Improving Recycling in Washington through Producer Responsibility Policy: Costs and Benefits

Prepared for the Northwest Product Stewardship Council

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Executive Summary

Achieving a more circular economy for packaging and paper products (PPP), which represents approximately 38% of all residential waste, is a critical part of the state's efforts to reduce greenhouse gas emissions and protect Washington's economy and environment from the effects of climate change. Recycling PPP delivers substantial economic, environmental, and social benefits, including reducing climate pollution, creating jobs, and contributing to circular economic activities.

Despite increasing investments in recycling services, **less than half of all packaging and paper waste generated by residents in the state is recycled,** and the state's recycling rate has been on a declining trend since 2011.

Moreover, changes in packaging designs, shifts in consumer habits, and local recycling market disruptions have made recycling services more expensive and challenging to deliver, and **many local governments and service providers in Washington have been forced to increase residents' utility rates, cut recycling services, or both**.

> **"[EPR policy] has demonstrated the potential to simultaneously address the multiple challenges facing the State and local governments, residents, and businesses in the management of plastic and other consumer packaging and paper."**
>
> **– Recommendations for Managing Plastic Packaging Waste in Washington**

Numerous groups and studies have identified that **Extended Producer Responsibility (EPR) is the preferred policy approach for improving Washington's recycling system for packaging and paper products (PPP).**

EPR for PPP transfers the cost of recycling from households onto the companies that are responsible for placing the products and packaging on the market. This policy approach is used widely throughout Europe and Canada and across much of the developed world, and its use is growing in the U.S.

EPR for packaging and EPR for PPP policies were passed in Maine and Oregon, respectively, in 2021 and are now on the path to implementation. A number of additional state legislatures, including in California, Colorado, Hawaii, Maryland, Massachusetts, New York, Vermont, and Washington are pursuing similar policies, and legislation at the federal level was introduced in February 2020. More than 100 companies, including Nestlé, PepsiCo, The Coca-Cola Company, Unilever, and Walmart, have voiced their support for EPR.

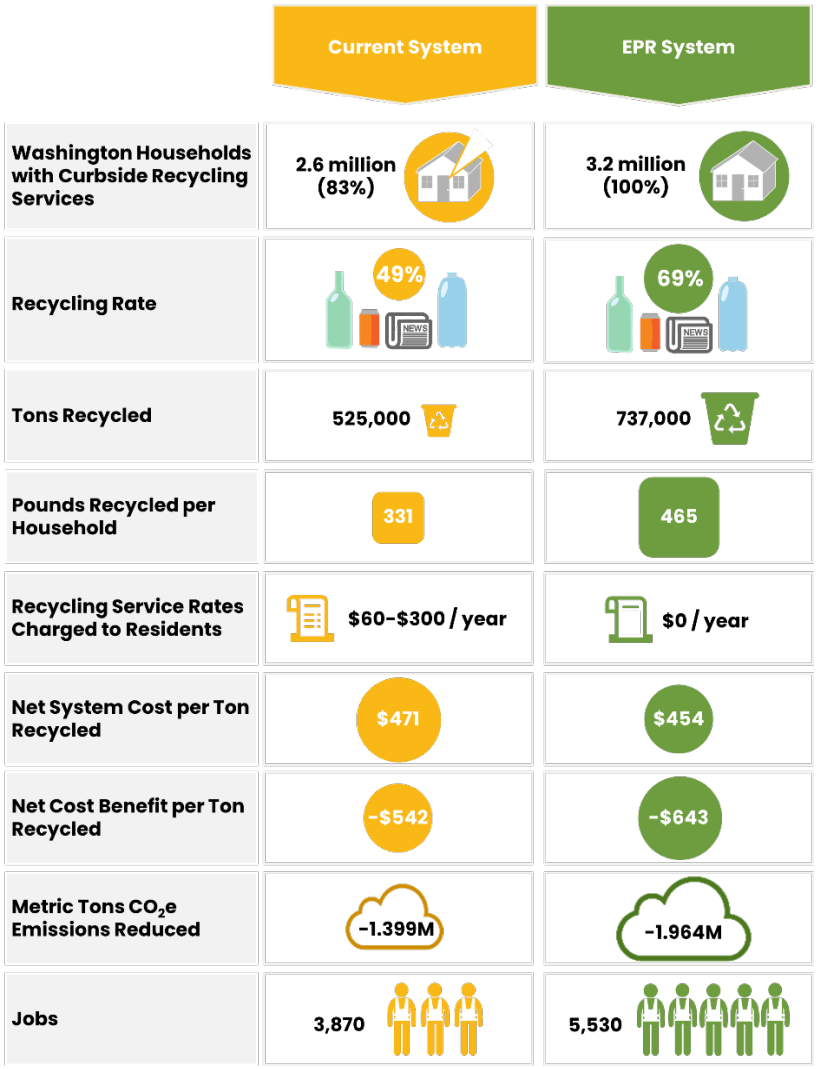
Prior research has identified that EPR for PPP policy can achieve the following outcomes:

- **Increase recycling rates for PPP materials.**
- **Provide the resources and coordination needed to modernize recycling programs.**
- **Stimulate infrastructure investments and innovation.**
- **Engage consumer product companies that have set voluntary circular economy goals.**
- **Motivate product redesign so that it is more easily recyclable.**

To better understand the potential costs and benefits of implementing an EPR policy for packaging and paper products in Washington, the Northwest Product Stewardship Council commissioned this report to provide an overview of the costs and benefits of a future system with EPR compared to the current system of recycling services provided in the state. The future system modeled and presented in this report is based on the Extended Producer Responsibility Policy Framework and Implementation Model developed for the King County Responsible Recycling Task Force and supplemented with best practice system design principles and assumptions established by the Northwest Product Stewardship Council Packaging Policy Committee.

The results for the model analysis indicate that **implementation of EPR for PPP in Washington has the potential to deliver substantial economic, social, and environmental benefits.** A summary comparison of system outcomes, costs, and benefits under current and future systems is presented in **Figure E-1**.

Figure E-1. Comparison of Current and Future System Outcomes, Costs, and Benefits



Under the modeled EPR system, Washington households are provided curbside recycling services at no cost wherever curbside garbage service is available, which **expands recycling service to an additional 360,000 households** currently without access to service and to an estimated 181,000 households, which have the option for recycling service, but do not subscribe to the service. Furthermore, **curbside collection service is complemented by a statewide system of convenient drop-off locations for collection of additional materials.**

This expansion of collection service—along with the use of a **harmonized, comprehensive list of materials collected statewide** and **additional investment in education and outreach**—as well as **additional sorting of mixed plastic bales and MRF residuals** results in **212,000 additional tons of materials recycled** – a **40% increase in the recycling rate of PPP** materials, from 49% to 69%, assuming no adjustments in packaging designs and no changes to the distribution of packaging types supplied into the state. Additional gains could be achieved through design changes to increase recyclability and reuse of packaging and paper products, but those potential EPR system benefits are not included in the future system modeled for this report.

Rates charged to households for recycling service under the current system, which range between $60 and $300 per year under the current system, **are eliminated**, as—under EPR policy—a producer responsibility organization reimburses local governments and service providers for these services instead.

While the overall cost of the residential recycling system for the statewide system necessarily increases under the future system with EPR due to the expansion of services and investments in sorting infrastructure, the recycling system becomes more efficient and effective, and the **net cost per ton recycled falls from $471 to $454**. Efficiency within the recycling system increases as a result of economies of scale, fleet optimization and increased capture through coordinated education.

EPR also delivers benefits in the form of **over 1,650 additional jobs created** and a resulting **additional $207 million contributed to Washington's economy measured in GDP** through increased spending associated with the additional direct, indirect, and induced jobs created.

The environmental benefits of the additional recycling achieved under EPR include **565,000 $MTCO_2e$ of additional avoided GHG emissions**. The monetary benefit associated with these additional avoided emissions translates to an **additional $42.4 million in social costs of climate pollution avoided**.

Accounting for all of these factors, the current system of residential recycling already delivers a net societal benefit of $542 per ton of PPP material recycled. **Under the future system modeled with EPR, the net societal benefit increases to $643 per ton.**

Contents

1.0 Introduction

Washington state policymakers, government agencies, organizations, businesses, and residents are working together to reduce greenhouse gas emissions and protect Washington's economy and environment from the effects of climate change. Transitioning to a more circular economy is an essential element of these efforts. Reducing waste, increasing recycling and reuse, and managing materials through more accessible, equitable, and just systems are critical to this transition.

In Washington and elsewhere, state lawmakers, local governments, and the public have turned their attention to achieving a more circular economy for packaging and paper products (PPP), which represents approximately 38% of all residential waste generated in the state.[1] Recycling PPP delivers substantial economic, environmental, and social benefits, including reducing climate pollution, creating jobs, and contributing to circular economic activities.[2]

Although recycling systems for many types of packaging and paper are already widely established in Washington, **less than half of all packaging and paper product waste generated by residents in the state is recycled.** Despite increasing investments in recycling services on the part of local government and service providers, the state's recycling rate has been on a decreasing trend since 2011.[3]

Moreover, changes in packaging designs, shifts in consumer habits, and local recycling market disruptions have made recycling services more expensive and challenging to deliver, and **many local governments and service providers in Washington have been forced to increase residents' utility rates, cut recycling services, or both**.

> **"[EPR policy] has demonstrated the potential to simultaneously address the multiple challenges facing the State and local governments, residents, and businesses in the management of plastic and other consumer packaging and paper."**
>
> **– Recommendations for Managing Plastic Packaging Waste in Washington**

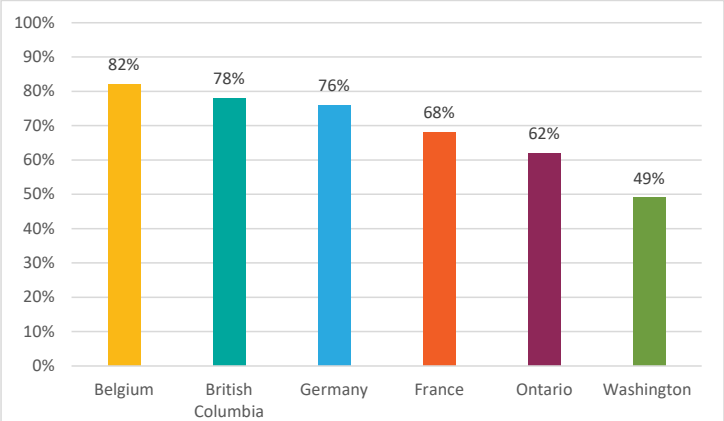
Several groups have been convened and studies commissioned to explore policy solutions and have identified that **Extended Producer Responsibility (EPR) is the preferred policy approach for improving recycling system outcomes for PPP**.[4,5,6] EPR for PPP transfers the cost of recycling from households onto the companies that are responsible for placing the products and packaging on the market. This policy approach is used widely throughout Europe and Canada and across much of the developed world, and its use is growing in the US.

