



Executive Summary

Container Deposit Study:

Analysis of Residential Packaging and Paper Product Recycling in Washington State



King County

Department of
Natural Resources and Parks
Solid Waste Division

Waste
Prevention

Resource
Recovery

Waste
Disposal

www.kingcounty.gov/solidwaste

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Background

A series of three reports were produced for the King County Responsible Recycling Task Force (RRTF) to address Action Item 1E from their [Recommendations Report](#), published in January 2019, which was to:

Develop a feasible model for beverage container stewardship in Washington similar to the Oregon Beverage Recycling Cooperative model.

The reports build upon the Extended Producer Responsibility (EPR) model developed in the March 2020 report for King County, [Extended Producer Responsibility Policy Framework and Implementation Model: Residential Recycling of Packaging and Paper Products in Washington State](#).

Phase I: Inventory of Existing Deposit Return Systems

To provide a basis for crafting a deposit return system (DRS) for beverage containers in Washington, existing DRSs from across the world were selected for evaluation using the following criteria:

- 1) Systems financed/operated/overseen by third party organizations or packaging and paper product producers.
- 2) Systems that include return mechanisms other than drop off at retail/grocery stores. This could include return mechanisms such as redemption centers, specialized depots, and other innovative methods used to collect containers, such as reverse vending machines (RVMs), bag drops, bulk redemption, etc.
- 3) Systems that work in tandem with Extended Producer Responsibility systems for residential packaging and paper products.
- 4) Systems operated in jurisdictions with curbside recycling programs similar to those in Washington State.

The selected programs are summarized in Table 1.

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Table 1: Phase I DRS Program Summaries

Jurisdiction	System Administrator	Criteria Met				DRS Operating in Conjunction with EPR for Packaging	Deposit Value	Redemption Rate
		1	2	3	4			
Oregon	Oregon Beverage Recycling Cooperative	✓	✓		✓	No	\$0.10	85% ⁱ
Maine	Department of Environmental Protection		✓		✓	No	Wine/liquor above 50mL: \$0.15 All others: \$0.05	No official redemption rate, but 2016 sales reports indicated rate of 74.7%. ⁱⁱ A redemption rate for distilled spirits was reported at 87.2%. ⁱⁱⁱ
British Columbia	Encorp Pacific/Brewers Recycled Container Collection Council (BRCCC)	✓	✓	✓	✓	Yes	CAD\$0.10 (USD\$0.074) for all beverages	Redemption rate across the two systems is ~82%. ^{iv} Encorp: 77.4% ^v BRCCC: 89.2% ^{vi}
Alberta	Beverage Container Management Board	✓	✓			No	Up to 1L: CAD\$0.10 (USD\$0.073) Over 1L: CAD\$0.25 (USD\$0.18)	85.3% ^{vii}
Norway	Infinitum	✓		✓		Yes	≤0.5L: NOK 2 (\$0.25) >0.5L: NOK 3 (\$0.38)	87.3% for cans and 88.6% for bottles ^{viii1}
Germany	Private competitive			✓		Yes	€0.25 (\$0.28)	~97% ^{ix}

¹ Redemption rates in Norway have typically been greater than 90%. Following the increase in deposit values in 2019, rates are again expected to rise.

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Phase II: A Beverage Container Deposit Return System for Washington Qualitative Research and Recommendations

Phase II proposes design for a best-in-class, stand-alone DRS for beverage containers in Washington State, implemented as in Figure 1, based on goals including:

- To maximize redemption rates through a **legislated redemption rate target of 90%** in order to prevent litter and maximize the value of the recyclable material, necessary for a circular economy.
- Provide equitable access for all residents across the state to be able to redeem their containers at convenient redemption points through a **legislated geographical coverage target and options for redemption**.
- Supplement and enhance the recycling system without jeopardizing existing curbside services by **supporting recycling infrastructure through unredeemed deposits when targets are unmet and options for MRF participation**.
- Remain **dynamic and relevant** to current economic, legislative and environmental conditions, with a design that allows for necessary adjustments over time without requiring additional legislation, such as adjusting the deposit to account for inflation and lagging redemption rates.

The flow of beverage containers through the system is shown in Figure 2, implemented through key elements, outlined below.

Figure 2: Beverage Container Flow through DRS System



Producer Responsibility and Obligated Parties: DRS operationally and financially managed through a single non-profit producer responsibility organization (PRO). Obligated parties include:

- State government or government-appointed agency as program administrator;
- Producers, manufacturers and importers to fund and manage the DRS;
- PRO to manage and coordinate the collection and reprocessing of beverage containers under the DRS on behalf of producers; and
- Retailers greater than or equal to 5,000ft² to act as redemption points, either in store or kiosks (i.e. in parking lots) to ensure consumer convenience and geographic coverage requirements (one redemption point for every 5,000 residents and all households able to access a redemption point within a 5 miles).

