The Recycling Partnership
SOLVING FOR CIRCULARITY

Increasing Recycling Rates with EPR Policy

How Extended Producer Responsibility Law for Packaging and Printed Paper Creates High-performing Recycling Programs

About The Recycling Partnership

At The Recycling Partnership, we are solving for circularity. As a mission-driven NGO, we are committed to advancing a circular economy by building a better recycling system. We mobilize people, data, and solutions across the value chain to reduce waste and our impact on the environment while also unlocking economic benefits. We work on the ground with thousands of communities to transform underperforming recycling programs; we partner with companies to achieve packaging circularity, increase access to recycled materials, and meet sustainability commitments; and we work with government to develop policy solutions to address the systemic needs of our residential recycling system and advance a circular economy. We foster public-private partnerships and drive positive change at every step of the recycling and circularity process. Since 2014, we have diverted 770 million pounds of new recyclables from landfills, saved 968 million gallons of water, avoided more than 670,000 metric tons of greenhouse gases, and driven significant reductions in targeted contamination rates. Learn more at *recyclingpartnership.org*.

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Introduction

In June of 2021, Maine became the first U.S. state to pass a stewardship program for packaging, known as the *extended producer responsibility (EPR) law* for packaging and printed paper (PPP), with a goal to reduce volume and toxicity and increase the recycling of packaging material. Since Maine's enactment, three other states—Oregon, Colorado, and California—have followed suit, and momentum is building for policy action in additional states.

While EPR for products like electronics and paint is not new to U.S. state legislators, the passage of EPR for PPP programs marks an important next chapter in U.S. recycling. EPR for PPP is the primary way packaging (and often paper) is managed in countries worldwide. Previous research has already documented the high recycling rates achieved by EPR for PPP programs worldwide and the low recycling rates in U.S. states.[1] [2] This report further validates that EPR successfully increases recycling rates for PPP and demonstrates the projected substantial impacts of EPR policy in a sample of U.S. states.

Most previous studies on the effects of EPR focus on programs in Canada and the European Union (EU). The Recycling Partnership expanded that scope by analyzing seven programs—British Columbia, Belgium, Spain, South Korea, The Netherlands, Quebec, and Portugal—representing a mixture of under and widely discussed programs of varying sizes, geographies, and policy differences. Not all EPR for PPP programs are created equal, and many important policy, geographic, and demographic factors differentiate EPR programs from one another. Regardless of these differences, EPR for PPP programs in jurisdictions around the world have demonstrated strong, sustained growth in recycling rates, proving that EPR has its desired effect.

Key Takeaways

U.S. recycling rates are *substantially* lower than recycling rates in jurisdictions with extended producer responsibility (EPR) for packaging and printed paper (PPP).

The analysis of individual states in this study strongly indicates all U.S. states could expect an increase in their recycling rates for PPP with the implementation of an EPR law.

EPR can help ensure universal recycling access, high participation rates, and optimal participant capture behavior, as well as better infrastructure, consistent education, and stable markets.

The Recycling Partnership hopes the demonstrated impact of EPR for PPP on recycling rates depicted in this report will encourage stakeholders to continue supporting new EPR for PPP legislation.

ALL U.S. STATES COULD EXPECT AN INCREASE IN THEIR RECYCLING RATES FOR PACKAGING AND PRINTED PAPER (PPP) WITH THE IMPLEMENTATION OF AN EPR LAW.

[1] **Gendell, A. and Stoner, R. (2021). *Extended Producer Responsibility for Packaging: Elements and Outcomes.* Eunomia Research & Consulting.**

[2] **Hesterman, B., Dimino, R., and Ricchi, K. (2020). *Impact of EPR for PPP on Recycling Rates.* Resource Recycling Systems.**

Four out of the seven international jurisdictions examined for this analysis had recycling rates over 78% in 2020, while five of the seven programs have surpassed a recycling rate of 75% in the past five years. Belgium's high-performing program stands out with a 95% recycling rate in 2020 despite a global recycling downturn.[3] Some individual material recycling rates are higher than others, but no one material is responsible in any jurisdiction for propping up the others. High recycling rates are especially impressive for materials like plastic that tend to underperform in U.S. programs.

Across all materials, U.S. state programs perform much lower. According to The Recycling Partnership's analysis, the six U.S. programs examined in this report—Washington, Connecticut, Wisconsin, Maryland, Colorado, and Florida—have stagnant or declining recycling rates. Top recycling rates are seen in Connecticut and Washington, at or slightly above 50%. Colorado and Florida represent the low end of the U.S. recycling spectrum, with percentages in the high teens to low 20s. This data demonstrates that U.S. programs would benefit from an EPR for PPP policy. Colorado already has an EPR for PPP law, enacted in 2022, providing a key policy guide to other state legislatures.

The empirical evidence drawn by The Recycling Partnership for this study demonstrates that EPR is a cornerstone of a high-performing recycling system.

How exactly does EPR increase recycling rates?

The Recycling Partnership anticipates that the following four recycling system areas where U.S. recycling systems often fall short will see significant improvement under EPR.

Improvement 1

Better Recycling Access, Participation, and Participant Capture Behavior

EPR can help ensure universal recycling access, high participation rates, and optimal participant capture behavior by providing financial support to the recycling system.

The Recycling Partnership estimates that 40% of U.S. households lack equitable access to recycling where it is as easy to recycle material as to throw it away.[4] States like Connecticut require universal access to recycling, while other states like Florida and Colorado have whole regions receiving little to no recycling services.

But even in geographies with high access, household participation in recycling may sit well below 100%. Residents who often participate still dispose of some recyclable materials and place non-recyclable materials in recycling bins. Where curbside access is provided, The Recycling Partnership estimates only 72% of households participate in recycling, and participants only recycle 64% of the recyclable materials. The combination of limitations to recycling access and optimum recycling behavior leads to a U.S. single-family recycling rate of 32%. If multifamily homes are included, the recycling rate would certainly be lower.

Let's compare The Recycling Partnership's U.S. data to EPR for PPP jurisdictions.

- In available data from British Columbia, Quebec, Spain, and Belgium, **98-99%** of all residents had access to recycling services.
- In Quebec and British Columbia, **97% and 99%** of participants, respectively, report recycling all or most of the time.[5] [6]

Contractual relationship differences between Quebec and British Columbia's producer responsibility organizations (PROs), municipalities, and service providers in those provinces can help explain the difference in recycling rates between the provinces. Still, both programs provide greater access with higher and better participation than U.S. states.

[3] *https://com.fostplus.be/activityreport2020en/key-figures/*

[4] *https://recyclingpartnership.org/paying-it-forward/*

[5] *https://www.eeq.ca/wp-content/uploads/EEQ-Memoire-BAPE-residus-ultimes_VFA-1.pdf*

[6] *https://www2.gov.bc.ca/assets/gov/environment/waste-management/recycling/recycle/paper-package/recyclebc_annual_report_2021.pdf*

Improvement 2

Optimized Infrastructure

Under EPR, producers are incentivized and often required to invest in the collection, sorting, and end-market infrastructure to meet their recycling performance standards. These investments help overall system performance, efficiency, and widespread deployment of the best technologies.

Private subscription or municipally-funded recycling programs are limited in investment capacity by several factors, including the willingness of customers to pay for recycling, strained municipal budgets, inadequate state and federal grants, and unpredictable recycled commodity markets.

Improvement 3

Better Education

As with infrastructure, the funding needed for clear, consistent education depends on municipal efforts, state and federal grants, or nonprofits like The Recycling Partnership. In a 2019 survey, 75% of municipalities surveyed reported to The Recycling Partnership an average education spending of $0.95 per household per year.[7] The Recycling Partnership estimates less than half of communities nationwide have dedicated outreach budgets. Some states, like Connecticut, have statewide efforts to support recycling education through groups like RecycleCT.

Let's compare the average U.S. education budget per household with education spending in EPR for packaging jurisdictions.

- In 2019, RecycleCT brought in $402,500 in state and federal grants to support the education of 1.3 million households—an average of just under $0.31 per household.[8]
- In British Columbia, RecycleBC spent $1.3 million in 2021 to provide promotion and education to 2 million households—an average of $1.54 per household.[9]

Improvement 4

Better Market Stability

EPR for PPP helps maintain recycling rates despite market downturns. During the peak 2018-2020 period of China's National Sword policy, in which Chinese import restrictions led to a market crisis that severely affected local recycling programs, recycling rates in EPR jurisdictions *continued* to improve while many U.S. programs saw moderate to significant recycling rate drops.

While EPR does not directly improve material value, it provides base system funding that shields recycling programs from market downturns. Whereas in the current U.S. recycling system, low material values might lead the local government to stop recycling or a private materials recovery facility (MRF) to stop accepting certain materials, EPR requires producers to meet recycling performance goals regardless of material value and short-term market fluctuations.

The four areas identified above as key impact areas for EPR on U.S. recycling systems make clear that EPR improves recycling by aligning incentives with funding. When producers are responsible for managing the recycling system and achieving performance targets:

- Critical investment flows into communities and the recycling value chain
- Significant costs are lifted from municipalities and onto packaging producers
- Communities gain better access to recycling
- Recycling participation increases

The Recycling Partnership hopes the demonstrated impact of EPR for PPP on recycling rates depicted in this report will encourage stakeholders to continue their support for new legislation.

[7] *https://recyclingpartnership.org/wp-content/uploads/dlm_uploads/2020/02/2020-State-of-Curbside-Recycling.pdf*

[8] *https://www.recyclect.com/assets/downloads/RecycleCTAnnualReport2019.pdf*

[9] *https://www2.gov.bc.ca/assets/gov/environment/waste-management/recycling/recycle/paper-package/recyclebc_annual_report_2021.pdf*

EPR Effect on Recycling Rates

Results from Previous Studies

EPR for PPP programs have operated in jurisdictions around the world since the 1990s, providing ample longitudinal data to analyze their performance. Many studies have examined various questions related to EPR performance, including cost efficiency, market stabilization, and incentives for product redesign, along with explorations of recycling rates. The literature review conducted by The Recycling Partnership found *overwhelming* evidence that EPR increases recycling rates for PPP.