The EPR for PPP policy framework developed for the King County Responsible Recycling Task Force identified the following outcomes of implementing an EPR for PPP policy:

- **Increase recycling rates for PPP materials.**
- **Provide the resources and coordination needed to modernize recycling programs.**
- **Stimulate infrastructure investments and innovation.**
- **Engage consumer product companies that have set voluntary circular economy goals.**

As shown in **Figure 1**, jurisdictions with EPR systems in place elsewhere are achieving significantly higher PPP recycling rates compared to Washington. Many organizations and associations now identify EPR as the policy approach needed to ensure there is sustained sufficient investment over the long term to enable packaging to be collected, processed and fed back into the production of new products and packaging. Organizations such as the US Plastics Pact,[7] the World Wildlife Foundation,[8] the Ellen MacArthur Foundation,[9] and the American Beverage Association[10] have identified EPR as the linchpin for creating a circular economy. More than 100 companies, including Nestlé, PepsiCo, The Coca-Cola Company, Unilever, and Walmart, have also voiced their support for EPR to increase recycling rates and generate materials needed to achieve recycled content goals.[11]

Figure 1: PPP Recycling Rates in Areas with EPR Compared to Washington



Source: Washington State Department of Ecology, "Successful Plastic Packaging Management Programs and Innovations" 2020, https://apps.ecology.wa.gov/publications/documents/2007025.pdf

Statewide EPR for packaging and EPR for PPP policies were passed in Maine and Oregon, respectively, in 2021 and are now on the path to implementation. A number of additional state legislatures, including in California, Colorado, Hawaii, Maryland, Massachusetts, New York, Vermont, and Washington are pursuing similar policies, and legislation at the federal level was introduced in February 2020.

To better understand the potential impacts of implementing an EPR policy for PPP in Washington, the Northwest Product Stewardship Council commissioned this report to provide an overview of the costs and benefits of a future system modeled with EPR compared to the current system of recycling services. The future system model is based on the policy framework established in the Extended Producer Responsibility Policy Framework and Implementation Model developed for the King County Responsible Recycling Task Force and supplemented with best practice system design principles and assumptions established by the Northwest Product Stewardship Council Packaging Policy Committee.[12] A summary of the policy framework, design principles, and assumptions used in the model is provided in Section 3.1.

This report provides an accounting and comparison of the following factors under the current system, and in a future system where EPR is in place in Washington:

- Access to residential recycling services for PPP materials.
- Recycling rates for PPP in the residential sector.
- Total costs and financing, including rates charged to Washington households for residential recycling service.

- Economic, social, and environmental benefits generated from recycling activities—including jobs created and associated economic contributions, GHG emissions reductions and associated social costs of climate pollution avoided.

A technical appendix is also available as a separate document with detail on the data sources, assumptions, and calculation methodologies for all system outcomes, costs, and benefits estimated and presented in this report.

2.0 Current System

2.1 Residential Recycling Services Overview

2.1.1 Responsibility for Residential Recycling Service Provision

Under current Washington state law, there is no statewide mandate for residential recycling services. However, local governments must consider and plan for the collection of at least a basic set of paper, metal, glass, and plastic materials from residents to the extent determined feasible within each county as part of their solid waste management plan (SWMP).[13]

Counties are responsible for overall planning and oversight of residential recycling services and education in their jurisdictions, including designating the minimum list of recyclable materials to be collected and determining which types of recycling services are to be provided to residents.[14] These services may include curbside recycling collection or permanent drop-off collection facilities. The nature and extent of recycling services required to be available to residents varies widely from county to county, influenced by geographic factors, population density, the presence of regional service providers and infrastructure, among other factors.

Incorporated cities and towns may choose to take responsibility for residential recycling programs in their jurisdictions, either through direct municipal collection or by contracting for service from a private collection service provider.[15] Of the 29 cities and towns that provide direct municipal collection of garbage, 10 also choose to provide direct municipal collection of residential recycling, providing service to approximately 8% of all households in the state. Another 86 of Washington's 281 cities and towns choose to provide residential recycling through contracted service. These jurisdictions include approximately 43% of all households in the state, some of which offer opt-in services so not all households subscribe to a service.

Cities that choose not to take responsibility for residential recycling services then fall under county jurisdiction. Counties are also responsible for overseeing delivery of residential recycling services in unincorporated areas where it has been designated to be provided. Counties can opt to contract for residential recycling services directly but currently only one county (Clark) has elected to exercise this option for providing residential recycling to households in areas under its jurisdiction, covering approximately 3% of all households in the state.

In most areas under county jurisdiction where residential recycling service has been designated, residential recycling collection services are provided by private solid waste collection companies under a system regulated by the Washington Utilities and Transportation Commission (WUTC).[16] Approximately 37% of state households have access to residential recycling service provided by WUTC-regulated collection service providers.

Table 1 presents the count of jurisdictions and corresponding percent of state households covered under each type of service provision. See the Section A.1.1.1 in the Appendix for details and data sources related to types of service providers and numbers of households served.

Table 1: Percent of Households Covered by Jurisdiction

		Muni Recycling	Contract Recycling	UTC Recycling	No Recycling	Total
Cities and Towns	Muni Garbage	10	6	1	12	**29**
		8%	*0*	*1%*	*1%*	***12%***
	Contract Garbage	-	76	-	25	**101**
		0%	*40%*	*0%*	*1%*	***40%***
	UTC Garbage	-	7	63	81	**151**
		0%	*1%*	*9%*	*3%*	***13%***
	Count	**10**	**89**	**64**	**118**	**281**
	% of state HHs	***8%***	***43%***	***10%***	***4%***	***66%***
Unincorporated Areas	**Count**	**-**	**2**	**18**	**19**	**39**
	% of state HHs	***-***	***3%***	***27%***	***5%***	***0***
All Areas	**Count**	**10**	**91**	**82**	**137**	**320**
	% of state HHs	***8%***	***46%***	***37%***	***9%***	***3,170,916***

2.1.2 Access to Residential Recycling Services for PPP

In most large urban areas, curbside recycling services are available to single- and multifamily residents, either as a universal service provided alongside (and paid for through) garbage collection service (embedded), a mandatory subscription service, or an optional subscription service.

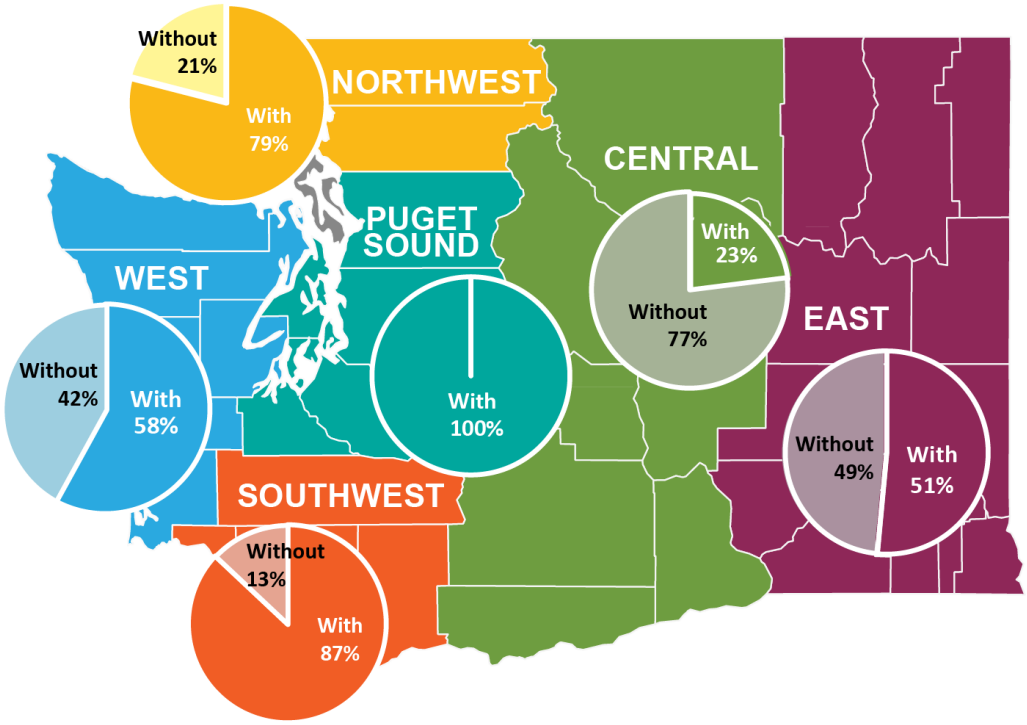
However, access to curbside recycling collection service is not universal, even in urban areas, and the degree of access is not consistent statewide. Although virtually all 3,170,900 Washington households have access to curbside garbage service, as of 2017, over 360,000 households in Washington (9% of single family and 15% of multifamily) do not have any access to curbside recycling service.[17] This includes the entire residential population of 11 counties, and all residents of unincorporate areas in six counties.[18] Another 323,000 households (10% of both single- and multifamily) have access on an

optional subscription basis only and it is estimated that only [141,000] of these households subscribe.[19] In total, 83% of households are estimated to have curbside recycling service.[1]

Residents who do not have access to curbside recycling collection—or, where it is optional, choose not to subscribe—must self-haul recyclable materials to transfer stations or other publicly provided drop-off locations in order to participate in recycling. The relative convenience of these drop-off collection locations for residents varies widely.

Access to curbside recycling service in each of Washington's six waste generation regions are shown in Figure 2.[20]

Figure 2: Percent of Households with Curbside Recycling Services



The type and level of curbside recycling services provided to households varies from jurisdiction to jurisdiction with respect to the collection methodology, frequency of collection, and the materials collected. All of these factors impact the quantity and quality of PPP collected for recycling, and the cost of collection services. Also of note, a number of jurisdictions in Washington have changed their

[1] A subscription rate of 25% was assumed for SF households in areas where curbside recycling service is optional. In the East and Northwest regions, this rate was increased, increasing the total number of households with service in the region. This was done to keep the tons per household collected by curbside serviced households in both regions within orders of magnitude of the tons per household generated in the other five regions.

accepted materials lists in recent years—some including cuts to the types of PPP accepted—following the implementation of China's National Sword/Blue Sky policies and the increasing costs of recycling programs incurred as a result of associated recycling market challenges.[21]

A comprehensive accounting of the types of residential recycling collection services available and materials collected across Washington jurisdictions is provided in *The State of Residential Recycling and Organics Collection in Washington State*, published by Zero Waste Washington in 2019.[22] Additional details are documented in *Plastic Packaging in Washington: Assessing Use, Disposal, and Management*, prepared for the Washington State Department of Ecology in 2020.[23] A description of how data from these studies were used in the modeling conducted for this report is presented in Section A.1.1.3 in the Appendix.