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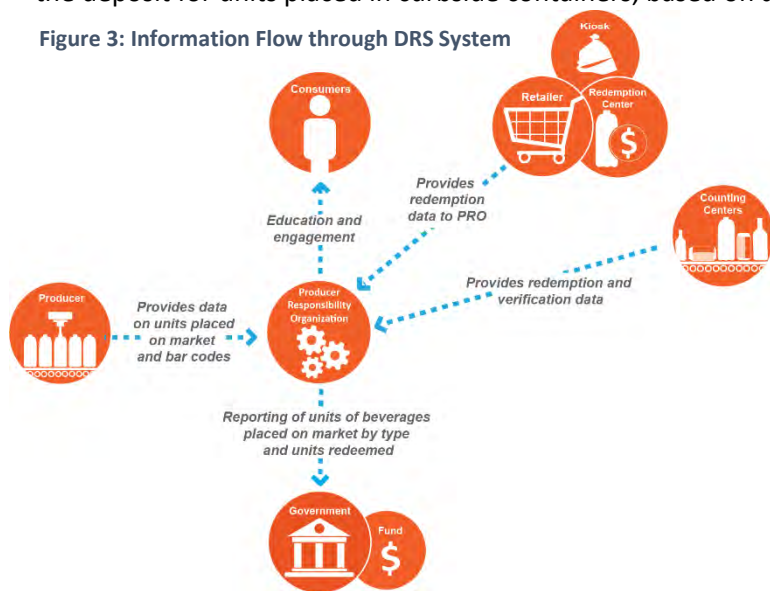
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Information flow through the DRS and the PRO's role is shown in Figure 3.

Obligated Materials: All alcoholic and non-alcoholic beverages, defined as any liquid that is a ready-to-serve drink, regardless of packaging material in beverage containers up to and including 3L in volume.

Deposit Rate, Structuring, Mechanism for Refund and Use of Unredeemed Deposits: A minimum of \$0.10 deposit rate across all container sizes and beverage types with transparent mechanism to adjust deposit rate over time, to account for inflation or as redemption rate drops. Ability for MRFs to redeem the deposit for units placed in curbside containers, based on actual count and not on weight or periodic

Figure 3: Information Flow through DRS System



audit-based assessments. Fund set up to support recycling infrastructure from portion of unredeemed deposits when redemption target is unmet. Flow of the deposit and other finances through the system is shown in Figure 4.

Redemption Infrastructure, Access, Location and Convenience: Mix of redemption options that focus on using technology to prevent fraud and increase convenience, determined by PRO to meet set redemption and geographical coverage targets and compensated by handling fee based on actual costs. Requires retailer participation of stores with square

footage >5,000ft². Retailers can apply to the PRO to opt-out if they can demonstrate that other redemption points allow geographic coverage requirements to be met. Redemption options to include:

- RVMs that use barcode technology to verify a unit and crush it to prevent it from being redeemed more than once.
- Bag drop kiosks that allow consumers to redeem large volumes in a short period of time and for the deposit to be credited to a personal account.
- Redemption centers for bulk redemption including from commercial businesses.

Figure 4: Monetary Flow through DRS System



Fraud Mitigation: Audit, oversight and enforcement authority given to the government agency. To prevent free riders, the PRO should be allowed to set fees and regulate membership, which will establish a dedicated interest in addressing free riders. Technology-driven approach, such as registered bar codes and bulk counting machines limits deposit return only to in-scope beverages and ensure that only in-

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scope containers are counted towards the redemption target. Counting centers and RVMs provide verification and RVMs crush containers, preventing duplicate, fraudulent redemption.