Watkins et al. (2012) analyzed 24 EPR for packaging schemes in the EU, comparing them across many metrics, including the amount of material captured and recycling rates.[10] Beyond the general survey, their analysis closely examined several jurisdictions, including Belgium, where per capita collection of glass, paper and cardboard, and plastic containers grew from 67.59 kg/person in 1996 (one year before the EPR program began operation) to 115.95 kg/person in 2009, a 71.5% increase in the collection. Their analysis also found the Netherlands saw plastics recycling rates grow from 12.5% to 22% over an 8-year period before the 2005 introduction of EPR. In the three years after implementation, recycling rates for plastic increased to 36%. Despite introducing a more stringent measurement point for determining recycling rates, the Dutch PRO Afvalfonds Verpakkingen reported a 46-52% recycling rate for plastic in 2020.[11]

Two research consultants, Eunomia and RRS, have each recently conducted an EPR analysis of recycling rates on behalf of U.S. clients. Eunomia conducted a survey in 2021 of EU EPR for packaging programs on behalf of the National Waste and Recycling Association which demonstrated significant recycling rate increases in Germany, France, and Italy over program operation.[12]

Eunomia's research also sought evidence of an increase in recycled content usage, packaging design changes, and the market value of packaging waste. While programs have not always delivered on these other program goals, recycling rates in Germany, France, and Italy have been high. Most striking is Germany, where between the implementation of the Packaging Ordinance in 1991 and 2016, the overall recycling rate for packaging increased from 37.7% to 76.2%. Eunomia found a critical element for increased recycling rates was material-specific performance targets.[13]

RRS's 2020 study was conducted on behalf of the Oregon Department of Environmental Quality and strictly limited the jurisdictions analyzed to those where data was available directly before and five years after program implementation.[14] Five cases were developed for British Columbia, Quebec, and Ontario in Canada, and Greece and Malta in the EU. In the first five years of program operation, recycling rates increased by 9.5% in Greece to over 44% in Quebec.

Lastly, a very recent study by Colelli et al. (2022) used regression analysis on 25 EU EPR for packaging schemes to determine what factors played a role in increasing recycling rates.[15] They find that non-competitive (i.e., nonprofit) PROs increase recycling rates compared to competitive systems, and jurisdictions with waste collection managed by local authorities outperform fully privatized programs.

[10] Watkins, E., Hogg, D., Mitsios, A., Mudgal, S., Neubauer, A., Reisinger, H., Troeltzsch, J., & Acoleyen, M. V. (2012). *Use of Economic Instruments and Waste Management Performances. Final Report*, 180.

[11] *https://www.afvalfondsverpakkingen.nl/en/node/390*

[12] Gendell, A. and Stoner, R. (2021). *Extended Producer Responsibility for Packaging: Elements and Outcomes.* Eunomia Research & Consulting.

[13] In addition to studies examining EPR for packaging, Eunomia also produced *The 50 States of Recycling: A State-by-State Assessment of Containers and Packaging Recycling Rates*. Edwards, S., and Grushack, S. (2021) The report developed a baseline recycling rate in each U.S. state for calendar year 2018 for commonly recycled containers and packaging. Eunomia also developed *an in-depth analysis of Washington state's recycling system characteristics* and assessed the impact of an EPR policy on recycling rates. While The Recycling Partnership's findings roughly align with Eunomia's in Washington and each of the other five U.S. states examined by The Recycling Partnership, this analysis also includes generated and recycled paper in recycling rates, leading The Recycling Partnership's overall recycling rate to differ somewhat from Eunomia's.

[14] Hesterman, B., Dimino, R., and Ricchi, K. (2020). *Impact of EPR for PPP on Recycling Rates*. Resource Recycling Systems.

[15] Colelli, F. P., Croci, E., Bruno Pontoni, F., & Floriana Zanini, S. (2022). *Assessment of the effectiveness and efficiency of packaging waste EPR schemes in Europe*. Waste Management, 148, 61–70.

Research Finding

EPR Delivers High Recycling Rates for Packaging

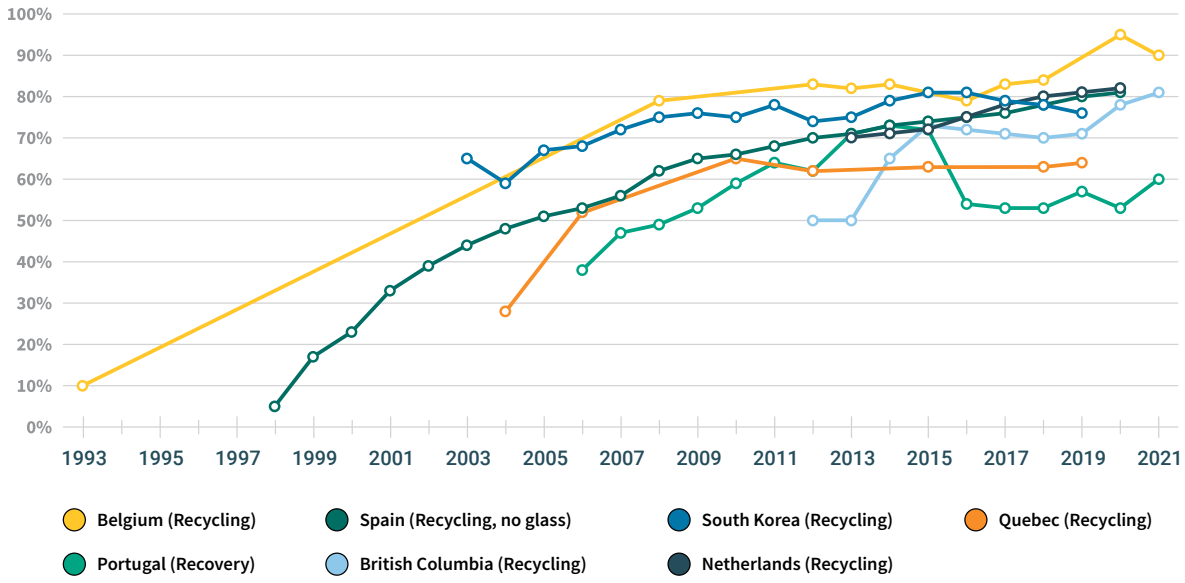
What proof is there that EPR increases recycling rates for PPP? The Recycling Partnership examined seven jurisdictions worldwide—British Columbia, Quebec, Belgium, Spain, Portugal, the Netherlands, and South Korea—that have some form of EPR for packaging or PPP. While program specifics differ between jurisdictions, the recycling rates seen in each EPR program far outperform the recycling rates of the U.S. states examined in this report.

Evidence of Increased Recycling Rates Under EPR for PPP

Recycling rates in the seven analyzed jurisdictions rose by very different percentages depending on when the program started, what system was in place before, and how long the system had been in operation. Some programs have had varying scopes, which has dramatically altered outcomes. Programs in the EU and Asia have tended to collect just packaging, while Canadian programs have taken over curbside recycling, requiring paper to be included in the EPR scope.

All programs have shown modest to significant growth in recycling rates, with five of the seven exceeding a 75% recycling rate at some point in the past five years. Belgium stands out as a very high performer with a 95% recycling rate in 2020, [16] while in North America, British Columbia is the high performer with an 81% recycling rate and 94% recovery rate in 2021.[17]

Figure 1. EPR for packaging recycling rates across international jurisdictions.



Individual material recycling rates have also fared well under EPR for PPP. In Belgium, the plastic recycling rate has grown from 38% in 2012 to 52% in 2021,[18] [19]and Spain's recycling rate for plastic containers has increased from 17% in 2002 to 75.8% in 2018.[20] Despite being relatively lower performing than other EPR programs, Quebec's paper and cardboard recycling has increased from 56% in 2006-2007, right after program implementation, to 72% in 2019. These results contrast U.S. individual material and overall recycling rates for PPP, which remain well below EPR jurisdictions for most materials.

[16] *https://com.fostplus.be/activityreport2020en/key-figures/*

[17] RecycleBC. (2022). *2021 Annual Report.*

[18] *https://www.ivcie.be/wp-content/uploads/2020/02/ENG-IVCIE-Jaarverslag-2013.pdf*

[19] *https://com.fostplus.be/activityreport2021en/key-figures-2021*

[20] *https://ecoembes.com/landing/informe-anual-2018/*

The one exception to sustained recycling rate growth has been Portugal, which in 2016 transitioned from managing both residential and commercial packaging to just residential packaging. Before the shift, Portugal's packaging PRO Sociedad Ponto Verde had focused primarily on commercial packaging and recovered 93% of commercial packaging compared to 64% for residential in 2015, leading to a net recycling rate of 73%. [21] Following the change in scope, Portugal's residential recycling rate shifted to 54% before climbing to 60.4% in 2021.[22]

Individual Jurisdiction Detailed Analyses

British Columbia

British Columbia's EPR for packaging program has been a leading example of successful programs. Legislation passed in 2011 took effect in 2014, and over the seven years of existing program data, recycling rates have increased from between 50-57% to 81%, while the recovery rate in the most recent year (2021) was 94%.[23]

The program is producer-led, with PRO RecycleBC funding both collection and recycling through agreements with municipalities and contracts with recycling service providers[24] The number of households served through the program has grown from 1.2 million in 2014 to 1.8 million in 2020, which accounts for 99.3% of both single and multifamily units in the province. British Columbia's program focuses strictly on residential PPP, but materials collected through the province's deposit return program are excluded from the recycling rate reported by RecycleBC.[25] Most importantly, the recycling rate has increased as the amount of material managed under the EPR program has also increased from 145,351 tons in 2014 to 227,603 tons in 2021.