2.1.3 Sorting and Marketing of Recyclable PPP Materials

Most recyclable materials collected through residential recycling services flow through one of eight primary materials recovery facilities (MRFs) in the state that handle residential recyclables and are sorted into marketable commodities.

Municipalities work with their haulers or MRFs to determine what materials to collect. MRFs decide what commodities to produce based on market conditions and cost-benefit analysis weighing up the cost to sort a material given its prevalence in the stream against the market value. [24]

Once sorted, recyclable commodities are sold to buyers under confidential arrangements made by the MRFs. Because of the private nature of these transactions, relatively little documentation is accessible about the flow of material and end markets for recyclable PPP collected from residents. Materials that are not effectively captured as recyclable commodities through sortation are considered residuals and disposed as solid waste.

More information about the primary MRFs and other aspects of the sorting and marketing system for residential PPP materials in Washington are documented in two recent reports published by King County.[25,26]

2.2 PPP Generated, Disposed, and Recycled

It is difficult to accurately estimate the amount and types of packaging and paper products generated in the state. In jurisdictions with EPR systems for PPP, producers are typically required to report on the amounts and types of PPP supplied annually. But such a reporting requirement is not currently in place in Washington and producers generally do not disclose it voluntarily. In the absence of producer-reported data, this report presents data related to "downstream" management activities (i.e., recycling, composting, and disposal) to estimate the total amount of PPP generated annually in

the state. This type of estimation of PPP generation has been used for preliminary planning purposes in advance of implementation of EPR in other jurisdictions and has shown to be reasonably accurate.[2]

Table 2 shows the estimated tons of each PPP material category generated, disposed, and recycled in Washington, along with the estimated recycling rate for each material category and for PPP overall.[3] 2017 data has been used for this report as it is the most recent dataset published by Washington state. A description of how these estimates were calculated is presented in Section A.1.1.2 in the Appendix.

[2] It is important to note, however, that there are some important limitations to this approach that may result in over- or underestimation of the quantity and composition of PPP generated, with particular impacts on certain material categories. Where relevant, these are noted and described in subsequent footnotes.

[3] In this report, the quantity "recycled" is defined as the quantity sold by the sorting facility to a reprocessor. This is not the same as the quantity collected for recycling. Sorting facility inefficiencies can result in material either being lost to residuals or flowing through to other material streams. For example, a study of material flows at MRFs serving King County found that approximately 10% of PET bottles collected for recycling either end up in residues or in other material bales and therefore not included in tons reported as recycled. The actual quantity of material recycled will be less than the amount sold to a reprocessor, as additional contaminants will be removed and some yield loss will occur at the reprocessor. However, for the purposes of this study, the sorting facility outputs are used as the point of measurement to calculate the recycling rate, which calculated as the total quantity of a given material category sold by sorting facilities to reprocessors divided by the total quantity generated.

Table 2: Tons of Residential PPP Generated, Disposed and Recycled 2017

PPP Material Category	Tons Generated	Tons Disposed	Tons Recycled	Recycling Rate
All Plastics	**193,080**	**158,780**	**30,580**	**16%**
Rigid & Foam Plastic Packaging	**120,880**	**90,280**	**26,880**	**22%**
#1 PET Bottles	**34,100**	**21,900**	**12,200**	**36%**
#1 PET Other Packaging	**20,000**	**17,500**	**2,500**	**13%**
#2 HDPE Natural Bottles	**9,700**	**6,200**	**3,500**	**36%**
#2 HDPE Colored Bottles	**12,800**	**8,700**	**4,100**	**32%**
# 2 HDPE/#4 LDPE Other Packaging	**4,670**	**3,670**	**960**	**21%**
#5 PP Packaging	**13,000**	**10,100**	**2,900**	**22%**
Other Rigid Plastic Packaging	**7,410**	**7,010**	**420**	**6%**
Polystyrene Foam Packaging	**13,300**	**13,000**	**300**	**2%**
Plastic Composite Packaging	**1,800**	**1,800**	**0**	**0%**
Compostable Plastic Packaging	**4,100**	**400**	**0**	**0%**
Plastic Film & Flexible Packaging	**72,200**	**68,500**	**3,700**	**5%**
PE Plastic Bags & Film	**21,600**	**17,900**	**3,700**	**17%**
Other Film & Flexible Packaging	**50,600**	**50,600**	**0**	**0%**
Steel	**25,300**	**15,400**	**9,900**	**39%**
Aluminum	**37,100**	**16,800**	**18,900**	**53%**
Paper	**683,000**	**298,900**	**384,100**	**56%**
Newspaper	**206,890**	**67,725**	**139,165**	**67%**
Cardboard	**220,812**	**72,703**	**148,109**	**67%**
Cartons	**3,928**	**3,895**	**33**	**1%**
Mixed Paper	**251,414**	**154,550**	**96,864**	**39%**
Glass	**129,400**	**48,200**	**81,200**	**63%**
Total	**1,067,900**	**538,100**	**524,700**	**49%**
Total lbs. per household			***331***	

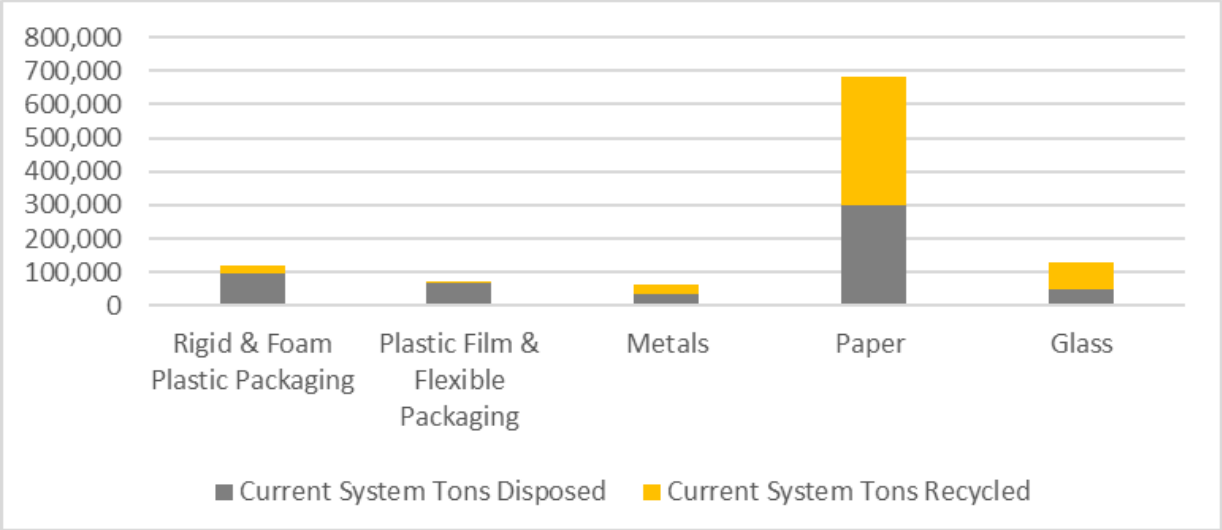
Source: Washington Department of Ecology Waste Generation and Recovery Data (2017), Cascadia Statewide Waste Characterization (2015-2016), Eunomia Modeling

Overall, less than half (49%) of all residential PPP materials are recycled, and the recycling rates for different PPP materials range from 5% for flexible plastic packaging to 63% for container glass.[4] For flexible packaging specifically, roughly 87% of what is recycled is collected through store take back programs. Paper packaging and products make up nearly two-thirds of the PPP generated and account for nearly three-quarters of all PPP tons recycled in the state, achieving an estimated recycling rate of 56%. The recycling rates for aluminum and steel packaging, both readily recyclable and valuable commodities, are 53% and 39%, respectively. Together, these metals account for approximately 6% of all PPP tons generated and 5% of PPP tons recycled. Plastics represent approximately 18% of all PPP tons generated but only 6% of tons recycled, and plastic PPP is recycled at a rate of 16% overall. The majority of this is PET, which has a recycling rate of 36%.

Figure 3 illustrates the tons recycled and recycling rate achieved for each material category under the current system. For example, 56% of the 683,000 tons of paper generated is recycled.

[4] Because the estimates presented here are based—in large part—on data from disposed waste characterization studies, the estimates for quantities disposed of many PPP material categories are likely overestimated due to the impacts of collection for disposal, such as the presence of moisture and contamination from food and other materials in sampled PPP materials. This is especially true for packaging formats that are highly absorbent and/or susceptible to contamination from food or other debris, such as paper, as well as flexible plastic packaging. The result of this is an estimated recycling rate that is likely lower than the rate would be if more accurate generation data were available. Conversely, the quantity of glass packaging disposed is likely underestimated, as glass is often pulverized into shards and dust during collection and compaction prior to disposal and, as a result, not captured in the glass category in waste characterization studies. The result of this is an estimated recycling rate that is likely higher than the actual rate.

Figure 3: Tons Disposed and Recycled in Current System by Material Type with Recycling Rates



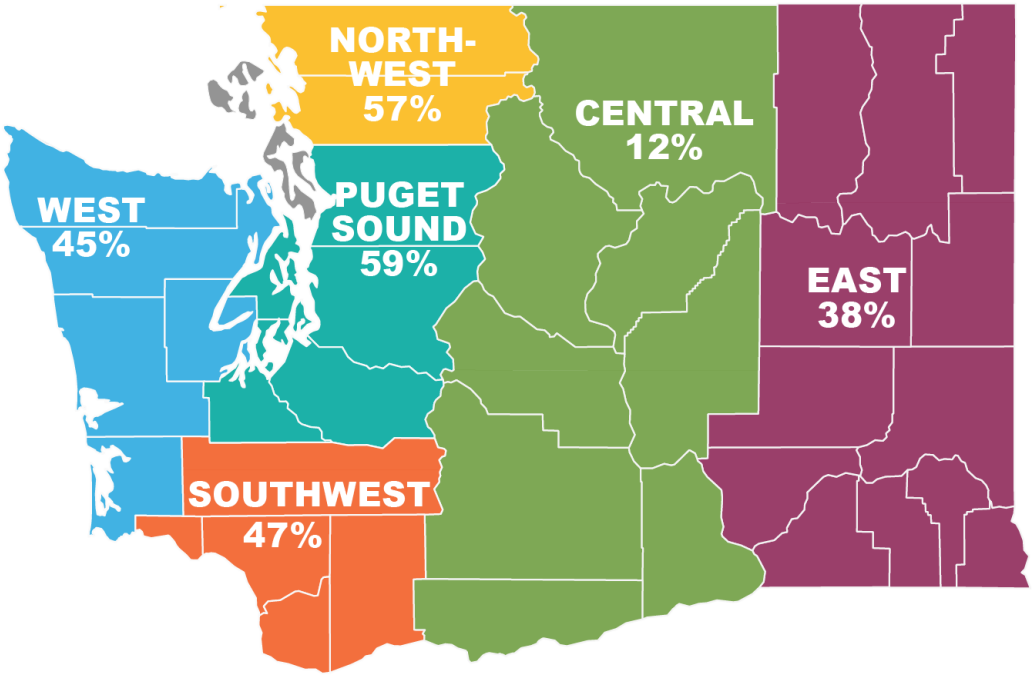
Source: Washington Department of Ecology Waste Generation and Recovery Data (2017), Cascadia Statewide Waste Characterization (2015-2016), Eunomia Modeling (2020)

The recycling rates for PPP also vary across the different regions. Figure 4 shows the PPP recycling rate in each region of Washington State.

