as its guiding beacon to drive and measure progress, has many advantages. For example, it is easy to communicate to the public and relatively easy to calculate, given that Seattle tracks disposed and recycled tons. Efforts to achieve recycling rate target drove Seattle's large advances in landfill diversion since the late 1980s (Figure 2.3, on page 2.8). The recycling rate is an important measurement that SPU uses to:

- Monitor progress of and adjust existing diversion-related services, programs, and policies
- Inform processing and disposal contracts
- Design and implement new diversion-related services, programs, and policies, especially as materials used for product packaging continue to change

Although using recycling rates goals to drive solid waste management suited the City when Seattle's recycling rate was low at 24%, over time, the solid waste management industry has come to understand the limitations of focusing solely on the recycling rate to measure success of solid waste management programs.

One of the main limitations of the weight-based recycling rate is that it does not fully measure the benefits of waste prevention activities. Consider the example of a waste prevention policy, such as a ban on phone book deliveries. The recycling rate does not measure the reduction in paper use from this ban nor its associated environmental impacts, such as greenhouse gas emissions avoided in the harvesting of trees for paper and in the manufacturing of phone books. The recycling rate not only misses key benefits of waste prevention activities, but it can also be undermined by them. The phone book ban example illustrates this point—reducing phone book deliveries also reduces the amount of paper available to be recycled, which is material weight that would have been counted toward the recycling rate goal.

Despite its limitations, the recycling rate remains a useful measurement and communications tool for solid waste programs. As a result, SPU will continue to track recycling rates for each waste sector, but SPU will not continue to use recycling rates as the primary driving metric going forward. With Seattle shifting toward a life cycle approach that emphasizes upstream waste prevention strategies, the recycling rate cannot continue to be the sole guiding consideration for program-related decision-making nor the primary data point by which Seattle measures success.

As SPU's solid waste management approach shifts upstream, SPU is adjusting its measures for success to examine reductions in waste generation as well as reductions in environmental impacts related to the production, transportation, and end-of-life management of materials. To better align goals, metrics, and targets with a greater focus on upstream strategies like waste prevention, SPU would like to focus less on hitting recycling rate targets and more on developing new measures of success for preventing waste ad minimizing environmental impacts.

Recommendation

Consistent with a life cycle view of materials and SPU's increased focus on moving toward zero waste by emphasizing waste prevention, SPU recommends the following.

Rec 02. Keep developing overarching goals consistent with waste prevention and reduction activities instead of continuing to emphasize recycling rate goals focused on diversion

SPU should update metrics used to evaluate and improve SPU services. Objectives for these expanded efforts include:

- Researching, evaluating, and identifying performance metrics that consider life cycle environmental and climate impacts of waste (not just tons managed) to evaluate the overall impact of and prioritize SPU's solid waste activities.
- Researching, evaluating, modeling, and identifying performance metrics to recommend waste prevention goals and environmental impact goals or performance metrics.

To accomplish this recommendation, SPU has begun the work of developing metrics or proposing further research of metrics to measure system-wide upstream impacts and environmental impacts described in the following sections.

SPU is focused on moving toward zero waste by emphasizing waste prevention through actions such as reducing food waste and using reusable items (Source: SPU Image Library)

Measuring Upstream Goals

Recognizing that the main performance metric that SPU has used to track progress and make decisions about program implementation—the weight-based recycling rate—is not well-suited to measure upstream strategies like waste prevention, SPU organized a symposium in 2017—*Goals, Metrics, and More: Defining Success in Materials Management Symposium.* SPU held the symposium to discuss new ways to measure performance success in the solid waste industry and identify new metrics that better measure and communicate the success of Seattle's solid waste management system.[6]

The one-day symposium included regional and national stakeholders in education, environmental consulting, government, business (grocery, retail, reuse, and technology), waste haulers, and media. The symposium provided a collaborative forum for Seattle to:

- Start a dialogue with regional and national stakeholders from across the materials management life cycle about measuring success in materials management.
- Explore options for defining success in materials management beyond a weight-based recycling rate.
- Identify possible new metrics and targets to include in SPU's *2022 Plan Update* and annual *Waste Prevention & Recycling Report.*

Based on learnings from the 2017 Symposium, research conducted by other solid waste leaders, and guidance from the Department of Ecology, which moved away from focusing on the recycling rate in 2019, SPU is working to create goals consistent with a focus on upstream activities.[7]

[6] Seattle Public Utilities, "Goals, Metrics, and More: Defining Success in Materials Management Symposium Summary Report," February 16, 2018, http://www.seattle.gov/Documents/Departments/SPU/Documents/SPUMeasurementSymposium11022017Summary.pdf.