Except for plastic, all materials managed under British Columbia's EPR program have experienced recycling rate increases between 2017 and 2021. Glass, paper, cardboard, and metal recycling have each grown significantly over the five years of available program data. While plastic recovery has grown from 41-55%, most of the data between British Columbia's recovery and recycling rates is flexible plastic either collected and disposed of or collected and converted to fuel. The low recycling rate for plastics in British Columbia reflects several factors:

- Most highly recycled plastic packaging is covered in the DRS system.
- The remaining plastics packaging under EPR contains a wide range of materials for which disposal and engineered fuels are the only options.
- The lack of appreciable effects from the redesign, advances in recyclability, or switching of packaging to more widely recycled resins also impact that rate.

Figure 2. Material recycling rates for residential packaging, British Columbia.*

Material	2012	2017	2021
Total Packaging Recycling Rate	**50-57%**[26]	**71%**	**81%**
Paper & Cardboard Recycling Rate	—	**85%**	**95%**
Plastic Recycling Rate	—	**26%**	**25%**
Metal Recycling Rate		**66%**	**83%**
Glass Recycling Rate		**60%**	**85%**

**Recycling rates are calculated from the 2017 and 2021 annual RecycleBC and Newsprint Media Canada reports. Recycle rates exclude disposed of materials and engineered fuel*

[21] *https://www.pontoverde.pt/assets/docs_publicacoes/20170407149156568 7EP.pdf*

[22] *https://www.pontoverde.pt/assets/docs_publicacoes/20220419165035710 6EP.pdf*

[23] RecycleBC. (2022). *2021 Annual Report.*

[24] Multi-Material BC. (2013). *Packaging and Printed Paper Stewardship Plan.*

[25] Multi-Material BC. (2013). *Packaging and Printed Paper Stewardship Plan.*

[26] Multi-Material BC. (2013). *Packaging and Printed Paper Stewardship Plan.*

There have been a few key amendments to the program, including the formation in 2017 of a newspaper-specific PRO Newsprint Media Canada in British Columbia and the inclusion of "packaging-like products" in the scope of covered materials in 2020. Packaging-like products include non-packaging products like aluminum foil and single-use food ware, which may be collected through curbside recycling. Despite the addition of Newsprint Media Canada, RecycleBC continues to collect newsprint on behalf of the new stewardship organization.

British Columbia's high plastic collection rate but low recycling rate demonstrates the ongoing need for EPR member companies to partner with each other, packaging converters, and the PRO to shift packaging design and grow plastic end-markets in North America.

Belgium

Belgium's program has the highest recycling rate of all jurisdictions studied, achieving a 95% recycling rate in 2020 before falling back to 90% in 2021. Like many other EPR for packaging programs in Europe, EPR legislation was enacted in 1994 with program operation beginning in 1997, and represents an agreement between PRO Fost Plus and the three subnational government entities in Belgium. In some cases, Fost Plus reimburses the municipal entity for the cost of collection and sorting, but at the municipality's discretion Fost Plus may hire a private hauler.[27] Fost Plus manages approximately 92% of residential packaging placed on the Belgian market, with sister organization Val-i-pak handling commercial packaging.[28]

Along with a 92% recycling rate for residential paper and cardboard in 2021, Belgium's EPR for packaging program also boasts 52% and 73% recycling rates for plastic and polycoat/aseptic cartons, respectively. Paper, cardboard, metal, and glass have all had recycling rates over 100% since 2013, driven by the collection of additional material outside the mandate of Fost Plus.[29]

Figure 3. Residential packaging recycling rate in Belgium.

Material	2012	2021
Total Packaging Recycling Rate	**82.9%**	**89.8%**
Plastic Recycling Rate	**37.6%**	**52%**

Spain

Like Belgium, Spain's EPR law was enacted in 1994. It became operational in 1997, with producers required to fund the collection and recycling of their packaging waste. Two PROs have since formed; ECOEMBES manages metal, plastic, paper, cardboard, wood, and multi-material/flexible packaging, while ECOVIDRIO manages all glass packaging. In the original legislation, producers were given the option to institute a deposit return system for containers or participate in the EPR for packaging program and chose to participate in an EPR program.[30] Spain is one of only two EPR jurisdictions in this analysis without a deposit return system. Through the PROs, municipalities are reimbursed for operating central collection points for covered materials. Other than legislatively mandated material recovery targets, there have been no major changes to the program since its inception. However, a new law passed in April 2022 limits some plastics and adds a tax to others.[31] As of 2019, 98-99% of all households in the country were covered under the program.[32]

From the earliest program data in 1998, the packaging recycling rate, excluding glass, grew from just under 5% to 80.7% in 2020.[33] Annual data for glass managed by ECOVIDRIO could not be found, but the recycling rate was in the mid-70s between

[27] *https://www.pro-e.org/files/PRO-EUROPE_Producer-Responsibility-in-Action_web-version_final_150811.pdf*

[28] *https://www.pro-e.org/files/PRO-EUROPE_Producer-Responsibility-in-Action_web-version_final_150811.pdf*

[29] *https://www.ivcie.be/wp-content/uploads/2020/02/ENG-IVCIE-Jaarverslag-2013.pdf*

[30] EXPRA. (2022). *Spain.*

[31] Tsang, H. (2022). *Spain Issues a Law on Waste and Contaminated Soil for a Circular Economy.*

[32] Rubio S., Ramos, T. R. P., Leitão, M. M. R., & Barbosa-Povoa, A. P. (2019). *Effectiveness of extended producer responsibility policies implementation: The case of Portuguese and Spanish packaging waste systems*. Journal of Cleaner Production, 210, 217-230.

[33] *https://ecoembes.com/landing/informe-anual-2020/*

2017-2019.[34] [35] When combined with the data from ECOEMBES, Spain's overall packaging recycling rate was 76.5% in 2019, with plans to push it over 80% by 2025.[36] Perhaps most impressively, ECOEMBES boasted a 75.8% recycling rate for plastic containers in 2018.[37] The high plastic container recycling rate compared to other EPR jurisdictions is likely due to the lack of a deposit return system, meaning ECOEMBES collects a significant amount of plastic beverage containers. The amount of material collected has risen against a relatively constant generation rate of 1.5 million tons per year.

Figure 4. Packaging material recycling rates in Spain.

Material	1998	2002	2018	2020
Total Packaging Recycling Rate (no glass)	4.8%[38]	38.5%	78.8%	80.7%
Glass Recycling Rate (ECOVIDRIO)	-	—	76.5%	—
Plastic Container Recycling Rate (ECOEMBES)	—	17.0%	75.8%	—
Paper/Cardboard Recycling Rate (ECOEMBES)	—	52.7%	80.0%	—
Metal Recycling Rate (ECOEMBES)	—	45.0%	85.4%	—

South Korea

South Korea has operated a municipal reimbursement EPR scheme for packaging since 2003, with producers subsidizing some municipal costs and processing costs for packaging materials by recycling companies. The Korean Resource Circulation Service Agency (KORA) runs the program, while the Korea Packaging Recycling Cooperative (KPRC) acts as a PRO and collects funds from each producer. Other than the 2013 formation of KORA, no major amendments to the program have been implemented. No accurate data from before the implementation of EPR could be found, but KPRC documents show that since the program began, the amount of material managed has grown from 999,823 tons in 2003 to 1,654,912 tons in 2019.[39] The program covers 100% of Korean households and only manages residential packaging, excluding cardboard and paper.

Recycling rates have grown steadily in South Korea from 64% in 2003, when the program began, to 78% in 2019.[40] However, recycling rates in South Korea include extraneous data not counted in other programs. First, the country operates a deposit return system for glass beverage containers and mixes the data from the deposit return system with data from other glass recycling. Further, plastics managed through waste-to-energy are counted as recycled in South Korea, and plastic containers and film have made up as much as 43% of the total packaging recycled through the program (2017).[41] Lastly, South Korean municipalities must operate strict Pay-As-You-Throw laws and recycling policies, which may be as significant a contributor to the country's recycling rates.

Figure 5. Recovery/recycling rates for packaging in South Korea.[42]

Material	2003	2019
Total Packaging Recovery/Recycling Rate (includes WTE)	64%	78%
Metal Container Recycling Rate	72%	89%
Expanded Polystyrene Recovery Rate (includes WTE)	42%	82%
Plastic Container and Film Recovery Rate (includes WTE)	68%	91%

[34] *https://picvisa.com/en/glass-recycling-increases-spain/*

[35] *https://picvisa.com/en/glass-recycling-increases-spain/*

[36] *https://www.dammcorporate.com/en/ecovidrio-commits-82-recycling-rate-2025*

[37] *https://ecoembes.com/landing/informe-anual-2018/*

[38] *https://www.ecoembes.com/sites/default/files/inline-files/corporativo/ecoembes/Informes-anuales/2013-informe-anual-completo.pdf*

[39] Korea Resource Circulation Service Agency. (2022). Packaging Recycling Statistics, accessed from: *http://www.kora.or.kr/eng/products/packingRecyclingTotal.do*

[40] Korea Resource Circulation Service Agency. (2022). Packaging Recycling Statistics, accessed from: *http://www.kora.or.kr/eng/products/packingRecyclingTotal.do*

[41] Korea Resource Circulation Service Agency. (2022). Packaging Recycling Statistics, accessed from: *http://www.kora.or.kr/eng/products/packingRecyclingTotal.do*

[41] Korea Resource Circulation Service Agency. (2022). Packaging Recycling Statistics, accessed from: *http://www.kora.or.kr/eng/products/packingRecyclingTotal.do*

[42] Korea Resource Circulation Service Agency. (2022). Packaging Recycling Statistics, accessed from: *http://www.kora.or.kr/eng/products/packingRecyclingTotal.do*

Netherlands

Unlike other European countries, the Netherlands were a comparatively late adopter of EPR for packaging, passing legislation in 2007. Like Belgium, the Dutch PRO Afvalfonds Verpakkingen maintains agreements with local municipalities that collect and recycle packaging and are reimbursed by the PRO.[43] Afvalfonds Verpakkingen manages both residential and commercial packaging sold onto the Dutch market, making it the only EPR program examined in this analysis that includes commercial material. Even including commercial materials, the Netherlands has had recycling rates for all materials increase from 70% in 2013 to 82% in 2020.[44]

The Netherlands has also pioneered new measurement efforts in the EU to capture the amount of material used in new products and not just the amount of material sent for recycling from sorting facilities. This new measurement method reduces the overall recycling rate in 2020 from 82% to between 76-78%.[45] Plastic and glass have fared worst under this new measurement system with 10-18% drops in recycling rate, but paper, cardboard, and metal have mostly retained their high recycling rates of around 90% in 2020.[46] In addition to plastic package recycling, some amounts of plastic and wood packaging are managed through waste-to-energy, which is the preferred method of disposal in the Netherlands.[47]

Figure 6. Plastic and glass packaging material recycling rates, Netherlands.