These regional differences can be partly explained by differences in access to curbside collection services, as well as by different levels of acceptance of certain PPP materials in different regions. While a basic set of PPP materials are included in virtually all curbside recycling collection programs (PET and HDPE bottles, aluminum and steel cans, paper and cardboard), many others are collected only in certain geographic areas with better access to sorting facilities and reprocessors, and where market conditions are more favorable for recycling (such as glass bottles and jars, aluminum trays and foils, aerosol cans, polypropylene containers, PET thermoforms and other types of non-bottle plastic packaging). Drop-off collection services provide recycling access to residents without any form of curbside collection and some drop-off programs—both public and private—accept certain recyclable materials not included in curbside programs, such as plastic film and other flexible plastic packaging, but these services typically do not stimulate the same level of participation as curbside collection.

Regional differences may also be influenced by the reach and effectiveness of education activities as well as demographics or consumption patterns among households. Lack of data on these factors make it impossible to fully analyze the underlying causes of differences in recycling outcomes.

Figure 4: PPP Recycling Rates by Region



2.3 Current System Costs and Financing

2.3.1 System Costs for Residential Recycling of PPP

System costs for residential recycling of PPP in Washington include the costs to collect, transfer, and sort materials collected through residential recycling programs, net of the material revenues generated from the sale of recyclable PPP commodities, as well as the costs associated with disposal of MRF residuals and the costs associated with management, supervision, administration, overhead and profit, and taxes paid on service-related activities.

To estimate these costs, Eunomia drew on existing data sources and also gathered additional data on service costs and operations from select jurisdictions within Washington. A detailed description of the data sources, assumptions applied, and methodology used to calculate system costs is provided in Section A.1.2 in the Appendix.

The estimated cost of recycling 49% of residential PPP in Washington is presented in Table 3 and broken down into more detail in Section A.1.2 in the Appendix. Residential collection accounts for 69% of the gross total system cost. The gross cost of recycling residential PPP in Washington is $267M and the net cost—when material revenues are included—is $247M.

Table 3: Current System Costs for Residential Recycling of PPP in Washington

Cost Element	Current System Cost
Total Cost per Year	**$247,118,000**
Total Cost per Ton Recycled	**$471**

Source: Eunomia Modelling, Data from the cities of Enumclaw, Olympia, Tacoma, Spokane and Vancouver, Washington Department of Ecology Landfill fees, CSSA Annual Cost Reports, Correspondence with Washington MRF Haulers, Correspondence with Washington MRF Operators, RecyclingMarkets.net

2.3.2 Financing and Household Rates for Residential Recycling

Under the current system, residential recycling collection is generally financed through solid waste collection service rates paid by residents through utility bills issued either by local governments or by private collection service providers. The costs and financing structures differ depending on whether service is provided directly by cities that operate municipal collection, through contracted service, or by private collection service providers under the system regulated by the WUTC.

Financing and household rates under municipal and contracted service

Among cities and towns that provide residential recycling service to their residents, the most common approach has been to embed the costs of recycling collection service in garbage service rates and/or tipping fees, with no visible charge to residents for recycling service. An analysis of recycling services costs under embedded rate structures conducted on behalf of King County in 2020 found that residents receiving curbside recycling service under these arrangements across the state tend to

range between $60 and $120 per year for recycling.[27] In Seattle, the average single-family household pays approximately $96 per year, which accounts for approximately 20% of the bundled rate charged for garbage and recycling collection service.[28]

Historically, recycling service costs under embedded rate structures have been at least partially offset by commodity revenues. However, market values of recyclable PPP materials dropped significantly in the last several years due to the global market shifts and import restrictions initiated by China in 2018.[29] In addition, costs for material processing and residuals have risen due to a combination of lightweighting and other shifts in the packaging mix, as well as increasing prevalence of contamination in the recycling stream.[30]

In response to these trends, a number of cities that have historically used embedded rate structures have recently begun charging visible "recycling surcharges" to residents for curbside recycling service. In King County, these surcharges range between $0.76 and $2.26 per month.[31] In Tacoma, a $2.82 per month recycling surcharge was added to residential utility bills beginning in 2020. Some cities have so far avoided passing along the rising costs of recycling service to residents in the form of visible fees but may instead be required to increase residential rates for garbage service in subsequent rate adjustments if no changes are made to the approach to financing recycling for PPP materials. Cuts to residential recycling service, in place of or in addition to increases in residential rates, may also be used by cities as a means to contain costs.

Financing and household rates under WUTC-regulated service

In areas where residential recycling is available under WUTC-regulated service, it is offered on a subscription basis for a separate monthly rate using a rate calculation specified and reviewed by the WUTC, based on the service requirements established in the relevant Solid Waste Management Plan. In some areas, subscription is mandatory for all customers, meaning that all residents who subscribe to curbside garbage service must also subscribe to residential recycling service. In other areas, recycling service is required to be offered but subscription is optional.

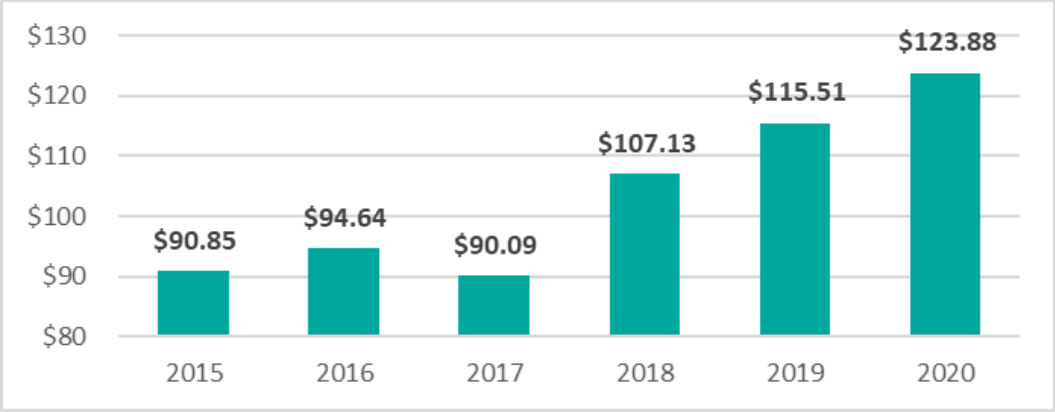
Mandatory subscriptions are in place for approximately 1,102,000 households (68%) with WUTC-regulated recycling service. This means that, under the current system, most residents in WUTC-regulated areas must pay directly for the full costs of recycling and bear the full impact of market fluctuations and escalating processing costs. They have virtually no recourse for addressing the rate increases experienced in recent years.

Optional subscriptions are available to approximately 209,000 households (13%) in WUTC-regulated areas. The WUTC does not track the subscription rate for optional services, but anecdotal data suggest that subscription rates for optional service are relatively low, in part due to the relatively high costs of service in these areas.[32]

Rates charged to households under WUTC-regulated service include a service fee representing the gross cost of collection, with separate credit/debit representing the net value/cost generated from recyclables collected (i.e., commodity value of materials recycled net of processing costs).

As shown in Figure 5, average rates charged to residents in WUTC-regulated areas for curbside recycling service, net of the commodity debit/(credit), increased by 36% between 2015 and 2020. This increase has largely been driven by the change in the commodity debit/(credit), which represented an average net credit of $11.75 per year for households in 2015, reducing the total rate charged to residents. The dramatic changes in markets and declines in commodity values transformed the net credit into an additional charge to residents starting in 2018. By 2020, the net debit represented an average annual charge of $14.85, added onto the base service rates charged to residential customers. The combined average annual rate, including both the base service rate and the commodity debit, charged to residents under WUTC-regulated service in 2020 was $123.88.[33]

Figure 5: Average Annual Cost to Residents for Recycling Service in WUTC-Regulated Areas



2.4 Economic, Social, and Environmental Benefits

2.4.1 Jobs

A benefit of recycling is its impact on job creation and greater stimulation of associated economic benefits relative to disposal. The majority (86%) of all U.S. jobs from managing our discards come from recycling activities, even though we only recycle about one-third of tons discarded.[34] Recycling creates an average of ten times more jobs than landfills and incinerators (per ton of material handled).[35] Local and state governments often cite the jobs benefits of recycling as a rationale for waste diversion requirements and regulations.

Jobs directly associated with the current residential recycling system for PPP materials include those related to collection operations, collections support and management, management of drop-off sites, and material sorting at MRFs. To estimate the number of jobs associated with the current system, Eunomia used data provided by cities, municipalities and their contractors as well as sorting facility published and provided data to calculate jobs per 1,000 tons recycled by activity and role, e.g., management and administration, engineer, collections staff and supervisors, vehicle maintenance teams etc.

As with all economic activities in the state, direct employment related to residential recycling produces ripple effects through the economy, which create additional benefits, including indirect and induced jobs.[36] Indirect jobs can be created through activity associated with the actual functioning of the system (e.g., a recycling plant purchasing processing equipment, supporting jobs in the vehicle manufacturing sector). Induced jobs are those supported by the wages from direct and indirect jobs created through recycling. For example, induced jobs may result from spending by recycling workers such as buying lunch, which supports jobs outside of the recycling industry. A detailed description of the data sources, assumptions applied, and methodology used to calculate jobs associated with the current system is provided Section A.1.3 in the Appendix.

The estimated direct, indirect and induced jobs associated with the current system are presented in Table 4. 1,502 full-time equivalent (FTE) resources are estimated to be employed in jobs directly related to service delivery, with a further 2,373 indirect and induced FTE employees, for a total of 3,874 jobs created across the state.