Phase III: Modeling and quantitative analysis









This study assesses the impacts of implementing a DRS for beverage containers in Washington State as well as the impacts of an EPR system for packaging and paper products (PPP) generated from residential households, the design of which is detailed in “*Extended Producer Responsibility Policy Framework and Implementation Model: Residential Recycling of Packaging and Paper Products in Washington State.*”^{ix} It considers the costs as well as the environmental, social and economic benefits of several models of DRSs and/or EPR systems, as follows and illustrated in Figure 5:

- **Future System (FS) 1: Current System with DRS**, current service provision funded through rates with a DRS funded by beverage producers
- **FS 2 (EPR): Enhanced Collection, Coverage and Capture**, producer EPR for PPP recycling services for all households equivalent to their trash services (except that households with new curbside recycling will be required to recycle glass through drop-offs), common set of PPP materials collected across the state from each household.
- **FS 3 (EPR): Aligned Collection Methodology and Frequency – single stream recycling (excluding glass) every other week with separate curbside glass collection every fourth week**, similar conditions to FS 2, but with consistent collection, as described in Figure 5, across the state.
- **FS 4 (EPR): Aligned Collection Methodology and Frequency - dual stream, fibers and metals/plastics/glass (MPG)**, similar conditions to FS 2, with consistent collection across state with fibers and MPG collected on alternate weeks, resulting in weekly collection of some recyclables.
- **FS 5 (EPR): Enhanced Collection, Coverage and Capture with DRS**, similar to FS 2 with DRS
- **FS 6 (EPR): Aligned Collection Methodology and Frequency – single stream with glass to drop-off plus DRS**, similar to FS 3, with DRS and without curbside glass collection
- **FS 7 (EPR): Aligned Collection Methodology and Frequency – dual stream plus DRS**, similar to FS 4, with DRS

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Figure 5: Overview of Future Systems Modeled Against the Current System

	BASELINE Current System	FUTURE SYSTEM 1 Current System + DRS	FUTURE SYSTEM 2 EPR + Enhanced Collection and Coverage	FUTURE SYSTEM 3 EPR + Aligned Universal Collection Option 1	FUTURE SYSTEM 4 EPR + Aligned Universal Collection Option 2	FUTURE SYSTEM 5 EPR + Enhanced Collection + DRS	FUTURE SYSTEM 6 EPR + Aligned Universal Collection Option 1 + DRS	FUTURE SYSTEM 7 EPR + Aligned Universal Collection Option 2 + DRS
EPR	N	Partial, only for DRS	Y	Y	Y	Y	Y	Y
DRS for Beverage Containers	N	Y	N	N	N	Y	Y	Y
Single Family Curbside / Multi- Family On-Site	 89% of HH	 89% of HH	 100% of HH	 100% of HH	 100% of HH	 100% of HH	 100% of HH	 100% of HH
Common Set of Materials Collected	N	N	Y	Y	Y	Y	Y	Y
Aligned Common Collection System	N	N	N	Y Biweekly collection of paper, plastics & metals Collection of glass every four weeks	Y Biweekly collection of metals, plastics & glass Alternate Biweekly collection of paper	N	Y Biweekly collection of paper, plastics & metals Glass collected only through drop-off	Y Biweekly collection of metals, plastics & glass Alternate Biweekly collection of paper
Post Collection Sorting System	Existing	Existing plus DRS	Existing with Secondary MRF	Existing with Secondary MRF	Dual Stream MRF	Existing with Secondary MRF plus DRS	Existing with Secondary MRF plus DRS	Dual Stream MRF

Each of the FSs was evaluated against a set of cost, environmental and social metrics, summarized in Figure 6 (social and environmental) and Figure 7 (financial).

No one FS outperforms the others against every metric. Those that have been modeled to deliver the highest recycling rates have higher cost, because the system is targeting the more difficult PPP to recycle and covering both urban and rural single and multifamily households, which increases the total cost of the system. Notable performers on specific metrics include:

Recycling rate:

- As illustrated in FS 2, without making any changes to the current system, adding a DRS funded by the producers, would **increase the overall recycling rate by almost ~6%, to ~55%**, resulting in an estimated 590k tons of material recycled, and almost **doubling the rigid plastic recycling rate to ~40%**.
- All of the systems with DRS outperform the equivalent system without DRS.**
- FS 7 is the highest performing system, estimated to deliver a **~75% residential PPP recycling rate**.