Material	2013	2020
Total Packaging Recycling Rate	70%	82%
Total Packaging Recycling Rate, new measurement method	—	76-78%
Plastic Packaging Recycling Rate	47%	66%
Plastic Packaging Recycling Rate, new measurement method	—	46-52%
Glass Packaging Recycling Rate	80%	90%
Glass Packaging Recycling Rate, new measurement method	—	74-80%

Quebec

Quebec's EPR for PPP scheme operates similarly to many European EPR for packaging programs, requiring local governments to maintain the operation of material collection and sorting. Municipalities are then reimbursed by PRO Eco-Enterprises Quebec (EEQ). However, beginning in 2022, the program is transitioning to a British Columbia model predicated on more robust PRO-decision-making. Quebec's program has operated since 2005 and increased recycling rates from at least 52% in 2006 to 64% in 2019.[48] Data from 2004 reported the overall recycling rate for curbside material was as low as 28%.[49] Quebec's program focuses strictly on residential PPP and excludes material collected through the deposit return system in their recycling rate.[50] Since at least 2011, EEQ has managed packaging on behalf of 99% of single and multifamily households in Quebec.

[43] *https://www.pro-e.org/files/PRO-EUROPE_Producer-Responsibility-in-Action_web-version_final_150811.pdf*

[44] *https://www.afvalfondsverpakkingen.nl/en/node/390*

[45] *https://www.afvalfondsverpakkingen.nl/sites/default/files/2022-03/Publieksverslag%202020.pdf*

[46] *https://www.afvalfondsverpakkingen.nl/en/node/390*

[47] *https://www.afvalfondsverpakkingen.nl/sites/default/files/2022-03/Monitoren%202014.pdf*

[48] Éco Entreprises Québec. (2022). *Documentation*. All calculations were conducted using annual reports and material characterization studies conducted by EEQ. The latest data are from 2019.

[49] *https://numerique.banq.qc.ca/patrimoine/details/52327/1992121?docref=zzWUJCQaKPN7f0rCRzwl6A*

[50] Eco Entreprises Québec and Recyc-Québec. (2015). 2012-2013 *Characterization of Residual Materials in Quebec's Residential Sector*. All recovery rates are for curbside recyclables collected on behalf of EEQ members. Curbside recycling may include DRS materials not returned at redemption centers, but recovery data are not built using DRS numbers.

According to EEQ recycling data, all materials in the program have shown an increase in recycling rates. In particular, paper and cardboard packaging, curbside glass, and plastic have seen increases in their rates between 2006 and 2019. While the glass recycling rate has increased over the program's lifetime, collection rates dropped after 2010 for a few years. EEQ has explained that this decrease was due to an influx of 18,000 tons of additional glass between 2010-2013.[51] After management capacity recovered, recycling rates for glass recovered to their previous rate near 80%. Unfortunately, EEQ has not reported recycling rates of any kind in 2020 and 2021, with no clear explanation given for the omission.[52]

Figure 7. Packaging recycling rates in Quebec.

Material	2004	2006/7	2019
Total Packaging Recycling Rate	28%	52%	64%
Paper Recycling Rate	34%	56.2%	71.5%
Plastic Recycling Rate	9%	27%	40%
Glass Recycling Rate	22%	66%	79%
Metal Recycling Rate	16%	38%	41.5%

Portugal

Portugal's EPR for packaging program was enacted and then operational in tandem with Spain and Belgium. The general scheme is also the same, with PRO Sociedad Ponto Verde (SPV) reimbursing municipalities and other private entities for the cost of collecting and recycling packaging materials. Until 2015, SPV managed both residential ("urban") and commercial ("non-urban") packaging waste, before transitioning to just managing residential packaging in 2016. After the transition, SPV managed 63% of all packaging waste in Portugal.[54] Portugal does not have a deposit return system for beverage containers, making it the second EPR jurisdiction in this analysis without one. Every resident in Portugal is covered under the program.[55]

EPR in Portugal has been the *least successful* of all European examples, partly due to the support of commercial materials. Before 2016, Portugal's recycling rate was at 73%. The year after commercial materials were excluded from the program, the recycling rate sank to 54%. Paper, cardboard, metal, and plastic all saw dramatic declines, while glass stayed relatively constant. All rates have slowly recovered after 2016, with the overall recycling rate reaching 60% in 2021.

Figure 8. Packaging recycling rates in Portugal, beginning eight years after implementation.

Material	2006*	2015*	2021**
Total Packaging Recovery Rate	38%	73%	60.4%
Paper/Cardboard Recycling Rate	83%	91%	81.3%
Plastic Recycling Rate	15%	76%	51.3%
Glass Recycling Rate	36%	51%	54.4%
Metal Recycling Rate	56%	113%	66.4%

**Residential and commercial materials*
***Residential materials only*

[51] Éco Entreprises Québec and Recyc-Québec. (2015). 2012-2013 *Rapport Synthèse: Caractérisation des matières résiduelles du secteur résidentiel*.

[52] *https://www.eeq.ca/wp-content/uploads/E%CC%81EQ_21005_RA_2021_VF_EN.pdf?v=2*

[53] *https://numerique.banq.qc.ca/patrimoine/details/52327/1992121?docref=zzWUJCQaKPN7f0rCRzwl6A*

[54] *https://rea.apambiente.pt/content/recycling-packaging-waste?language=en*; *https://www.pontoverde.pt/assets/docs_publicacoes/20170407149156568 7EP.pdf*

[55] Rubio S., Ramos, T. R. P., Leitão, M. M. R., & Barbosa-Povoa, A. P. (2019). *Effectiveness of extended producer responsibility policies implementation: The case of Portuguese and Spanish packaging waste systems*. Journal of Cleaner Production, 210, 217-230.

Conclusion

Each EPR program in these seven international jurisdictions has its unique policy, cultural, and scope differences. Still, across the board, recycling and recovery rates for materials managed under EPR have increased steadily over the lifetime of each program. Increased recycling rates are not isolated to one material substrate like paper or metal; instead, all materials have seen significant benefits from the policy.

Performance of U.S. State Recycling Programs

As EPR now gains traction in several U.S. states, what does recycling rate data tell us about how non-EPR states are currently performing in PPP recycling? Although state recycling data is uneven and has clear limitations, estimates can be made and contrasted with the PPP recycling rates of EPR jurisdictions to understand the gaps that EPR may fill. The six states examined in this section—Washington, Connecticut, Wisconsin, Maryland, Colorado, and Florida—were chosen due to the availability of key data and geographical diversity.

Estimations of State Recycling Rates

Recycling rate estimates vary significantly by state, with Connecticut and Washington boasting the highest state PPP recycling rates of the states examined while Florida and Colorado represent the lowest. A partial list of considerations when comparing EPR jurisdictions to U.S. states is available in ***Appendix C***. Despite the variation between states, and between the U.S. and EPR jurisdictions, each of the U.S. states examined has a recycling rate well below the worst-performing EPR programs examined.

Figure 9. Comparison of U.S. state recycling rates for packaging and paper.

State	Data Year	Recycling Rate
Washington	**2021**	**52%**
Connecticut	**2019**	**50%**
Maryland	**2020**	**31%**
Wisconsin	**2021**	**34%**
Colorado	**2021**	**21%**
Florida	**2021**	**17%**

It's important to note the six states studied are not without waste policies.

- Connecticut has a deposit return system and requires statewide recycling.
- Maryland has county-level recycling requirements.
- Washington's largest municipality, Seattle, bans the disposal of recyclables.
- Wisconsin bans the disposal of certain materials and mandates recycling provisions.
- Florida set a statewide recycling goal of 75% by 2020, which it fell short of by 34 percentage points, even with counting incineration as recycling.

Individual State Detailed Analyses

Washington

Of the six states analyzed, Washington had the highest recycling rate for residential PPP. Cardboard, mixed paper, and glass had relatively high recycling rates, which pulled the overall recycling rate for the state higher. While PET and HDPE perform well in Washington's program, the plastics category overall is negatively impacted by the low recycling rates for polypropylene containers, #3-7 plastics, and films and flexibles, which pull the category recycling rate down to 31%. The Washington Department of Ecology reports that fewer than 108 tons of aseptic and gable top material has been separated and recycled per year between 2014 and 2018, and that number is not likely to have increased after the introduction of China's National Sword policy in 2018.[56]

Figure 10. Recycling rates for residential PPP materials in Washington.