[7] Washington State Department of Ecology, "Changes in Washington's Statewide Solid Waste Metrics – FAQ," April 19, 2019, https://www.ezview.wa.gov/Portals/_1962/Documents/Water2Resources/SWAC19-05MetricsChangesFAQ.pdf.

Per Person Residential Waste Generation and Disposal

Following the *2011 Plan Revision* and reaffirmed in its *2021–2026 Strategic Business Plan*, SPU developed residential per-person generation and disposal targets described in Table 2.3.

Table 2.3 Metrics and Targets for Residential Per Person Waste Generation and Disposal 2021–2026

METRIC	TARGET
Reduce garbage, recyclables, and organics (food and yard waste) generated per resident per day (2019 baseline)	2.11 pounds (lbs.) per person per day
Minimize residential garbage tonnage transported to landfill for disposal (2019 baseline)	0.80 pounds (lbs.) per person per day

Potential Metrics and Targets

The following sections describe metrics and potential targets for further consideration as SPU attempts to better capture the success and environmental impacts of upstream activities. Every metric has advantages and disadvantages. Choosing the optimal subset of metrics will require additional analysis. More research and evaluation are needed to identify what metrics and targets best balances SPU's needs, costs of the measurement activities, and alignment to overall goals. The scenario selected in the *2022 Plan Update* was analyzed using the RPA model and can be used to propose potential targets for some of the metrics described below.

The following sections describe potential metrics, reasons to use them, limitations, and possible targets for:

- Landfill disposal and waste generation for commercial, residential, and self-haul waste (Table 2.4)
- Landfill disposal and waste generation for C&D debris (Table 2.5)
- Reductions in food waste (Table 2.6)
- Capture and contamination rates (Table 2.7)
- Environmental Impacts (no table)

In the second half of 2022, SPU plans to start a project to research, evaluate, and if appropriate, develop the solid waste metrics and targets proposed in the *2022 Plan Update*.

Commercial, Residential, and Self-Haul Waste

The metrics for commercial, residential, and self-haul waste proposed in Table 2.4 expand on the landfill tonnage and recycling rate metrics that Seattle has used in the past to present a fuller picture of Seattle's performance in preventing waste and increasing recycling. Many of the data for the proposed metrics for commercial, residential, and self-haul waste are already available. Note that although SPU developed per person residential waste generation and disposal goals as part of the *2021–2026 Strategic Business Plan*, SPU plans, starting in the second half of 2022, to reevaluate these measurements for their suitability in measuring Seattle's waste prevention and reduction progress.

Table 2.4 Potential Metrics and Targets for Commercial, Residential, and Self-Haul Waste

METRIC	REASONS TO USE	LIMITATIONS	POTENTIAL TARGETS
Total tons landfilled (update from *Zero Waste Resolution* goal of ≤438,000 tons per year)	May measure advances in both waste prevention, recycling, and composting efforts	Sensitive to economic variables and population growth	▪ Reduce 10% from 2018 levels by 2028 ▪ Reduce 1% from the previous year
Per-employee or per $1000 B&O tax commercial tons landfilled	Less sensitive than total landfill amount to economic factors and population growth; may measure advances in both waste prevention, recycling, and composting efforts	May produce unreliable outcomes when the economy grows or shrinks quickly	N/A (more analysis is needed to determine what is the best normalizing factor)