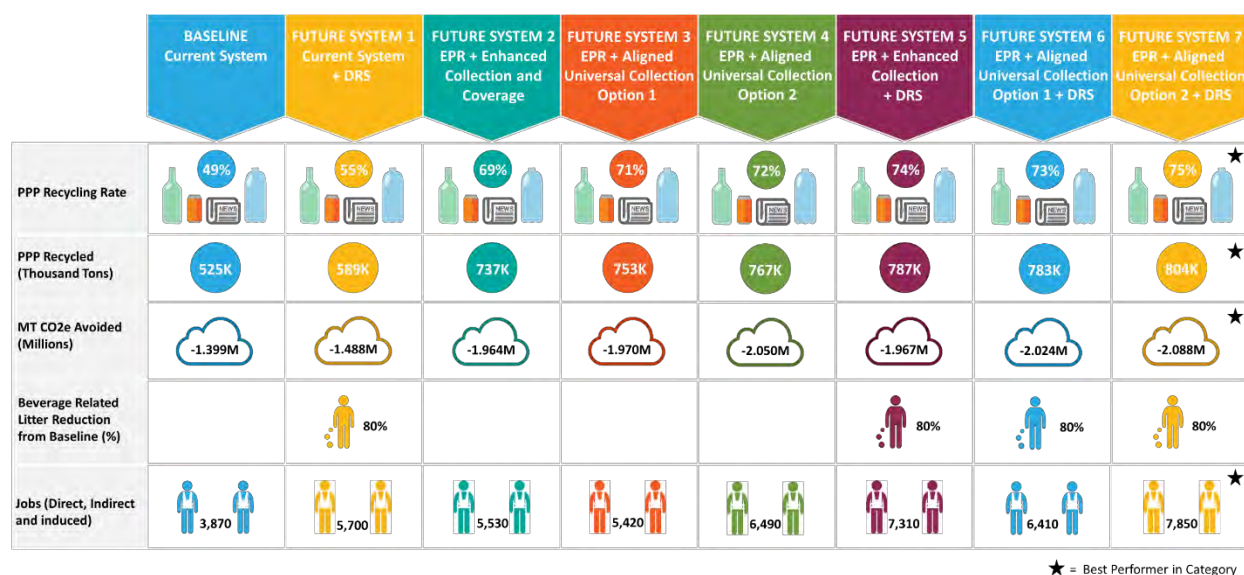
Cost per ton recycled:

- FS 6 presents the lowest cost per ton recycled system, indicating that it is the **best value for the money** in terms of material recycled, and is estimated to deliver a recycling rate of ~73%.

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Figure 6: Overview of Costs and Financial Benefits



Total Net Benefit Per Ton Recycled:

- The system with the highest net benefit is FS 7, which also provides 100% recycling collection coverage and parallel service for all residents with trash collection, plus a common, expansive set of materials collected statewide under full EPR.
- **All of the systems with DRS outperform the equivalent system without DRS.** The reasons for this are:
 - A DRS results in an additional net 788 direct jobs created;
 - DRSs maximize the capture rate of aluminum cans, which can be indefinitely recycled and used as recycled content in new products, resulting in significant reduction in MTCO₂e;
 - DRSs delivers a higher material revenue for PET, due to the level of purity of bales.

Environmental and Social Benefits:

- FS 7 delivers the most environmental and social benefits, while FS 6 has the lowest cost per ton recycled, both of these systems include a DRS.
- In all systems, **more high value materials are captured for recycling** (~+64k tons per annum in FSs with DRS), supporting a circular economy and **reducing GHG emissions** (additional savings of ~89M MTCO₂e compared to the baseline).
- **Additional direct, indirect and induced jobs** (FS 7 ~+3,970) and associated annual gross value added (GVA²) (FS7 ~+\$635M) resulting from an increase in the amount of PPP collected and recycled.

² GVA is the measure of the value of goods and services produced in an area, industry or sector of an economy.

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Figure 7: Overview of Environment and Social Benefits

	BASELINE Current System	FUTURE SYSTEM 1 Current System + DRS	FUTURE SYSTEM 2 EPR + Enhanced Collection and Coverage	FUTURE SYSTEM 3 EPR + Aligned Universal Collection Option 1	FUTURE SYSTEM 4 EPR + Aligned Universal Collection Option 2	FUTURE SYSTEM 5 EPR + Enhanced Collection + DRS	FUTURE SYSTEM 6 EPR + Aligned Universal Collection Option 1 + DRS	FUTURE SYSTEM 7 EPR + Aligned Universal Collection Option 2 + DRS
Cost per Ton Recycled (USD)	\$471	\$523	\$454	\$503	\$529	\$532	\$442 ★	\$542
Total Cost of System (Millions, USD)	\$247M	\$308M	\$334M	\$379M	\$406M	\$419M	\$346M	\$436M
PPP Disposal Cost Savings (Millions, USD)	\$0	\$7.3M	\$25.9M	\$27.9M	\$27.9M	\$31.4M	\$30.7M	\$31.9M ★
Material Value (Millions, USD)	\$21.5M	\$50.3M	\$37.4M	\$36.9M	\$44.9M	\$64.3M	\$64.6M	\$71.4M ★
GVA (Millions USD) (Direct, Indirect, Induced)	-\$497M	-\$848M	-\$705M	-\$694M	-\$834M	-\$1,050M	-\$928M	-\$1,132M ★
Social Cost of Carbon (Millions, USD)	-\$105M	-\$112M	-\$147M	-\$148M	-\$154M	-\$148M	-\$152M	-\$157M ★
Net Benefit per Ton Recycled (USD)	-\$542	-\$998	-\$643	-\$558	-\$704	-\$939	-\$886	-\$1,012 ★