Material	Recycling Rate (2021)
Cardboard	55%
Mixed Paper	64%
PET Bottles	68%
Non-Bottle PET	20%
HDPE Natural Bottles & Jars	48%
HDPE Colored Bottles & Jars	68%
Glass Containers	68%
Steel Cans	47%
Aluminum Cans	57%
Aluminum Foil & Trays	22%
Other Plastic Packaging (#3-7)	0%
PP Containers	6%
Films and Flexibles	0%
Bulky Rigid Plastics	0%
Total	52%

Washington has a very recent waste characterization study from 2020-2021 which allows for a more precise comparison between The Recycling Partnership's capture study data and disposal amounts in Washington.[57] Washington does not have a statewide recycling mandate or deposit return system for beverage containers.[58] However, most of the state's population is urban, and more than 90% have access to recycling.[59] The state is served by private haulers with permits from the Washington Utilities and Transportation Commission, private haulers with direct contracts, and municipal management. Nearly 60% of all households are served by curbside recycling.[60]

[56] *https://ecology.wa.gov/Asset-Collections/Doc-Assets/Solid-waste/Solid-waste-recycling-data/WasteGenerationAndRecovery-2018*

[57] *https://apps.ecology.wa.gov/publications/documents/2107026.pdf*

[58] *https://www.seattle.gov/utilities/your-services/collection-and-disposal/ban-of-recyclables-in-garbage*

[59] Edwards, S., and Grushack, S. (2021). *The 50 States of Recycling: A State-by-State Assessment of Containers and Packaging Recycling Rates*, Eunomia Research & Consulting.

[60] *https://zerowastewashington.org/wp-content/uploads/2020/09/State-of-Residential-Recycling-and-Organics-Collection-in-WA-Nov-27-2019_Sept-8-2020-update.pdf*

Figure 11. Access to recycling in Washington.

Generating Sector	Access (%)
Statewide	82%
Single Family	100%
Multifamily	34%

Single-family residents in every municipality in Washington have access to recycling, and the high access rate likely contributes to Washington's higher than average recycling rate compared to other U.S. states. For single-family homes, 92% have access to curbside recycling, with 6% utilizing drop-off services and 2% requiring subscriptions for recycling services. Anecdotal evidence collected in Washington state demonstrated that in 2017, several subscription municipalities had participation below 30%.[61] Multi-family data suggests as few as 34% of multi-family homes reside within a mandatory multi-family collection ordinance. Without a mandatory ordinance, multi-family recycling is limited. Combining single-family and multifamily access rates together, The Recycling Partnership estimates Washington's access rate to be 82%.

No Washington-specific survey data is available on the participation rate of residents in curbside recycling service nor the capture rates of PPP materials when residents participate.

Connecticut

Connecticut's PPP recycling performed just below Washington, with an overall rate of 50%. Collection and sorting of PPP materials for recycling are driven in part by a statewide mandated list of materials haulers and municipalities are required to collect. The state also has a deposit return system for beverage containers which boosts the collection and recycling of aluminum, glass, and #1 PET plastic. Legislative updates to Connecticut's deposit return system are expected to boost recycling rates for those materials above their current 50% redemption rate in the coming years.[62] Connecticut's low mixed paper recycling rate provides a significant drag on the state's overall recycling rate, as does the plastic films and flexibles category.

Figure 12. Recycling rates for residential PPP materials in Connecticut*

Material	Recycling Rate (2019)
Cardboard	66%
Mixed Paper	40%
PET Bottles	69%
Non-Bottle PET	58%
HDPE Natural Bottles & Jars	54%
HDPE Colored Bottles & Jars	49%
Glass Containers	79%
Steel Cans	47%
Aluminum Cans	77%
Aluminum Foil & Trays	0%
Other Plastic Packaging (#3-7)	24%
Films and Flexibles	0%
Bulky Rigid Plastics	0%
Total	50%

**Disposed deposit return containers included in the analysis.*

[61] *https://apps.ecology.wa.gov/publications/documents/2007024.pdf*

[62] *https://www.cga.ct.gov/2021/ACT/PA/PDF/2021PA-00058-R00SB-01037-PA.PDF*

The most recent waste characterization study in Connecticut was released in 2015 using data from calendar year 2013. Although overall tonnage of waste disposed of in Connecticut has not changed much between 2013 and 2019, the composition of the waste stream has likely shifted. Without a more current waste characterization study, The Recycling Partnership used the 2013 characterization factored against the overall tons of MSW generated in Connecticut in 2019.

Figure 13. Access to recycling in Connecticut.

Generating Sector	Access (%)
Statewide	**93%**
Single Family	**100%**
Multifamily	**62%**

Access to recycling in Connecticut is high, likely driven by the state's 1991 universal recycling requirement implemented.[63] Fewer single-family residents have access to curbside recycling than in Washington, with 68% of the state served. A much larger proportion, 30%, of single-family residents are served by drop-off facilities, and Connecticut has an extensive municipal transfer station network. Only 2% of the state has subscription service as their only recycling option, but anecdotal evidence suggests more than 2% of households in the state opt to subscribe to recycling service rather than participate in drop-off facilities. Multi-family data suggests 62% of multi-family homes in Connecticut reside within a mandatory multi-family collection ordinance. Without a mandatory ordinance, multi-family recycling is limited. Combining single-family and multi-family access rates together, The Recycling Partnership estimates Connecticut's access rate to be 93%.

No Connecticut-specific survey data is available on the participation rate of residents in curbside recycling service nor the capture rates of PPP materials when residents participate. However, the Connecticut Department of Energy and Environmental Protection published their intermittent solid waste management strategy in 2016 which included an anecdotal acknowledgment that not all residents have access to recycling, and of those that do many do not participate well or fully.[64]

[63] *https://portal.ct.gov/-/media/DEEP/reduce_reuse_recycle/Laws_and_Regulations/PA87544pdf.pdf*

[64] *https://portal.ct.gov/-/media/DEEP/waste_management_and_disposal/Solid_Waste_Management_Plan/CMMSFinalAdoptedComprehensiveMaterialsManagementStrategypdf.pdf*

Wisconsin

Despite surprisingly high residential recycling rates for cardboard and glass, The Recycling Partnership calculates Wisconsin's overall recycling rate in 2021 was only 34%. Low mixed paper and plastic recycling rates likely contributed to the depressed overall recycling rate, as these categories contain a significant portion of PPP materials in Wisconsin by weight. The elevated aluminum foil and tray recycling rate compared to the recycling rates for aluminum and steel cans is an anomaly reflective of the small amount of foil and trays generated in each household compared to the amount disposed of.

Figure 14. Recycling rates for residential PPP materials in Wisconsin.

Material	Recycling Rate (2021)
Cardboard	73%
Mixed Paper	29%
PET Bottles	28%
Non-Bottle PET	14%
HDPE Natural Bottles & Jars	35%
HDPE Colored Bottles & Jars	65%
Glass Containers	73%
Steel Cans	33%
Aluminum Cans	23%
Aluminum Foil & Trays	46%
Other Plastic Packaging (#3-7)	0%
Films and Flexibles	0%
Bulky Rigid Plastics	0%
Total	34%

The state conducted a waste characterization study in 2020 which was used to calculate the disposed fraction of each material category. Unfortunately, Wisconsin's waste characterization study did not separate tonnage by the source of generation (residential, institutional, commercial and industrial, or construction and demolition waste). Instead, The Recycling Partnership determined the tons of each material category disposed of from the residential sector based on the overall tons of material disposed of statewide.

Wisconsin's material management is influenced by two primary policies—a landfill disposal ban for certain PPP material categories (cardboard, paper, aluminum, steel, glass, and plastic containers) and the 1990 Wisconsin Recycling Law. The Recycling Law requires local governments to provide access to curbside recycling or nearby drop-off facilities for all state residents.[65] Eight percent of Wisconsin's single-family residents do not have access to any recycling services. Of the 92% that do have access, 64% have access to curbside recycling, 26% have access to drop-off facilities, and 3% have subscriptions as their only service option.

Figure 15. Access to recycling in Wisconsin.

Generating Sector	Access (%)
Statewide	92%
Single Family	92%
Multifamily	90%

[65] *https://dnr.wi.gov/files/PDF/pubs/wa/WA422.pdf*

Based on the state's universal recycling requirement, The Recycling Partnership calculates 90% of the multi-family buildings have access to recycling services, leading to an access rate of 92%. However, Wisconsin's low recycling rate suggests recycling access may not be provided to the legal requirement and that participation and capture behavior may be low in some areas where there is access. As with other states, no data pertaining to the rate or quality of resident participation was available, but given the lower recycling rate, participation and the quality of that participation are likely less than in Washington and Connecticut.

Maryland

Maryland's 2020 recycling rate is just below Wisconsin's 2021 recycling rate at 31%. Glass is the leading material in Maryland, helping support an otherwise low residential recycling rate, while cardboard and mixed paper each had surprisingly low rates. With the exception of mixed plastics and films and flexibles, plastic as a category performed moderately, as did the metal categories.

Figure 16. Recycling rates for residential PPP materials in Maryland.

Material	Recycling Rate (2020)
Cardboard	22%
Mixed Paper	30%
PET Bottles	47%
HDPE Natural Bottles & Jars	48%
HDPE Colored Bottles & Jars	33%
Glass Containers	60%
Steel Cans	43%
Aluminum Cans	41%
Aluminum Foil & Trays	6.7%
Other Plastic Packaging (#3-7)	8.2%
Films and Flexibles	0%
Bulky Rigid Plastics	0%
Total	31%

Maryland's most recent waste characterization study is from 2014. To calculate a 2020 recycling rate in Maryland, The Recycling Partnership used the individual category percentages from Maryland's 2014 data and factored them against the total amount of residential municipal solid waste (MSW) disposed of in Maryland in 2020. Because residential disposal grew by 540,000 tons between 2014 and 2020, the weight of each material also increased by a fraction of that, driving down the recycling rate. Based on pre-2017 national capture study data, The Recycling Partnership calculates that Maryland's 2014 PPP recycling rate was 39%. This analysis assumes disposed PPP materials in Maryland increased proportionally with total residential MSW, but if disposed PPP materials stayed relatively constant between 2014 and 2020, Maryland's 2020 recycling rate would be closer to 39%.