METRIC	REASONS TO USE	LIMITATIONS	POTENTIAL TARGETS
Per-capita or per household residential landfilled	Less sensitive than total landfill amount to economic factors and population growth; may measure advances in both waste prevention, recycling, and composting efforts	May produce unreliable outcomes when the economy grows or shrinks quickly	N/A (more analysis is needed to determine what is the best normalizing factor)
Total tons generated	May measure advances in waste prevention	Highly sensitive to economic and population growth; does not measure advances in recycling and composting	▪ Less than 2.5% increase from previous year
Per-employee or per $1000 B&O tax commercial generation	Less sensitive than total generation to economic factors and population growth; may capture waste prevention efforts	May produce unreliable outcomes when the economy grows or shrinks quickly; does not measure advances in recycling and composting	N/A (more analysis is needed to determine what is the best normalizing factor)
Per-capita or per household residential generation	Less sensitive than total generation to economic factors and population growth; may capture waste prevention efforts	May produce unreliable successful outcomes when the economy grows or shrinks quickly; does not measure advances in recycling and composting	N/A (more analysis is needed to determine what is the best normalizing factor)

C&D Debris

Expanding on the C&D debris recycling rate metric used in the past, the potential metric for C&D debris in Table 2.5 presents a fuller picture of Seattle's performance using total tons landfilled and generated. For C&D debris, scaling tonnages by the dollar value of construction and demolition permits can mitigate the effect of changes in construction activity on tonnage that make it hard to compare progress year-to-year. Generally, the data for the proposed C&D debris metrics are already available.

Table 2.5 Potential Metrics and Targets for C&D Debris

METRIC	REASONS TO USE	LIMITATIONS	POTENTIAL TARGETS
Total tons landfilled	May measure advances in both waste prevention, recycling efforts	Sensitive to economic variables and population growth	▪ Reduce 20% from 2018 levels by 2028 ▪ Reduce 2% from the previous year
Total tons generated	May measure advances in waste prevention	Highly sensitive to economic and population growth; Does not measure advances in recycling	▪ Less than 11% increase from previous year
Tons generated per permit and per dollar of permit value	Less sensitive than total generation to construction activity; may measure advances in waste prevention	May be affected by the many types of construction permits that vary widely in amounts of waste generated	N/A (more analysis is needed)

Reductions in Food Waste

As a signatory to the Pacific Coast Food Waste Commitment, Seattle supports the regional commitment to reduce food waste 50% from 2015 levels by 2030.[8] Seattle is also supportive of the statewide goals recently adopted for Washington under RCW 70A.205.715 to "reduce by fifty percent the amount of food waste generated annually by 2030, relative to 2015 levels" and as part of the Use Food Well Washington Plan to "reduce at least half of edible food waste [disposed] by 2030, relative to 2015 levels."[9][10] As part of its efforts to support these state and regional goals, (Table 2.6), SPU must determine how to measure food waste, how to calculate the 2015 baseline and any changes over time, and whether to adopt specific targets related to food waste for Seattle. More on this voluntary commitment appears in Chapter 4, *Waste Prevention and Reuse*.

Table 2.6 Potential Metrics and Targets for Food Waste

METRIC	POTENTIAL TARGETS	TARGET YEARS	SOURCE
Food waste generated	Reduce food waste by 50% from 2015 levels	2030	Washington State, Pacific Coast Collaborative
Edible food waste disposed	Reduce edible food waste disposed by 50% from 2015 levels		

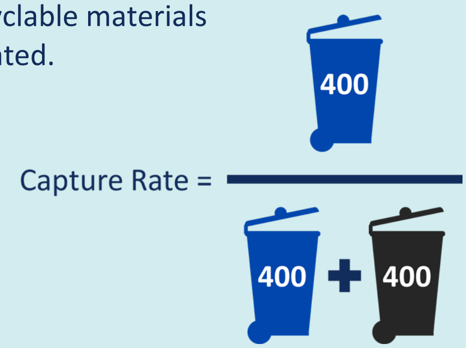
[8] https://pacificcoastcollaborative.org/food-waste/
[9] https://app.leg.wa.gov/RCW/default.aspx?cite=70A.205.715
[10] https://apps.ecology.wa.gov/publications/documents/2107027.pdf

Capture Rates and Contamination Rates

In addition, two other potential metrics that measure how well Seattle is recycling deserve more study (Table 2.7). Where the recycling rate measures how much recyclable material is recycled compared to the total amount of waste generated, capture rates measure how much recyclable material is recycled compared to the total amount of recyclable waste generated. By measuring only recyclable materials, capture rates remove the impact of changes in the type of waste generated, such as changes in packaging, to focus on how well customers separate materials currently accepted for recycling from landfilled waste. When capture rates are calculated by material, such as cardboard, and by sector, such as multifamily residential, they can better show the effect of programs for individual sectors.