★ = Best Performer in Category

Stakeholder Impact:

Moving to a producer managed and financed recycling system will impact stakeholders:

- **Residents/Ratepayers:** PPP recycling costs will shift from ratepayers to producers under an EPR system and coverage of curbside services extends to all households, ensuring all rural households receive recycling services. Under a DRS, residents will have more options and a greater incentive to recycle.
- **Municipalities:** In a DRS, municipalities may expect disposal cost tipping fee savings of ~\$7M as material moves into the DRS system from the trash and a 6% increase in recycling rate without the need for jurisdictions to increase household rates. In EPR, producers cover the cost of recycling and municipalities have the option to manage, provide directly or contract the services allowing PPP services to be aligned with streams, i.e. trash and organics.
- **Waste Management Companies:** Recycling companies will have the opportunity to provide collection and other services under the DRS and more properties to collect from as a result of 100% coverage under the EPR systems.
- **MRFs:** MRFs may experience a loss from reduced tipping fees and material revenues under DRS but can redeem the value of the deposit containers passing through the MRF to make up for some or all of this loss. Revenue losses from reduced tipping fees and sales of recyclable materials are only relevant when the DRS is implemented without an EPR program for PPP. With EPR, a greater quantity of material will be collected at the curbside. In initial program years, when producers do not meet targets, unredeemed deposits will be available to existing sorting facilities for infrastructure improvements to maximize the capture and value of other PPP, estimated to deliver ~\$73M over the three-year DRS implementation period. MRFs may also serve as counting centers and receive handling fees.

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- **Low income families:** Those that rely on bottled water could be impacted by a DRS, as they would be required to outlay \$0.10 more than the current price for the deposit on each container. If the empty container is returned, this outlay is only temporary, as the deposit could be recovered once the container is returned. However, there is a potential burden associated with this initial payment. This payment could be mitigated by implementing a “deposit holiday” for the first week of the DRS program for non-carbonated water only. This would allow low income households to purchase essential beverages during the first week of the new program without the burden of the deposit, but still be able to claim the deposit when returning the container, as if they had paid it. The producers would cover the cost of the deposit on all non-carbonated water sold in the first week. The cost of this to producers would be just over \$3.2M, assuming all of those containers are returned. If only 70% are returned, then the cost would only be \$2.3M and only \$1.6M if only half redeemed.³

Conclusions

All future systems modeled in this study, with a DRS or EPR for PPP program, separately or together, result in better net benefits than the current system (baseline) for residential recycling in Washington, including contributions to the local economy (GVA) and the social costs of carbon.

All systems modelled result in an increase in the amount of material recycled at no additional cost to the ratepayer. Under FSs 2-7 the cost of collection and processing of recyclables transfer from households to producers. FS 7 achieves the highest recycling rate of ~75%. FS 6 achieves nearly as high a recycling rate at ~73%, and offers the lowest cost per ton of recycled material of all systems, including the current system. This is in part because glass is not collected at the curbside, but through infrastructure shared with the DRS and drop-offs.

EPR Systems:

EPR in Washington would save between \$90 to \$121 per household per year and create between 1,650 and 2,600 new, local jobs in the state. The program would divert between 210,000 to 240,000 tons of valuable material from landfill, reducing the amount of PPP going to landfill by 20%. This additional recycling would reduce greenhouse gas emissions by between 565,000 and 650,000 metric tons of CO₂-equivalent, equal to removing between 120,000 to 138,000 vehicles from the road every year.

DRS:

DRSs, when designed with best-in-class principles, as described above, enhance all curbside recycling systems by increasing recycling rates, yielding high-quality recyclable material for end-markets and reducing litter. A DRS system in Washington would cost ~\$59 million and recycle an additional 66,000 tons of high-quality recyclable materials such as PET, HDPE, aluminum and glass. It would also directly create 860 local jobs that contribute to a more circular economy.

If recycling performance targets were set at 75% and above, a DRS would be necessary, in addition to an EPR program, to achieve the target. The choice of which system would be best for Washington to implement: a DRS, EPR for PPP, or both, depends to a large extent on the level of ambition of the state to increase recycling rates, create jobs and reduce carbon emissions.

³ These figures are only for water, but this program could be extended to milk and other essential beverages.

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