Although the state does not have a statewide recycling mandate, the Maryland Recycling Act requires counties in Maryland over 150,000 to recycle 35% of their waste, and counties below the threshold to recycle 20% of their waste.[66] The Recycling Act includes waste beyond PPP materials in the recycling rate calculation (i.e., food waste, yard waste) which helps boost recycling rates above the rates for PPP alone. In addition to the Maryland Recycling

[66] *https://mde.maryland.gov/programs/land/Documents/MD%20Solid%20Waste%20Management%20and%20Diversion%20Report%20CY20%20(1).pdf*

Act, the governor signed a 2017 executive order initiating a process to set more advanced recycling goals, and in 2021 the Maryland Legislature passed a law to improve recycling markets within the state.[67] Neither the updated recycling goals nor the market development has taken effect yet to impact recycling rates.

Figure 17. Access to residential recycling in Maryland.

Generating Sector	Access (%)
Statewide	98%
Single Family	100%
Multifamily	90%

Like Washington and Connecticut, single-family residents in every municipality in Maryland have access to some type of recycling service.

- 78% have access through curbside recycling
- 12% have access to drop-off facilities
- 10% must subscribe to recycling services

As in Wisconsin, Maryland's universal recycling mandate has led The Recycling Partnership to calculate a 90% access rate for multi-family buildings in Maryland, although the real access rate may be significantly below that. As with other states, no data pertaining to the rate or quality of resident participation was available, but given the lower recycling rate, participation and the quality of that participation are likely less than in Washington and Connecticut.

Colorado

Colorado is one of two states analyzed with a very low recycling rate. Moderate recycling rates for cardboard and mixed paper were heavily counterbalanced in 2021 by low recycling rates for all plastics, metals, and glass. Glass was a unique issue in Colorado's program compared to other states analyzed with a low 15% recycling rate, and represented close to 20% of all residential PPP materials disposed of in the state by weight.[68] As with other states, mixed plastics and films and flexibles were assumed to not be recycled.

Figure 18. Recycling rates for residential PPP materials in Colorado.

Material	Recycling Rate (2021)
Cardboard	41%
Mixed Paper	37%
PET Bottles	9%
HDPE	9%
Glass Containers	15%
Steel Cans	26%
Aluminum Cans	26%
Aluminum Foil & Trays	0%
Other Plastic Packaging (#3-7)	0%
Films and Flexibles	0%
Bulky Rigid Plastics	0%
Total	22%

[67] *https://mde.maryland.gov/programs/land/Documents/MD%20Solid%20Waste%20Management%20and%20Diversion%20Report%20CY20%20(1).pdf*
[68] The disposed glass weight in all other states analyzed for this report as a fraction of all residential PPP materials disposed was at or below 12%.

Recycling and waste data are collected by the Colorado Department of Public Health and the Environment from local governments and MRFs.[69] The state has not conducted a statewide waste characterization study but has compiled county-level studies from Boulder and Larimer counties, accounting for roughly 12% of the state's population.[70] The lack of a comprehensive statewide waste characterization study is a limitation of this analysis and led to several anomalies in the data which required assumptions. Primarily, the disposal weight of several residential PPP material categories was higher than in capture studies, requiring adjustments to the capture study data.[71]

Before the summer of 2022, Colorado's only statewide policy was a set of recycling goals set by the Solid and Hazardous Waste Commission in 2017 to bring the statewide recycling rate up to 45% by 2036.[72] As of June 2022, Colorado became the third state in the country to pass an EPR for PPP law.[73] The analysis in this report makes clear that EPR for PPP is a key policy required to help Colorado achieve the Commission's goals.

Figure 19. Access to recycling in Colorado.

Generating Sector	Access (%)
Statewide	**74%**
Single Family	**93%**
Multifamily	**18%**

Colorado's access for single and multifamily homes reflects the state's low recycling rate.

- 51% of single-family residents in the state have subscription service as their only option
- 16% of the state's single-family residents have drop-off access
- 26% of the state's single-family residents have access to curbside recycling services
- 7% have no access at all

A 2019 report by CoPIRG and EcoCycle in Boulder estimated up to 50% of Colorado's residential waste was generated by multifamily buildings, yet most buildings did not provide recycling services.[74] These estimations align with multifamily data which suggests as few as 18% of multifamily buildings statewide have access to recycling services. In total, Colorado is estimated to have an ostensible recycling access rate of 74%, but the actual number of households with active service is affected heavily by the reliance on subscriptions.

No Colorado-specific survey data is available on the participation rate of residents in curbside recycling service nor the capture rates of PPP materials when residents participate.

Florida

Florida's recycling rate is the lowest of all the states analyzed. It is the only state in this analysis for which a recycling rate is calculated by the state agency, which makes reporting the state's overall and individual material recycling rates easy. However, the recycling rate is built off a model with limited data inputs, making the calculation's accuracy questionable.

[69] *https://cdphe.colorado.gov/solidwaste*

[70] Kate Bailey, September 15 2022

[71] The weight of residential disposed aluminum and steel cans were both higher than the weight of aluminum and steel cans generated in Colorado according to the capture study data. To align the disposal and capture study data, The Recycling Partnership assumed that aluminum and steel cans were recycled at the statewide recycling rate for those materials – 26%.

[72] *https://drive.google.com/file/d/1-y9l2ZyZnjtTDH3a-zdLhNgYpIoH32Re/view*

[73] *https://www.wastedive.com/news/colorados-epr-packaging-bill-recycling-polis/623623*

[74] *https://ecocycle.org/files/pdfs/Campaigns/zero-waste-colorado/2019_State_of_Recycling_in_Colorado_Eco-Cycle_CoPIRG_web.pdf*

The recycling model built by the Florida Department of Environmental Protection (FDEP) uses annually reported tonnages of recycled material, giving analysts a sense of the scale of recycling activity. The model is a stand-in for a more comprehensive waste characterization study, which has not been conducted at a state level. The weight of recycled aluminum, steel, glass, and plastics is only a few thousand tons higher than in Wisconsin, yet Florida has a population more than three-and-a-half times larger than in Wisconsin. Cardboard is the only material with a meaningful recycling rate of 41% in 2021.[75] The recycling rate reported by FDEP has decreased since 2014.

Figure 20. Recycling rates for packaging materials in Florida (residential and commercial).

Material	2014	2021
Cardboard Recycling Rate	40%	41%
Paper Recycling Rate	18%	10%
Plastic Recycling Rate	9%	4%
Glass Container Recycling Rate	29%	20%
Metal Container Recycling Rate	30%	17%
Total Packaging Material Recycling Rate	24%	17%

Florida's sole waste reduction policy is the Energy, Climate Change, and Economic Security Act of 2008 which set a statewide, weight-based goal of 75% recycling by 2020.[76] The goal is set for all waste materials and allows for waste-to-energy to count toward the calculation of a recycling rate. Even with waste-to-energy and the sweeping inclusion of material, Florida's recycling rate has fallen for most materials and plummeted for a few, such as metal containers and paper.

Figure 21. Access to recycling in Florida.

Generating Sector	Access (%)
Statewide	70%
Single Family	98%
Multifamily	13%

Florida's single-family curbside access rate is 85%, which makes their very low recycling rate surprising. Only 3% of single-family residents in the state have access to a drop-off facility as their only option, and 10% are subscription-only. Two percent of single-family residents do not have any access to recycling services. The gap in multifamily service plays a role in reducing the amount of material captured in Florida. Despite a higher single-family access rate, Florida's multifamily gap brings the statewide access rate down to 70%, the lowest of the six states analyzed.

While The Recycling Partnership is not aware of any surveys assessing the quality or rate of participation in curbside recycling programs, they are evidently low and decreasing, given the low recycling rate and trajectory between 2014 and 2021.

[75] *https://floridadep.gov/sites/default/files/2021%20Chart%20MSW%20Composition_1.pdf*

[76] *https://floridadep.gov/waste/waste-reduction/content/florida-75-recycling-goal*

Conclusion

Data examined by The Recycling Partnership indicates recycling rates in the U.S. are uniformly lower than recycling rates in EPR for PPP jurisdictions. The range of differences stresses important variations in individual state programs, including other existing policies, the scope and quality of recycling access, and the infrastructure supporting recycling provision and management. At best, recycling rates in Washington and Connecticut fall within ten percentage points of the worst-performing EPR for PPP programs. But when compared to the highest performing EPR for PPP programs in British Columbia, Belgium, the Netherlands, and Spain, Washington and Connecticut perform close to thirty percentage points below the EPR programs.

When it comes to lagging recycling programs in the U.S., Colorado and Florida have recycling rates as much as forty percentage points below the lowest EPR for PPP programs. Getting these states to the level of Connecticut and Washington would require tremendous municipal and state investment in those programs, which lies outside the budget scope of most local governments in those states. An EPR for PPP law will help Colorado achieve higher recycling rates with capital investment and dedicated funding from the thousands of companies placing the materials on the market, rather than municipal or state taxpayer funding.

Besides the general delta between U.S. state recycling rates and EPR for PPP program performance, research details a few important performance gaps across U.S. states.

- Mixed plastics and films and flexibles continue to be a drag on recycling performance. Both categories composed a significant amount of PPP material by weight, but, with the exception of Washington's polypropylene recycling, very little of this material was meaningfully recycled.
- Mixed paper, cardboard, and glass continue to dominate the weight of generated material. If just cardboard and mixed paper in Colorado performed at the levels seen in EPR for PPP programs, Colorado's existing recycling rate would almost double to 42%.
- Access data suggests a significant gap in U.S. state recycling performance is likely driven by the lack of comprehensive multifamily recycling.

Implications of EPR for U.S. States

Recycling Rates and Benefits

As demonstrated in the previous section, U.S. recycling rates are substantially lower than recycling rates in jurisdictions with EPR for PPP. The analysis of individual states in this study is a strong indicator that all U.S. states could expect to see an increase in their recycling rates for PPP.