Table 4: Direct, Indirect and Induced Jobs Associated with the Current Residential PPP Recycling System

Job Category	Jobs from Current Residential PPP Recycling System
Direct	
Curbside Collections Operations	773
Collections Support & Management	288
Drop-off Operations	22
Sorting	419
Subtotal direct	1,502
Subtotal indirect and induced	2,373
Total	**3,874**

Source: Eunomia, U.S Economic Policy Institute (2019), Bureau of Economic Analysis

2.4.2 Economic Contribution of Residential Recycling Activities

Gross value added (GVA) is the measure of the overall economic contribution of a given industry or sector of an economy. For this report, Eunomia used an income-based approach to estimate the GVA, which sums up all of the income earned by individuals or businesses involved in the production of goods and services. The income is estimated from the number of direct, indirect, and induced jobs associated with residential recycling activities in Washington under the current system (as shown above in Section 2.4.1), combined with data on prevailing wages for the job categories covered. A detailed description of the data sources, assumptions applied, and methodology used to calculate GVA associated with the current system of residential recycling in Washington is provided in Section A.1.4 in the Appendix.

The total direct GVA to the Washington economy resulting from the current residential PPP recycling services is over $200M with a further $297M of indirect and induced GVA, some of which will stay within Washington, as shown in Table 5.

Table 5: Direct, Indirect and Induced GVA Generated from Jobs Associated with Current Residential PPP Recycling Services

GVA Category	GVA from Current Residential PPP Recycling System
Direct GVA	$201,129,000
Indirect GVA	$166,412,000
Induced GVA	$129,335,000
Total Economic Contribution of Recycling Activities	**$496,875,000**

Source: Eunomia, Indices from Economic Policy Institute (2019), Bureau of Economic Analysis, Institute for Scrap Recycling Industries (2017)

2.4.3 GHG Emissions Reductions and Social Costs of Climate Pollution Avoided

Another benefit of recycling is the reduction of greenhouse gas (GHG) emissions associated with PPP materials when recycled compared to when disposed. While there are benefits in reducing the amount of biodegradable waste that is landfilled, the majority of GHG emissions reductions associated with recycling result from recycled material displacing the use of virgin materials in manufacturing of products.

To estimate the quantity of GHG emission reductions associated with PPP materials recycled under the current system, Eunomia used the WARM model developed by the U.S. EPA for this purpose.[37]

A value of $75 per $MTCO_2e$ was then applied to the WARM model output to represent the social cost of climate pollution. The social cost of climate pollution is an estimate, in dollars, of the economic damages that would result from emitting one additional ton of GHG into the atmosphere.[5] The estimated social cost of emissions used for this report was produced by the Interagency Working Group on Social Cost of Greenhouse Gases and adopted by the WUTC to represent the broad array of economic and social damage (i.e. climate change and associated social instabilities) caused by carbon and other GHG emissions. [38] The resulting value represents the social benefit of avoided GHG emissions associated with recycling of PPP materials under the current system.

The $MTCO_2e$ avoided from the current residential PPP recycling activities in Washington is 1.4M a year, which is the equivalent of taking more than 297,000 vehicles off the road. The monetary translation of that benefit is estimated to be an annual savings of approximately $104,910,000.

[5] The monetized damages include (but is not limited to) changes in net agricultural productivity, human health, property damages from increased flood risk, and the value of ecosystem services due to climate change.

2.5 Current System Costs and Benefits Summary

Table 6 provides an overarching view of the cost benefit of the current system for recycling residential PPP materials in Washington. Disposal costs are the costs associated with landfilling and incinerating PPP in the state. This is a cost borne by residents through solid waste rates under the current system and decreases under the future system as more material is captured for recycling. Table 6 shows that for every ton recycled, there is a net societal benefit of $542.

Table 6: Net Cost Benefit of Current Residential PPP Recycling System in Washington

Cost Category	Cost of Current Residential PPP Recycling System
System Costs	$317,492,000
Disposal Costs	$70,374,000
Monetized Cost of Carbon	-$104,910,000
Economic Contribution of Recycling Activities	-$496,875,000
Total Net	**-$284,293,000**
Net Benefit per Ton Recycled ($)	**-$542**

Source: Eunomia, EPA Warm Model v15, Indices from Economic Policy Institute (2019)[39], Bureau of Economic Analysis[40]

A summary of the environmental and social benefits is provided in Table 7.

Table 7: Environmental and Social Benefits of Current Residential PPP Recycling System in Washington

Benefit Category	Value in Current Residential PPP Recycling System
Recycling Rate	49%
Tons Recycled	524,700
$MTCO_2e$ Avoided	1,399,000
Jobs Direct, Indirect and Induced	3,874

Source: Eunomia, EPA Warm Model, Indices from Economic Policy Institute (2019)[41], Bureau of Economic Analysis[42], Institute for Scrap Recycling Industries (2017)[43], Cost of Carbon metric from Washington Utilities and Transportation Commission (2019)[44]

3.0 Future Recycling System with EPR

3.1 Residential Recycling Services Overview with EPR

The future system modeled for this report is based on the Extended Producer Responsibility Policy Framework and Implementation Model developed for the King County Responsible Recycling Task Force and supplemented with best practice system design principles defined by the Organization for Economic Co-operation and Development (OECD) and supported by the Northwest Product Stewardship Council Packaging Policy Committee.[45, 46]

Under this policy framework, the future system is one in which producers fully fund the residential recycling services that support recycling of PPP materials in the state.

Local governments retain their existing authority over residential recycling services and continue to operate or oversee collection programs while meeting performance standards set in a statewide plan, and producers are involved in system design and operations, and invest in service expansion and infrastructure improvements where needed. This includes both physical infrastructure and additional education and outreach needed to achieve the performance standards.

Policy Principles of Future System with EPR

The Northwest Product Stewardship Council supports an **outcomes-based policy framework**, based on best practice system design principles, that requires PPP producers to:

- **Fully fund recycling** for all residents
- Build on **existing service and infrastructure** and invest in **improvements**
- Create and fund **consistent education**
- Meet **mandated recycling and reuse targets**
- Ensure **responsible recycling**
- **Redesign packaging**
- **Use recycled materials** in new products

The future system is stimulated by an outcomes-based policy approach, in which producers are accountable for ensuring the availability of convenient collection services, achieving mandated performance standards—including material-specific recycling rates—and demonstrating that materials are responsibly recycled. Local governments or service providers are reimbursed for costs if they meet performance standards. The policy includes an effective mechanism for oversight and enforcement by the Department of Ecology, with agency costs for policy administration covered by producers.

To meet their obligations, producers form a producer responsibility organization (PRO) to carry out implementation activities.

The following section details the future system model assumptions around responsibility for service provision, access to services, and sorting and marketing of recyclable PPP materials with EPR.

3.1.1 Responsibility for Recycling Service Provision with EPR

The modeled future recycling system with EPR includes the following assumptions about recycling service provision:

- **Continued municipal service by cities:** Cities that choose to provide residential recycling service directly through municipal operations may continue to do so, receiving reimbursement payments from the producer responsibility organization for services that meet performance standards.
- **Continued service by private service providers contracted by cities and counties:** Cities and counties that choose to provide residential recycling service directly through contracts with private service providers municipal operations may continue to do so, receiving reimbursement payments from the producer responsibility organization.
- **Continued service by UTC-regulated service providers**: WUTC-regulated collection service providers continue to provide service to households that reside within WUTC-regulated areas under the current system but must meet new performance standards. WUTC-regulated rates for residential recycling service are paid by the producer responsibility organization.
- **Additional collection service provided by producer responsibility organization (PRO)**: To ensure the availability of convenient collection services and achieve mandated performance standards, the PRO provides service where other service providers do not as well as for PPP materials designated for collection and recycling but are not collected curbside. These drop-off collection services are assumed to be delivered by private service providers under contracts with the PRO.

The modeled costs and benefits are based on a system where EPR has been fully implemented.

Across all types of service provision, services are adjusted and/or expanded to align with the service access and outreach attributes described in Section 3.1.2.[6]

3.1.2 Access to Residential Recycling Services with EPR

In line with the Northwest Product Stewardship Council's established principles for an EPR policy for PPP in Washington, the future recycling system modeled with EPR assumes that residents are provided convenient, equitable recycling collection services for a comprehensive set of recyclable PPP materials. The future recycling system modeled with EPR also includes an enhanced, culturally

[6] The cost model developed by Eunomia for estimating collection costs uses actual operations and cost data provided by cities in Washington, as well as from rates charged in WUTC areas, as its inputs to calculate the collection operations, drop-off, and supervision and management. The model is agnostic to the service provider and instead assumes a percentage additional cost to cover taxes, overhead and profit. In the same way as the current cost assessment is agnostic as to who provides the services, the cost model for the future system is also agnostic. The regional quantities and flows of materials estimated to be collected under the future system determines the modeling of additional resources and routes will be needed under the future system, which in turn determines the future system costs.

appropriate, statewide approach to education and outreach to inform the state's diverse residents about how to recycle.

The modeled future recycling system with EPR includes the following assumptions about service access and outreach:

- **100% Curbside Coverage:** The percentage of households with curbside recycling services increases from 83% to 100%. This aligns with the EPR policy principle of equal convenience for recycling and garbage collection (virtually all Washington households are provided curbside garbage service).
- **Curbside service continuity and expansion**: Wherever recycling services are already available to residents, collection method (e.g., single stream, dual stream, etc.) and frequency (weekly, every other week) remain the same. Households that did not have curbside recycling under the current system are assumed to receive single stream recycling collection every other week excluding glass, with glass accepted at convenient drop-off locations. Services are expanded to all multifamily households as well.
- **Harmonized, comprehensive list of materials collected statewide:** The model assumes that all residents are provided recycling services for the same set of materials. This includes a standardized list of materials accepted curbside statewide, with the exception of glass, which remains collected curbside in jurisdictions where it is accepted under the current system but is collected via drop-off collection in areas where it is managed via drop-off under the current system. This ensures that all residents are able to recycle the same materials and facilitates consistent statewide education.[7] The list of materials assumed to be collected curbside and via drop-off is detailed in Section A.1.6.1 the Appendix.
- **Statewide system of convenient drop-off locations for collection of additional materials**: It is assumed that, under the future system, flexible plastic packaging and polystyrene foam packaging are collected via drop-off facilities statewide. To model the cost of this system, it has been assumed that there is one drop-off-location for every 15,000 people. Drop-off facilities are also used for the collection of glass in areas where it is not included in curbside collection. The same number of drop-off locations was assumed for glass collection, though the majority of these are assumed to be located in the central and eastern regions of the state, where the number of households without curbside recycling service currently is highest.
- **Coordinated, enhanced statewide education and outreach**: Regular, consistent messaging to households on how to recycle and why is critical for a successful, high performing PPP recycling system. Seattle's commitment to education has contributed to it having a best-in-class recycling

[7] The increased collection volumes and producer funding provided by the EPR program allows for the inclusion of recyclable materials that are not currently commonly collected because they are present in small volumes, or their markets are not high value, while economically separating and marketing these materials may be still be difficult, increased collection volumes and concentration of these materials collected under the future recycling system with EPR create economies of scale that are assumed to enable marketing and possible discussions for expanded infrastructure. In addition, future packaging may be required to be recyclable.

system. The future system estimated costs for education and outreach has been calculated based on Seattle's per household single-family and multifamily education and outreach costs. The cost includes education materials such as mailers as well as residential outreach personnel.