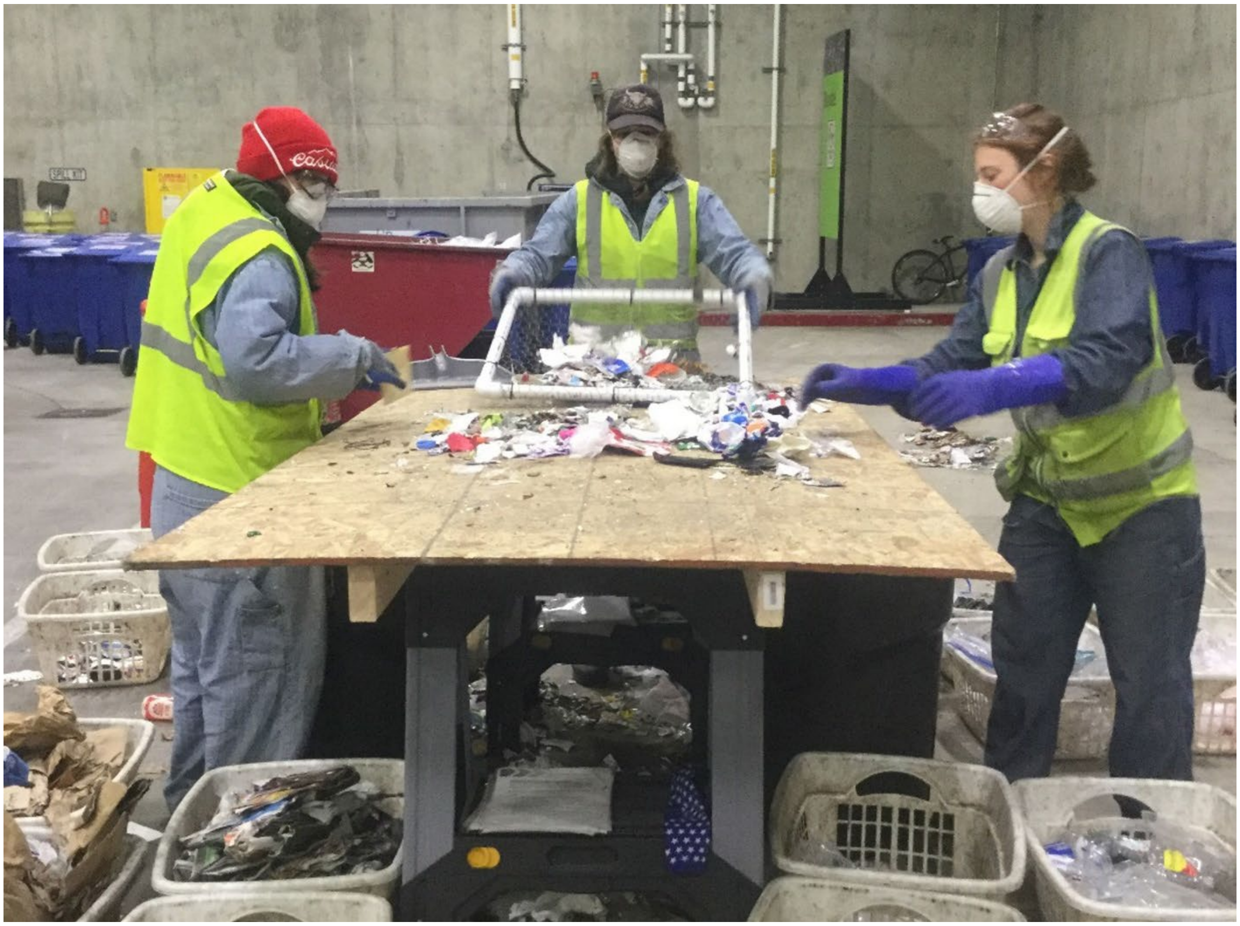
Calculating Capture Rates

The capture rate is the percentage of recyclable materials sorted for recycling compared to the total amount of recyclable materials generated.



For example, a household with 800 pounds of recyclable materials that puts 400 pounds in recycling and the other 400 pounds in garbage has a 50% capture rate.