Increased recycling rates for PPP would drive a number of additional positive impacts, including:

- Job creation in material collection, processing, and end-use
- Reducing climate-damaging emissions
- Fostering equitable access to recycling services for all residents
- Shifting PPP materials from waste disposal to recycling, which would reduce disposal tipping fees and diminish overall dependence on landfilling and waste-to-energy
- Injecting valuable material back into state economies through EPR
- Incentivizing investment in material processing and recycled product manufacturing
- Helping consumer packaged goods companies meet their recycled content goals
- Lifting a large cost from municipal budgets and residential subscription fees

Providing a data-driven answer on the specific benefits of EPR for any U.S. state is a difficult undertaking given the deficit of existing data. Some analysts have developed models to estimate the likely amount of material captured if EPR were to be implemented in a U.S. state.[77] The Recycling Partnership assumed under an EPR for PPP law, a state's individual material recycling rate would achieve equivalent individual material recycling rates to EPR for PPP jurisdictions.[78]

This section explores the scale of these benefits in four states that have not yet passed EPR: Washington, Connecticut, Wisconsin, and Maryland. Benefits are also shared for Colorado as it now plans for its implementation of PPP EPR. While data limitations described in *Appendix C* are a potential barrier to perfect accuracy, the magnitude of impact is substantial in each state. The benefits calculated in this section would be scaled across the U.S. with the adoption of more EPR for PPP programs, especially in states with underperforming recycling systems. Although The Recycling Partnership was able to estimate Florida's current recycling rate, Florida is excluded from the outcomes analysis due to limitations in the state's base data that do not allow for a confident projection of benefits from possible EPR implementation.

Based on The Recycling Partnership's recycling rate increase under EPR for PPP, four of the five U.S. states might expect to see recycling rates above 70%. In all states, mixed plastics and films and flexibles recycling remain unknown and is the single category that keeps all state recycling rates under 80% and Wisconsin's recycling rate under 70%. Regardless, the increased recycling activity under EPR would significantly boost the tons of recycled content delivered from each state's program and would inject tens of millions of dollars in each state back into the economy through preserved material value. According to EPA's WARM model, the greenhouse gas reductions in states like Washington, Maryland and Colorado approach one million metric tons of CO2 equivalent, and the increased recycling activity could generate several thousand jobs per state.

[77] *https://productstewardship.net/sites/default/files/Docs/packaging/eunomia-report-epr-cost-benefit-2022-01-12.pdf*

[78] A summary of the limitations of this methodology and a more detailed description of the methodology itself can be found in *Appendix C*.

Figure 22. Social and economic benefits of EPR in Washington.

Category	Benefit
EPR Recycling Rate	75%
Recycled Content Generated	248,001 tons
Economic Value Retained	$34,181,000
Greenhouse Gas Emissions Reduced	841,580 ($MTCO_2E$)

Figure 23. Social and economic benefits of EPR in Connecticut.

Category	Benefit
EPR Recycling Rate	74%
Recycled Content Generated	129,406 tons
Economic Value Retained	$12,660,000
Greenhouse Gas Emissions Reduced	370,247 ($MTCO_2E$)

Figure 24. Social and economic benefits of EPR in Wisconsin.

Category	Benefit
EPR Recycling Rate	66%
Recycled Content Generated	344,242 tons
Economic Value Retained	$53,495,000
Greenhouse Gas Emissions Reduced	953,107 ($MTCO_2E$)

Figure 25. Social and economic benefits of EPR in Maryland.

Category	Benefit
EPR Recycling Rate	70%
Recycled Content Generated	355,165 tons
Economic Value Retained	$43,026,000
Greenhouse Gas Emissions Reduced	1,001,897 ($MTCO_2E$)

Figure 26. Social and economic benefits of EPR in Colorado.

Category	Benefit
EPR Recycling Rate	**70%**
Recycled Content Generated	**441,302 tons**
Economic Value Retained	**$91,312,000**
Greenhouse Gas Emissions Reduced	**1,111,181 ($MTCO_2E$)**

Conclusion

EPR for PPP has enormous potential benefits for any state in the U.S., even states with nominally high recycling rates. EPR clearly delivers an unequivocal "yes" on the key question of whether it increases high recycling rates and sustains them. When using this baseline of experience against six states, this study demonstrates the gaps EPR for PPP can overcome not just in recycling rates but also in the universal provision of recycling services to all residents. That, in turn, pushes more recyclable materials out of disposal and back into economic use, where the energy efficiency of recycled materials drives down greenhouse gas generation while spurring economic growth.

Appendix A

EPR for PPP Recycling Rate Methodology

Determining recycling rates for EPR for packaging or PPP programs is usually a straightforward process. In all programs examined, PROs are required by law to disclose the amount of material reported to them by their member companies, along with the amount of material recovered and/or recycled in any given year. In some programs, the amount of material recovered and recycled are synonymous, while in others there is a gap between what is recovered from homes and businesses and what is actually recycled. In South Korea, producers are allowed to count recycled plastic sent for energy recovery, while in the EU and Canada, plastic sent for energy recovery counts as recovered, but not as recycled.

Where possible, this analysis tried to isolate the amount of packaging or PPP recycled from the amount recovered, and exclude any plastic burned or converted to fuel from counting.[79] The denominator in the recycling rate is therefore the amount of material reported to the PRO, and the numerator is the amount of material reported as recycled into products other than fuel. In all cases, data for each program were assembled from annual reports by the jurisdiction's PRO.

Comparing recycling rates before and after EPR for packaging implementation can be difficult, as the start of many EPR programs was when data collection began. In addition, the scope of materials managed may not hold constant between government data on a whole material stream from prior to EPR implementation, and the subsection of materials managed under EPR for PPP after implementation. Where accurate data from before a program's start was not available, The Recycling Partnership set the baseline as the earliest program data available. In either case, the data demonstrate that whether the baseline is pre-EPR or internal program improvement after implementation, EPR for PPP programs show sustained growth in material capture and recycling rates.

[79]**The exceptions are 1) South Korea, which provides no differentiation between plastics recycled and plastics combusted for energy or converted to fuel; and 2) Portugal, which simply reports the weight of material captured, not the subset of that material that is actually recycled.**

Table 1. Pre- and post-program performance data sources for EPR for PPP jurisdictions.

Jurisdiction	Pre-Program	Operation
British Columbia	Initial program plan submitted by Multi-Material British Columbia in 2013 included an estimation that PPP recycling rates were between 50-57% prior to program implementation.[80]	Annual program plans.[81]
Belgium	McCarthy (1993) reported that the Flanders region of Belgium, which at the time accounted for 55% of the country's population, had a packaging recycling rate of 10%.[82]	Annual program performance data from annual Interregional Packaging Commission (IRPC) reports,[83] or from Fost-Plus annual program activity reports.[84]
Spain	N/A – no pre-program data available	All program performance data from annual ECOEMBES[85] and trade media articles covering annual ECOVIDRIO performance.[86] [87]
South Korea	N/A – no pre-program data available	All program performance data from the KORA website.[88]
Netherlands	N/A – no pre-program data available	All program performance data from annual Afvalfonds Verpakkingen annual activity reports.[89]
Quebec	Pre-program performance data available from RECYC-QUEBEC report, *Bilan 2004 de la gestion des matières résiduelles au Québec*.[90]	Periodic program performance available from Eco-Enterprisés Quebec reports and publications.[91]
Portugal	N/A – no pre-program data available	All program performance data from annual SPV annual program activity reports.[92]

Note on Deposit Return

Only two of the EPR programs analyzed—Spain and Portugal—do not operate alongside a deposit return system for beverage containers. Deposit return systems are known to have high redemption rates for covered materials due to the strong incentive the deposit places on the consumer to return the container. While some containers that should be returned for deposit may inadvertently be managed by the EPR system, a high-functioning deposit return system minimizes this possibility. Producers of containers managed through deposit return do not pay into EPR programs for those materials, and deposit return materials are not included in EPR recycling rates. The exception in the case of this report is South Korea, which includes deposit return glass in its overall EPR recycling rate.

To ease the comparison between U.S. states and EPR jurisdictions, Connecticut's deposit return materials are entirely excluded from the analysis of the state's recycling rate. No other state included in this analysis has a deposit return system in place.

[80] *https://www2.gov.bc.ca/assets/gov/environment/waste-management/recycling/recycle/paper-package/ppp_stewardship_plan2013.pdf*

[81] *https://www2.gov.bc.ca/gov/content/environment/waste-management/recycling/extended-producer-responsibility/extended-producer-responsibility-reports-plans*

[82] McCarthy, J. E., (1993), *Recycling & Reducing Packaging Waste*: How the United States Compares to Other Countries, Resources, Conservation & Recycling, Vol. 8(3-4): 293-360.

[83] *https://www.ivcie.be/en/category/downloads-en/*

[84] *https://www.fostplus.be/en/about-fost-plus*

[85] *https://www.ecoembes.com/es/conoce-ecoembes/informes-anuales-anteriores*

[86] *https://picvisa.com/en/glass-recycling-increases-spain/*

[87] *https://picvisa.com/en/glass-recycling-increases-spain/*

[88] *http://www.kora.or.kr/eng/products/packingRecyclingTotal.do*

[89] *https://www.afvalfondsverpakkingen.nl/en/node/390*

[90] *https://numerique.banq.qc.ca/patrimoine/details/52327/1992121?docref=zzWUJCQaKPN7f0rCRzwl6A*

[91] *https://www.eeq.ca/en/news/documents-and-publications/reports-and-publications/*

[92] *https://www.pontoverde.pt/publicacoes.php*

Appendix B

U.S. State Recycling Rate Methodology

As companies in the U.S. are not required to report the amount of PPP placed on the market, any recycling rate estimation must be derived either from state recycling and disposal data or from industry estimates. Other recycling rate studies have generally relied on intermittent waste characterization studies (WCS) conducted on behalf of state environmental agencies by companies like MSW Consultants and Cascadia to determine the amount of material disposed of in a particular year.[93] Those studies are combined with available recycling data from the state or relevant industries to calculate the total amount of material generated. A statewide recycling rate is then determined by placing the tons of material recycled over the tons of material generated.