3.1.3 Sorting and Marketing of Recyclable PPP Materials

Also in accordance with the Northwest Product Stewardship Council's established EPR policy principles, the future recycling system modeled with EPR utilizes existing infrastructure for sorting recyclable PPP materials at the state's primary MRFs, and draws on additional infrastructure to enhance recycling outcomes to the extent considered technically and economically feasible.

The modeled future recycling system with EPR includes the following assumptions about sorting and marketing of PPP materials:

- **Primary sorting of PPP materials at existing in-state MRFs**: All tons collected under the future recycling system are sent to the state's existing primary MRFs for sorting. Materials collected by existing service arrangements under the current system are assumed to continue to be delivered to the same facilities as under the current system. Materials collected in areas where new curbside service is established are assumed to be directed to the closest existing facility. Primary MRFs generally continue sorting to the commodity types and bale specifications used under the current system.

  The specific commodity types assumed to be sorted in a primary sort at existing in-state MRFs under the future system are detailed in Section A.1.6.1 of the Appendix.
- **Secondary processing of mixed plastics bales and residuals from primary MRFs:** The model assumes that all mixed plastics not sorted into commodity bales, as well as residuals from the primary sortation, are put through a secondary sortation, either at a secondary processing facility or in a secondary sort conducted at a primary MRF.[8]

  The estimated tons recycled and assumed processing costs as a result of these additional sorting steps have been included separately in the material flows and are summarized in Section A.1.5 of the Appendix.

[8] The model does not specify whether the secondary processor is an existing or new facility or whether the facility is located in-state or out-of-state. While there is currently no secondary processing facility located within the state, there are several out-of-state facilities in the region that already receive mixed plastics bales from primary MRFs in Washington for secondary processing. Discussions with an existing out-of-state secondary processor indicate that there may also be interest in investment in an additional facility in the region in the future, depending on material volumes and processing terms available.

3.2 PPP Generated, Disposed, and Recycled with EPR

The increased access to convenient, equitable collection along with the investment in coordinated, enhanced statewide education and outreach provided under the future recycling system modeled with EPR are expected to drive increases in the quantity of PPP collected for recycling. Secondary processing of mixed plastics bales and MRF residuals increases the capture of recyclable materials collected which also contributes to a rise in the recycling rate of PPP materials.

The modeled future recycling system with EPR assumes the recycling rate for each PPP material increases to match the material-specific capture rates achieved in the City of Seattle (based on an analysis of program data from 2015), where comprehensive, universal collection service and excellent education and outreach programs for both single-family and multifamily residents (who represent approximately half of all residential units in the city) have resulted in recycling rates that are among the highest in the U.S. These target rates were assumed to be achievable under a high functioning EPR recycling program. If statewide waste and recycling data provided by the Department of Ecology indicated that a region already achieved a higher recycling rate for a given material than was estimated for Seattle, the region's existing estimated recycling rates for that material were used under the future scenario, rather than Seattle's.

To estimate the recycling rates for films and EPS the recycling rates in those municipalities that are currently collecting these materials in depots was reviewed. This data was compared to collection rates in other programs for example in British Columbia which in 2019 reported a flexible film recycling rate of 22% in their return to depot model.[47] This was used to estimate a single-family collection rate. We assumed the recycling rates for multifamily households was 60% of that for single-family households.

For households that would be required to take glass to a drop-off location, collection rates were first assumed to be 50% of that collected at the curb and then adjusted to ensure the maximum recycling rate did not exceed 90%, which is what is achieved in high performing curbside programs.

A detailed breakdown of the sources of the additional tons recycled are shown in Section A.1.5 of the Appendix.

Table 8 shows the estimated tons of each PPP material generated, disposed and recycled, along with the estimated recycling rate for each material category and for PPP overall under the future recycling system modeled with EPR. While even higher recycling rates could be achieved with additional adjustments to the collection methods used (such as universal curbside collection of glass or the use of dual-stream collection, where containers are collected separately from paper), the introduction of a deposit-return system, or redesign of PPP to be recyclable, compostable or reusable, this increase represents what is considered feasible without any adjustments to collection methods for existing services and without the use of deposits to further incentivize recycling.[48]

The future system results in approximately 212,100 tons of additional PPP material recycled, a 40% increase over the current system, increasing the overall PPP recycling rate from 49% to 69%. The amount of PPP material recycled increases from 331 pounds to 465 pounds per household per year under the future EPR system. This is in line with national estimates of recycling potential under a system with automatic provision of residential recycling service. A recent study conducted of actual program performance outcomes found that the average household with automatically provided service recycles 459 pounds annually.[49]

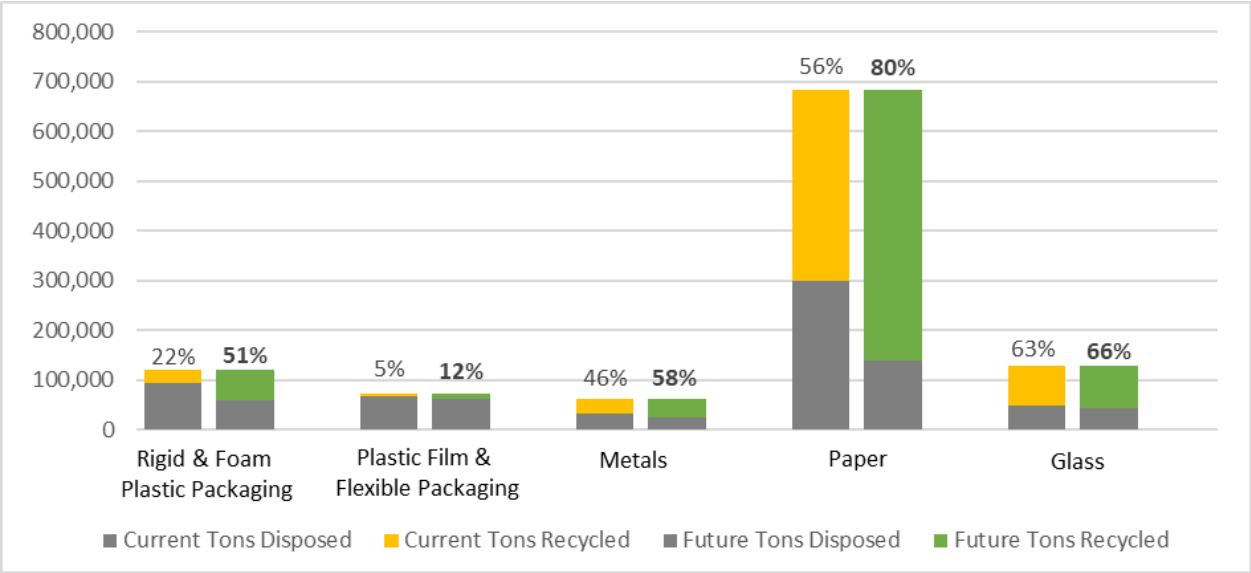
Figure 6 illustrates the increase in recycling rate for each material category, comparing the recycling rates achieved under the current system to those achieved under the future system with EPR. For example, 80% of the 683,000 tons of paper generated is recycled under EPR while under the current system the paper recycling rate is 56%.

Table 8: Tons of PPP Generated, Disposed and Recycled with EPR Compared to Current System

Material	Residential PPP Tons Generated	Current System (2017)		EPR System	
		Tons Recycled	Recycling Rate	Tons Recycled	Recycling Rate
All Plastics	**193,080**	**30,580**	**16%**	**70,480**	**37%**
Rigid & Foam Plastic Packaging	**120,880**	**26,880**	**22%**	**61,580**	**51%**
#1 PET Bottles	34,100	12,200	36%	22,290	65%
#1 PET Other Packaging	20,000	2,500	13%	12,240	61%
#2 HDPE Natural Bottles	9,700	3,500	36%	6,540	67%
#2 HDPE Colored Bottles	12,800	4,100	32%	7,700	60%
# 2 HDPE/#4 LDPE Other Packaging	4,670	960	21%	1,790	38%
#5 PP Packaging	13,000	2,900	22%	8,200	63%
Other Rigid Plastic Packaging	1,700	420	6%	1,100	16%
Polystyrene Foam Packaging	13,300	300	2%	1,500	11%
Plastic Composite Packaging	1,800	0	0%	200	11%
Compostable Plastic Packaging	4,100	0	0%	0	0%
Plastic Film & Flexible Packaging	**72,200**	**3,700**	**5%**	**8,900**	**12%**
PE Plastic Bags & Film	21,600	3,700	17%	5,300	25%
Other Film & Flexible Packaging	50,600	0	0%	3,600	7%
Steel	**25,300**	**9,900**	**39%**	**15,700**	**62%**
Aluminum	**37,100**	**18,900**	**53%**	**20,590**	**56%**
Paper	**683,000**	**384,100**	**56%**	**544,500**	**80%**
Newspaper	206,890	139,165	**67%**	172,974	84%
Cardboard	220,812	148,109	**67%**	191,243	87%
Cartons	3,928	**33**	**1%**	105	3%
Mixed Paper	**251,414**	96,864	**39%**	180,197	72%
Glass	**129,400**	**81,200**	**63%**	**85,500**	**66%**
Total	**1,067,900**	**524,700**	**49%**	**736,800**	**69%**
Total lbs. per household		***331***		***465***	

Source: Washington Department of Ecology Waste Generation and Recovery Data (2017), Cascadia Statewide Waste Characterization (2015-2016), Eunomia Modeling

Figure 6: Tons Disposed and Recycled in EPR System by Material Type with Recycling Rates



Source: Washington Department of Ecology Waste Generation and Recovery Data (2017), Cascadia Statewide Waste Characterization (2015-2016), Eunomia Modeling (2020)

3.3 System Costs and Financing with EPR

3.3.1 System Costs for Residential Recycling of PPP with EPR

In line with the Northwest Product Stewardship Council's EPR policy principles, the future recycling system modeled with EPR assumes that producers of PPP are responsible for all costs associated with residential recycling of PPP materials. Best practices from EPR systems around the world show that the most effective EPR policies require producers to cover all costs associated with activities necessary to meet specific performance targets and requirements mandated by the policy.[50]

Producers are also responsible for covering:

- Costs incurred by the state regulatory agency to oversee and enforce the EPR policy;
- Administrative costs associated with operating a PRO that coordinates all activities on behalf producers.