Capture rates help measure the success of recycling programs by stripping out variables such as light-weighting of recyclable products and packaging or changes in the non-recoverable portion of waste. For example, plastic bottles (already a relatively light material) have become even lighter over time, so the recycling rate may not change even when the capture rate for plastic bottles increases. In addition, the decrease in newspapers (a relatively heavy material) can decrease the recycling rate even if people are recycling newspapers at the same or a higher rate over time. Material-specific capture rate data can also help SPU prioritize educational efforts by identifying where people excel at recycling and opportunities for recovering more of certain materials with lower recovery rates.



City contractors sort residential waste to measure capture and contamination rates (Source: Cascadia Consulting Group)

SPU designed the most recent study characterizing single-family residential waste to provide data to calculate capture rates for this sector. Data to calculate capture rates are harder to obtain for other sectors because nonresidential customers are not required to recycle using Seattle's collection contracts, from which Seattle obtains waste and recycling data.

While capture rates focus on whether customers separate accepted materials for recycling, contamination rates focus on whether customers are also placing unwanted materials in recycling containers, which increases the cost of recycling and can make some materials too dirty to recycle into new products. Residuals rates measure the amount of material collected for recycling that is ultimately landfilled. Residuals rates are affected by both contamination from customers and how effectively the recycling process properly sorts wanted recyclables. As with capture rates, data to calculate contamination and residuals rates are more available for the residential sector and harder to obtain for nonresidential sectors.

Table 2.7 Metrics for Capture and Contamination Rate

METRIC	BENEFITS	DRAWBACKS	POTENTIAL TARGETS
Capture rates by material and by sector	Provides quantitative information on specific materials that are landfilled; helpful in targeting materials for recovery	Hard to calculate as waste composition information of all three streams are needed; the definition can change with time if the list of accepted materials changes	N/A (more analysis is needed)
Contamination and residuals rates by stream and by sector	Focuses on quality of recyclables and recovered food and yard waste	May be difficult to obtain the data by sector	N/A (more analysis is needed)

Measuring Environmental Impacts

Measuring environmental impacts enables us to understand the broader impacts that Seattle's waste has on climate change, ecosystems, and human health. For 30 years, SPU has sought to examine benefits and costs that are external to its financial budget by considering greenhouse gas emissions reductions and other environmental and public health impacts when making decisions around solid waste management. For example, SPU has historically used information from life cycle assessments to prioritize which products or materials to focus on. Life cycle assessment is a technique used to quantitatively evaluate environmental impacts associated with some of (or ideally all) the stages of a product's life from raw material extraction through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recovery.

SPU's data-driven approach to planning includes modeling a wide range of environmental impacts associated with the programs SPU considers for implementation. See Appendix E, *Recycling and Environmental Benefits Analysis,* for an explanation of the models Seattle used to forecast the impacts of the recommendation in the 2022 Plan Update.

Seattle has not yet assessed environmental impacts after implementing recommendations to measure progress for several reasons. Estimating environmental impacts using this method requires the same data that are needed to calculate capture, contamination, and residuals rates. The overall level of effort to estimate environmental impacts using Seattle's method is relatively high compared to the range of uncertainty in the modeling results.

While a wide range of environmental impacts are important, Seattle and many jurisdictions have focused primarily on greenhouse gas emissions, because of their impact on climate change. The City established goals and metrics for reducing greenhouse gas emissions in the *2013 Climate Action Plan* and the *2018 Climate Action Strategy*. Citywide, the *2013 Climate Action Plan* established goals to:

- Reduce total core emissions 58% from 2008 levels by 2030
- Become carbon neutral by 2050 (based on the Paris Climate Agreement)

For solid waste, the *2013 Climate Action Plan* established goals to:

- Reduce methane emissions from landfill by 50% by 2020
- Recycle 70% commercial, residential, and self- haul waste by 2022 (based on the *Zero Waste Resolution*)

The City's current greenhouse gas emissions inventory estimates the contribution of waste from collection through disposal, focusing on end-of-life management. This inventory does not measure the full life cycle impacts of those materials during resource extraction, manufacturing, packaging, and transportation.

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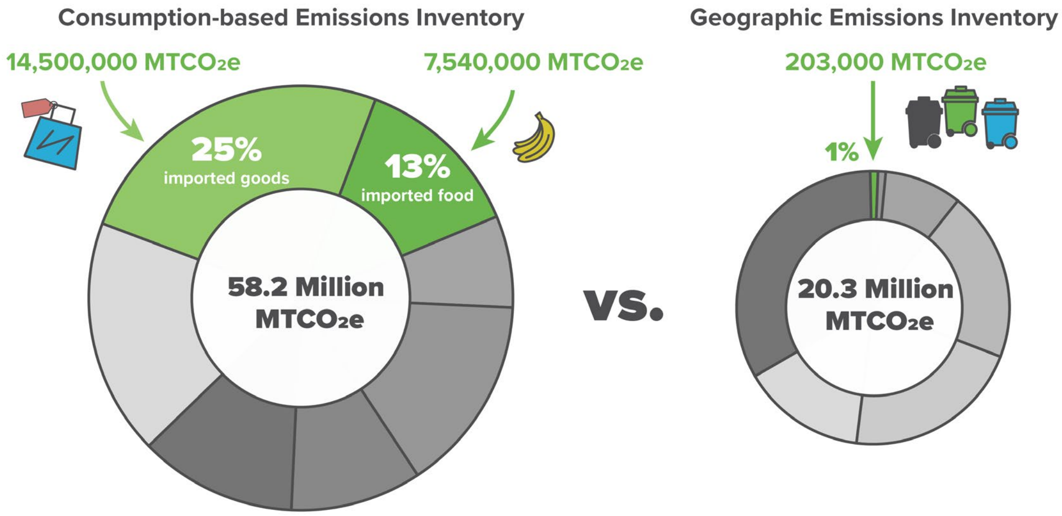
By contrast, conducting a greenhouse gas emissions inventory using a consumption-based methodology would better capture emissions associated with the whole life cycle of producing materials, including emissions from imported goods (see Figure 2.6). Measuring and tracking greenhouse gas emissions requires cooperation from many local agencies because such inventories require large-scale data sets. King County developed countywide consumption-based inventories in 2008 and 2015. Currently, Seattle is working with a team of local jurisdictions led by King County to develop a regional greenhouse gas emissions inventory that will also establish a consumption-based inventory specifically for Seattle. Such an inventory would be the first step in developing potential metrics and targets for solid waste in Seattle that measure impacts across the full life cycle of materials. Measuring the environmental life cycle impact of materials and operations could also include evaluating plastic pollution or energy use.

Figure 2.6 Consumption-Based vs Geographic Emissions Inventories



Source: Seattle Public Utilities and Cascadia Consulting Group.

Measuring the Impact of Activities and Services

In the Introduction (Chapter 1, *Development of the 2022 Solid Waste Plan Update*) SPU explained that the Solid Waste Utility plans to explore and expand the evaluation and measurement of its programs and services across all stages of the materials management supply chain. SPU will benefit from new metrics that align with the goals set in this *2022 Plan Update*. New research and future decision-making will be needed to identify, assess, and select these metrics.

Recommendation

Expanding data collection and analysis and developing future metrics will support Seattle's solid waste goals related to racial equity, safety, and affordability, so SPU makes the following recommendation:

Rec 03. Expand solid waste data analytics, metrics, and evaluation to improve assessment of services and operations

SPU should explore developing and tracking data related to:

- **Racial equity of service** such as demographic distribution of services provided and used, transfer station users, and missed collections by demographics, sector, and zip code. For example, in the multifamily sector, outreach distribution is evaluated every year to assess whether buildings of different sizes and in all geographic areas are being served. SPU evaluates whether residents living in the far north and south areas of the city are being served, as these areas have higher disadvantage in the Racial and Social Equity Index, the index used to map the city by race, English language proficiency, and socioeconomic and health disadvantages.[11] Adjustments are made to the next round of outreach based on the outcome of the evaluation.
- **Industry-standard safety metrics** to evaluate transfer station operations and contracted collectors, processors, transporters, and disposal.
- **Cost-related metrics**, including assessment of access and affordability of services and benchmarking of service costs.

[11] City of Seattle Office of Planning and Community Development, "Racial and Social Equity Index Map 2018," 2018 Accessed August 25, 2019, Race and Social Equity Index Map 2018.pdf (seattle.gov).