Under the future system modeled with EPR, revenues generated from the sale of recyclable PPP materials are used to offset costs incurred. The outstanding balance—the total net system cost—is covered by fees paid by producers to the PRO that coordinates system activities on behalf of producers in accordance with the requirements set out in the EPR policy.

A comprehensive accounting of the data sources, assumptions, and methodologies used to estimate system costs is provided in Section A.1.7 of the Appendix.

The estimated total cost of residential recycling of PPP materials in Washington under the future system modeled with EPR is presented in Table 9. While the cost of the system increases due to the expansion of curbside collection service and drop-off locations along with investments in sorting infrastructure, the net cost per ton recycled falls, from $471 to $454, as more material is recycled. And likely more if materials are redesigned to be recyclable, compostable or reusable.

Table 9: Cost of Future Residential PPP Recycling System in Washington with EPR

Cost Element	Current System Cost	Future System Cost
Total Cost per Year	**$247,118,000**	**$334,482,000**
Total Cost per Ton Recycled	***$471***	***$454***

Source: Eunomia Modelling, Data from the cities of Enumclaw, Olympia, Tacoma, Spokane and Vancouver, Washington Department of Ecology Landfill fees, CSSA Annual Cost Reports, Correspondence with Washington recycling collection service providers, Correspondence with Washington MRF Operators, RecyclingMarkets.net

3.3.2 Financing and Household Rates for Recycling with EPR

Under the assumed future recycling system modeled with EPR, local governments are able to pass on the reimbursement payments from producers to their residents. For residents who already have curbside recycling service under the current system, this will equate to savings of between $60 and $300 per year, depending on the rates charged by their service providers under the current system for curbside recycling. In cities like Seattle, Tacoma, Spokane, and Olympia, expected annual savings range between $60 and $120 for single-family residential customers, equivalent to between 16% and 20% of current residential rates charged for garbage and recycling service. In WUTC-regulated areas, where households paid near the upper end of the $60 - $300 range for curbside recycling service in 2020, the future system modeled with EPR will fully offset those costs.

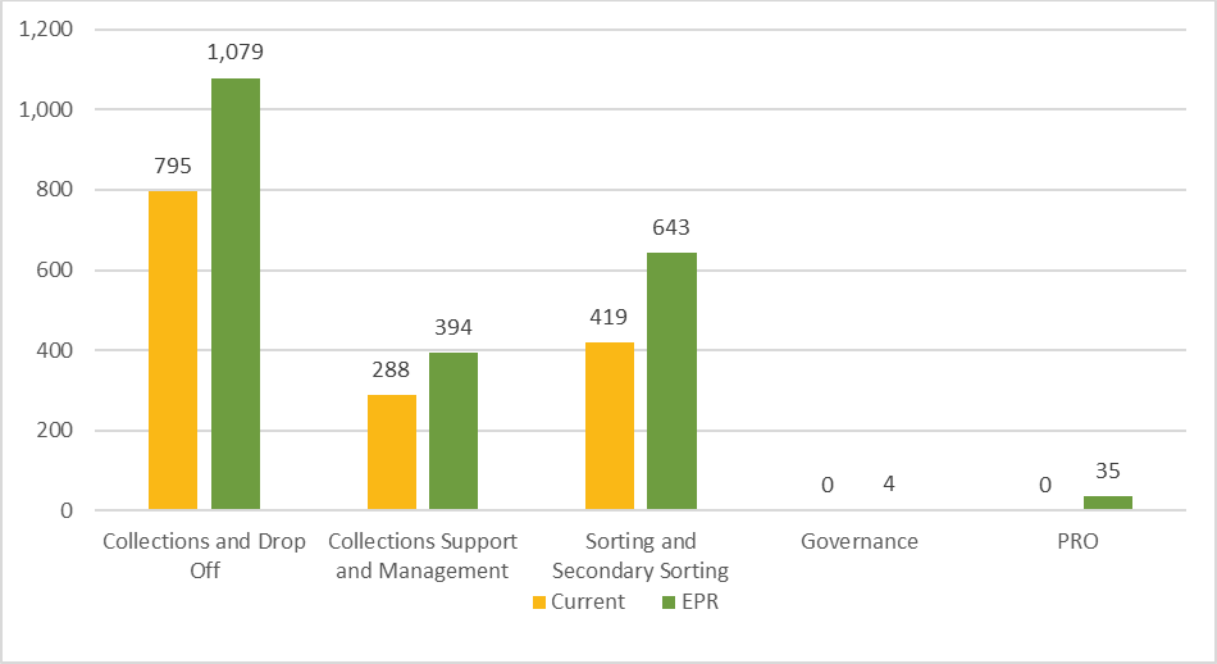
3.4 Economic, Social, and Environmental Benefits with EPR

3.4.1 Additional Jobs with EPR

Under the future system modeled with EPR, the number of jobs associated with residential recycling will increase. An estimated 650 direct jobs would be created in the future system to collect, transport, sort, and market the additional 212,000 tons of material recycled. Most new direct jobs are based on the delivery of collection services and would be created in rural areas of the state where the gaps in curbside services persist under the current system.

The total number of direct jobs associated with residential recycling in the future system with EPR compared to the current system is shown in Figure 7. Additional detail about the jobs estimates is provided in Section A.1.7.1 of the Appendix.

Figure 7: Direct Jobs in Current System vs EPR

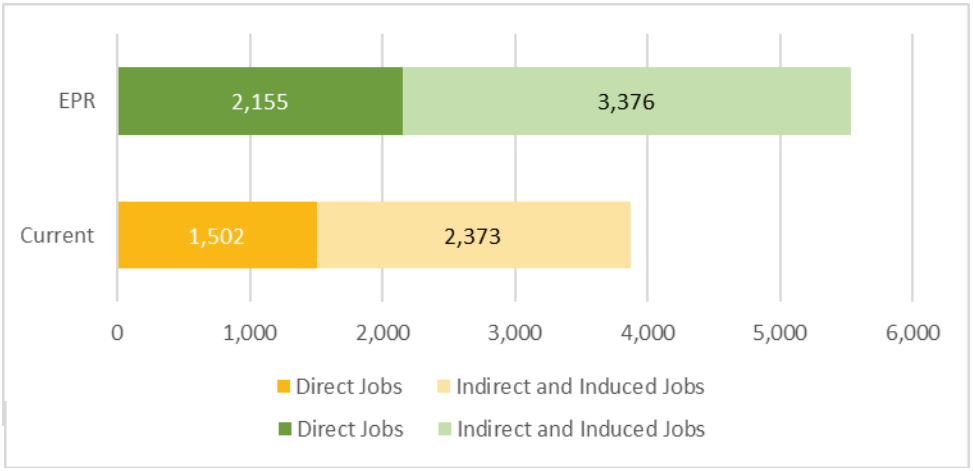


Source: Eunomia modelling

Using the same assumptions as applied to the current system, the future system modeled with EPR also generates indirect and induced jobs.

As shown in Figure 8, the total number of direct, indirect and induced jobs associated with the future system modeled with EPR is estimated at over 5,500. In comparison, the estimate for the current system is 3,875 direct, indirect, and induced jobs, indicating that over 1,650 additional jobs will be created under the future system modeled with EPR compared to the current recycling system.

Figure 8: Direct, Indirect, and Induced Jobs



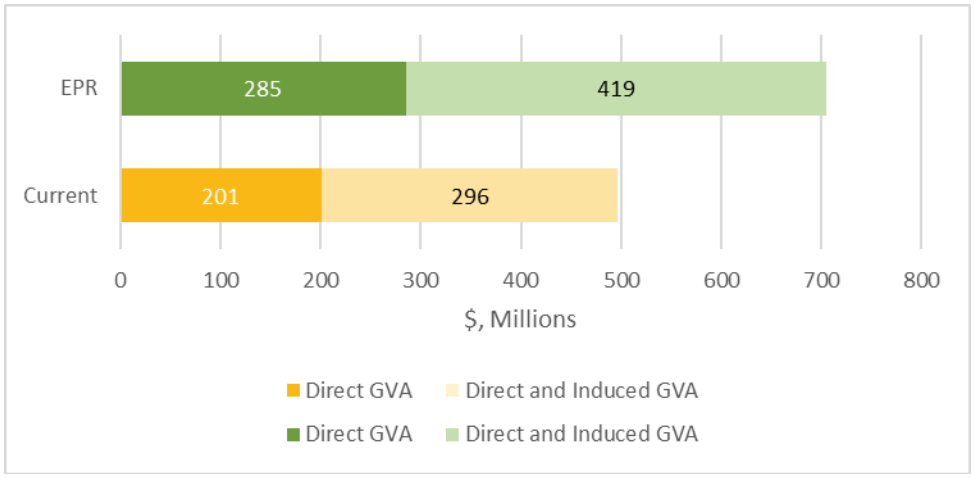
Source: Eunomia modelling

3.4.2 Increased Economic Contribution with EPR

As described in Section 2.4.2, the economic contribution of jobs associated with residential recycling in Washington is measured here using an income-based gross value added (GVA) calculation.

The GVA calculation estimates that the future system modeled with EPR contributes an additional $207 million to Washington's GDP through increased spending associated with direct, indirect, and induced jobs, as shown in Figure 9.

Figure 9: GVA Associated with Direct, Indirect, and Induced Jobs



Source: Eunomia modelling

3.4.3 Greater GHG Avoidance with EPR

As detailed in Section 2.4.3, current residential recycling activities in Washington avoid 1.4 million metric tons carbon dioxide equivalent ($MTCO_2e$) a year. The GHG emissions avoided through

residential recycling activities in Washington under the future system modeled with EPR increase to almost 2 million $MTCO_2e$ per year, or 565,000 $MTCO_2e$ more than currently. This is the equivalent of taking an additional 120,000 vehicles off the road every year.

The monetary benefit associated with avoided emissions, calculated using the same method for quantifying the social cost of carbon as described in in Section 2.4.3, increases to $147.3 million under the future system, an additional benefit of $42.4 million compared to the monetary benefit associated with avoided emissions under the current system. This benefit is the result of the approximately 212,100 tons of additional PPP materials estimated to be recycled under the future system modeled with EPR.

3.5 Summary of Relative Costs and Benefits with EPR

The implementation of EPR for PPP in Washington has the potential to deliver substantial economic, social, and environmental benefits.

Under the assumed future system for residential recycling modeled with EPR, all Washington households are provided curbside recycling where curbside garbage service is available, bringing service to an additional 360,000 households without any curbside recycling, and providing recycling service to another 323,000 households, where service is only available under an optional additional subscription under the current system.

Curbside collection service is complemented by a statewide system of convenient drop-off locations for collection of additional materials.

This expansion of collection service, the use of a harmonized, comprehensive list of materials collected statewide, additional investment in education and outreach, additional sorting of mixed plastic bales, and MRF residuals results in an increase in the tons of PPP materials collected and recycled. The 212,000 additional tons of PPP materials recycled under the future system with EPR represents a 40% increase in the recycling rate of PPP materials, from 49% to 69%.

Under EPR policy, a PRO reimburses local governments and service providers for recycling service, eliminating the current fees households pay, which range from $60-$300 per year.

While the cost of the residential recycling system as a whole increases due to the expansion of services and investments in sorting infrastructure, the system becomes more efficient and effective, and the net cost per ton recycled falls, from $471 under the current system to $454 under the future system with EPR.

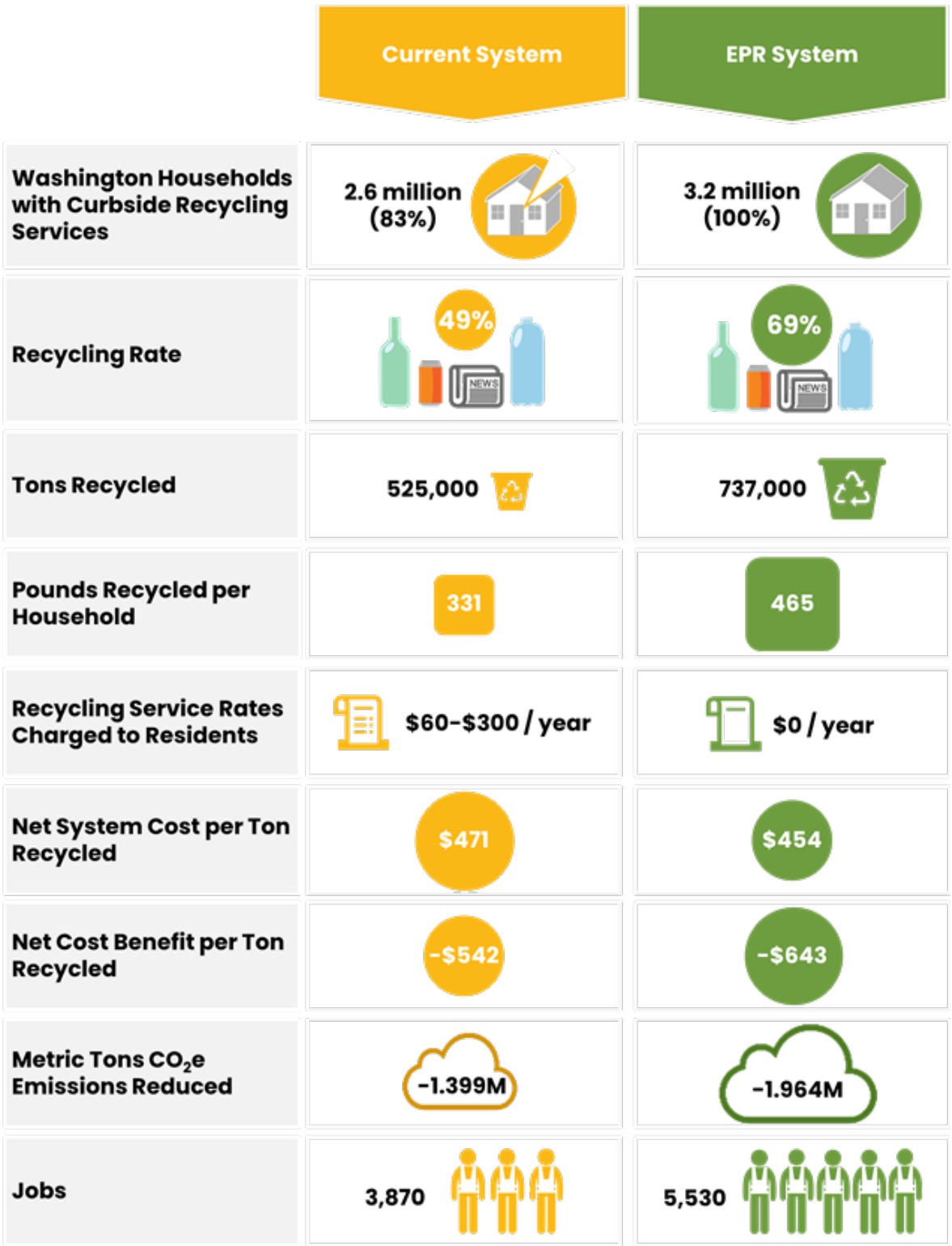
EPR also delivers benefits in the form of over 1,650 additional jobs created under the future system and a resulting contribution of an additional $207 million to Washington's GDP through increased spending associated with the additional direct, indirect, and induced jobs created.

The environmental benefits of the additional recycling achieved under EPR include an additional 565,000 $MTCO_2e$ of avoided GHG emissions. The monetary benefit associated with these additional avoided emissions translates to an additional $42.4 million in social costs of climate pollution avoided.

Adding up all of these factors, the current system of residential recycling already delivers a net societal benefit of $542 per ton of PPP material recycled. Under the future system modeled with EPR, this increases to $643 per ton.

A summary comparison of system outcomes, costs, and benefits under current and future systems is presented in Figure 10.

Figure 10: Comparison of System Outcomes, Costs, and Benefits under Current and Future System with EPR



4.0 Glossary

Term	Definition
Capture Rate	The amount of material captured for recycling through collection and delivered to a sorting facility, divided by the amount of that same material generated.
Contamination	Unaccepted material in a recycling or organics stream. Common recycling stream contaminants include materials that are not recyclable (e.g., compostable packaging, food scraps, liquids, electronics and small appliances, tanglers like cords and garden hoses, diapers, household hazardous waste, textiles and shoes, furniture, etc.)
Curbside Collection	The collection method by which waste generators deposit specified materials in bins, carts, or dumpsters, and place those at the street or curb or in another designated collection location for periodic emptying by collectors. [51]
Direct Impact	Jobs and GVA resulting from organizations managing and contracted to supply waste management activities (e.g. collection agent, sorting facility worker, etc.).
Drop-off	A form of collection of household recyclables wherein the generators deliver the items to a central aggregation location.[52]
Dual Stream	A curbside recycling practice in which two different groups of recyclable materials are collected separately, often in two different containers. In many jurisdictions, dual stream programs collect cans, bottles, and other containers separately from paper and cardboard. [53]
Extended Producer Responsibility (EPR)	A mandatory type of product stewardship that includes, at a minimum, the requirement that the producer's responsibility for its product extends to post-consumer management of that product and its packaging. There are two related features of EPR policy: (1) shifting financial responsibility and in operational coordination, with government oversight, upstream to the producer and away from the public sector; and (2) providing incentives to producers to incorporate environmental considerations into the design of their products and packaging, such as designing for recyclability and using recycled content.
Generation	The total amount of waste, including recyclable material, produced by a resident, household, business, or other waste generator. The basic formula is disposal + diversion = generation.[54]
Gross Value Added (GVA)	The measure of the value of goods and services produced in an area, industry or sector of an economy.
Indirect Impact	Jobs and GVA generated as a result of the waste management sector using amounts of goods and services from other sectors, thereby generating employment and profit in these sectors (e.g. supply of recycling collection vehicles)
Induced Impact	The additional economic activity resulting from the direct and indirect economic impacts from recycling. This is the consequential economic impact created from, for example, workers spending their wages.
Materials Recovery Facility (MRF)	Also sometimes called a recycling processor or sorting facility, an establishment primarily engaged in sorting fully or partially mixed recyclable materials into distinct categories and preparing them for shipment to recycling markets. There are also recovery facilities that focus on specific materials, such as plastic recovery facilities or container recovery facilities.
Packaging and Paper Products (PPP)	Category of materials that includes traditional curbside recyclables, such as aluminum, glass, plastic, cardboard paperboard, newspapers, phone books, and office paper.
Producer	An organization or company that is a brand owner, first importer, or franchisor that supplies designated packaging and paper products to consumers in a jurisdiction where producer responsibility obligations have been regulated. A manufacturer of packaging, e.g. the manufacturer of plastic bottles, is not necessarily a producer in the context of EPR. The producer is the company that uses the plastic bottle as packaging and sells it under its own brand.

Term	Definition
Producer Responsibility Organization (PRO)	The entity (usually a non-profit organization) designated by a producer or producers to act on their behalf to administer a product stewardship program aimed at compliance with the EPR program.
Recovery	Material that is diverted from the solid waste stream for the intended purpose of recycling, composting, burning source-separated materials for energy, anaerobic digestion, land application, and other beneficial uses. [55]
Recyclables/ recyclable materials	Those materials identified for collection, sorting, and eventual transformation into new material feedstocks as part of a local government, business, or other recycling collection program. [56] This term is not synonymous with "recycled materials," since not all recyclables end up being remanufactured into new items.
Recycling Rate	The amount of material sent to reprocessors divided by the amount of material generated. The recycling rate is one way to measure the effectiveness of the system, the greater percentage of PPP recycled, the less landfilled. The recycling rates presented in this study are based on tons coming out of MRFs/secondary sorting facility and sold to reprocessors over the amount of material generated. The recycling rate does not include tons of contaminants/processing residues.
Reprocessor	Also called a reclaimer, these companies purchase post-consumer or post-industrial recycled commodities and process into resin feedstock to sell to manufacturers. For plastics reprocessors, end products include pellet, flake, and other resin products. Some vertically integrated reprocessors also have manufacturing operations and may use the recycled content that they reprocess in the production of their own products.
Secondary Processor	Processor that receives materials from a MRF or sorting facility, usually baled materials, and converts them to a usable material for reprocessors to make into new products (e.g., flaking of plastic).
Single Stream	A municipal, commercial, or industrial practice in which multiple recyclable materials are combined for collection, with no sorting required by the generator. Sorting is performed at a central location, such as a MRF. [57]
Social Cost of Carbon	Estimate, in dollars, of the economic damages that would result from emitting one additional ton of greenhouse gases into the atmosphere.[58]
Sorting Facility	Also sometimes called a recycling processor or material recovery facility (MRF), an establishment primarily engaged in sorting fully or partially mixed recyclable materials into distinct categories and preparing them for shipment to recycling markets.
Utilities and Transportation Commission (UTC)	A three-member commission in Washington appointed by the governor and confirmed by the state senate. The commission regulates intrastate residential household movers, solid waste collection companies, private ferries, as well as the safety of charter buses, railroads, railroad crew transportation, and transportation for persons with special needs such as private, non-profit transportation providers.[59]
Waste Diversion	The act of redirecting waste away from landfill disposal and incineration and instead into recycling or other beneficial uses.

5.0 End Notes

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