Calculating a specific recycling rate for PPP materials which would likely be included in an EPR for a PPP program in a U.S. state is much more complicated. Most EPR for PPP programs around the world only manage materials generated in households, and any rough comparison to existing U.S. recycling rates requires that residential materials generated in a U.S. state's households be isolated from the overall tons of MSW and recyclables in the Industrial, Commercial & Institutional (ICI) and Construction and Demolition (C&D) categories. For most WCS, this is straightforward as the vast majority of WCS analyze residential waste separately from ICI and C&D waste. However, most states do not require MRFs and municipalities to report the generating sector of recycled materials. With the exception of Washington and Maryland, state recycling data lumps together residential and commercial recycled materials. The Recycling Partnership confirmed with multiple state waste divisions that there is no clear way to disaggregate residential recycled materials from other sectors' data.

Additional complexities further hinder accurate recycling data analysis. In Maryland, the Maryland Department of Environment collects annual data from each county on the amount of material recycled, but only requires that each county report the total amount of "metal," "glass," "plastic," and "paper" recycled. Their reporting methodology is especially troublesome for metal, as recycled metal combines recycled metal pipes, paint cans, and copper wire with aluminum and steel cans. In Connecticut, transfer stations and MRFs are required to report the outbound tons of recycled material from their facilities. Yet many transfer stations and smaller MRFs will transport loads of commingled single-stream materials to larger in-state MRFs for sorting, leading to likely double counting of materials as they leave both the first and second facility.[94]

The Recycling Partnership Capture Studies

Recycling rates are built from three primary elements: the amount of material disposed of and the amount of material recycled, which, combined, add up to an amount of material generated.[95] The derived amount of material generated then becomes the denominator of the recycling rate, and the amount of material recycled is used as the numerator. Based on the limitations of waste and recycling data, The Recycling Partnership determined that calculating a recycling rate for PPP materials in each state was impossible without excessive assumptions that threatened the accuracy of the findings. Gaps primarily existed in recycling data. Residential and commercial materials are often reported together, categories of recycled material are overly aggregated, and double counting of materials threatens to inflate recycling rates.

[93]Edwards, S., and Grushack, S. (2021). The 50 States of Recycling: A State-by-State Assessment of Containers and Packaging Recycling Rates, Eunomia Research & Consulting, accessed from: *https://www.eunomia.co.uk/reports-tools/the-50-states-of-recycling-a-state-by-state-assessment-of-containers-and-packaging-recycling-rates/*

[94]Brenna Toman, CT DEEP, November 7, 2022, email.

[95]The Recycling Partnership recognizes that not all material is disposed or recycled, as some material is lost to the environment as litter or kept in homes long-term. However, these amounts are so small as to have a negligible impact on the overall recycling rate and are therefore not included in this analysis.

Instead of a bottom-up recycling rate calculation, The Recycling Partnership opted to develop a novel recycling rate calculation method using internal data compiled from municipal household capture studies. Capture studies use one of two methodologies: 1) a sampled analysis of the contents of paired set-out recycling and trash carts, or 2) sampling and characterization of truck contents from parallel recycling and trash routes. Together with household service and tonnage data, both methods deliver the ability to see the whole picture of the generation of discards and allow the calculation of capture rates for individual materials on a per-household basis.

Except for films and flexibles, the material categories included in the capture study map to the subset of PPP materials that would be included in the scope of an EPR for PPP law. After conducting dozens of studies across the country, The Recycling Partnership has found surprising consistency in the quantity and composition of household material generation. Some variations in the data exist between regions and over time, but the differences are small enough to have a limited impact on the overall generation of material. While some of the data dates back to 2013, the strongest and most reliable information has been collected in the past four years.

Table 2. The Recycling Partnership Household Material Generation Averages from 2017-2021

Material	Single-Family Household (lbs/year)	Multifamily Household (lbs/year)
Cardboard	123.70	92.78
Mixed Paper	264.60	198.45
Aseptic and Gable Top	7.10	5.33
PET Bottles	57.30	42.98
Non-Bottle PET	12.00	9.00
HDPE Natural Bottles & Jars	11.80	8.85
HDPE Colored Bottles & Jars	15.80	11.85
HDPE Non-Bottle	1.80	1.35
Glass Containers	153.40	115.05
Steel Cans	20.30	15.23
Aluminum Cans	22.50	16.88
Aluminum Foil & Trays	7.20	5.40
Other Plastic Packaging (#3-7)*	30.70	23.03
Films and Flexibles	50.00	37.50
Bulky Rigid Plastics	22.80	17.10
Total	801.00	600.75

**The Recycling Partnership capture study data indicates that polypropylene packaging is typically 2/3rds of the 3-7 mixed plastic category by weight.*

To determine a state recycling rate in Connecticut, Washington, Maryland, Wisconsin, and Colorado, The Recycling Partnership took the household capture data above and multiplied the weight by the number of single-family and multifamily households in each state. Each state's waste characterization study was then used to subtract the amount of material disposed of from the amount of material generated.[96] The remaining amount of material was all assumed to be recycled.

[96]For a full list of the material categories from each state's waste characterization study used, refer to *Appendix E*.

Several limitations need acknowledgment. First, not all waste characterization studies are perfectly equivalent. They vary in level of detail and rigor of the study and only include disposal data from a one-to-two-year period. Where possible, The Recycling Partnership worked to align the year in which a waste characterization study took place with capture study data from that same time period. Second, waste characterization study data did not always align well with the capture study data. For instance, The Recycling Partnership's data on films and flexibles is limited compared to other materials, and the weight of films and flexibles reported as disposed of through state waste characterization studies was almost always higher than the capture study data. In all states, all films and flexibles were assumed to be disposed and the waste characterization data were substituted for the capture study data.

Florida Methodology

Most states included in this analysis have populations under 8 million, and all but Colorado have a recycling rate for PPP materials above 30%. The Recycling Partnership wanted to include at least one large, low-performing state in the analysis for comparison with smaller, higher-performing states. Florida does not have a waste characterization study which limited The Recycling Partnership's ability to use capture study data, but Florida does annually report recycling rates for individual material streams. The reports provided by the Florida Department of Environmental Protection are based on a model using incomplete data but offer a view of the magnitude of environmental and economic opportunity in a state like Florida if EPR for PPP were to be adopted.

Recycling Access Assessment

The Recycling Partnership has data compiled in each state regarding residential access to recycling, including the type and provider of that service. For multifamily buildings, the data include whether the multifamily building resides within a targeted multifamily recycling ordinance or not.[97] This data has been collected from interviews with state agencies, local municipalities, and publicly available information at municipal and state levels across the U.S. For each state included in this report, The Recycling Partnership developed a characterization of the type and scope of residential recycling access in each state.

[97] **For municipalities with multifamily ordinances, The Recycling Partnership estimates that 90% of multifamily buildings provide access to recycling. The 90% assumption may be higher than actual access and should be considered a limitation of the analysis. Where no multifamily recycling ordinance is in place, or in municipalities where The Recycling Partnership has not done in depth research, recycling access for multifamily residents is considered to be 6%.**

Appendix C

Social and Economic Benefits of EPR for PPP Methodology

Providing a data-driven answer to the benefits of an EPR for PPP law for any U.S. state is a difficult undertaking. Some analysts have developed models to estimate the likely amount of material captured given certain policy and program operation parameters.[98] Unfortunately, a more complex model was beyond the scope of this report as model development both require policy assumptions about a particular state's EPR proposal and would necessitate a significant primary research effort within each state given the deficit of existing data.

Table 3. Policy and contextual concerns when comparing U.S. EPR policies with each other and with existing EPR for PPP programs.

Scope of EPR for PPP	Does the U.S. state EPR policy cover packaging and paper, or just packaging? Are multi-family buildings, public spaces, or schools included in U.S. state policy? Conversely, if an EPR jurisdiction has a narrower scope of materials than is managed through a U.S. state's current recycling program, a comparison of the U.S. state program to the EPR program might inflate the forecasted U.S. state EPR recycling rate.
Deposit Return Systems	In Canadian provinces and much of the EU, most beverage packaging is managed through deposit return systems. These systems extract a significant amount of recyclable glass, aluminum, and plastic from the recycling stream, leaving harder-to-recycle materials behind. EPR systems operating in tandem with these reflect the recycling rates of harder-to-recycle materials and can only be compared with U.S. states with deposit return systems (i.e., Connecticut).
Types of Material Generated	Each jurisdiction has a different mixture of materials depending on the markets in that jurisdiction. For instance, South Korea has a much higher quantity of plastic, while Canadian recycling rates are largely driven by paper and cardboard recycling. An accurate EPR forecast in a U.S. state would need to control for the specific mixture of materials.
Collection Methods	How are materials collected in each jurisdiction? In British Columbia and Connecticut, the collection is provided by a mixture of curbside and drop-off. However, in many EU countries, collection in urban centers occurs through centralized, source-separated bins. The specific collection method used in the EPR jurisdiction would need to match the expected collection method in a U.S. state to accurately calculate the expected increase in material capture.
EPR Program Adaptation	U.S. state-level EPR for PPP laws and proposals aren't exact replicas of EU and Canadian EPR programs. Many U.S. states wish to see source reduction of hard-to-recycle plastics, design changes, and aggressive performance standards for EPR programs. It is difficult to forecast the impacts of these adaptations on EPR program performance.
Current Performance of U.S. States	How high performing is a given U.S. state? Washington and Connecticut might expect to see peak EPR impacts within 2-3 years of implementation, while Wisconsin and Florida might take 5-10 years to fully see the benefits of the policy.

[98] *https://productstewardship.net/sites/default/files/Docs/packaging/eunomia-report-epr-cost-benefit-2022-01-12.pdf*

The Recycling Partnership chose to provide a snapshot of the magnitude of benefit opportunities across a number of U.S. states. To calculate U.S. state recycling rates for various materials under an EPR for PPP law, assumed individual material recycling rates were developed based on individual material performance in EPR for PPP jurisdictions. The average material recycling rates used were from British Columbia, Spain, Belgium, the Netherlands, and Quebec. Portugal and South Korea were excluded due to a lack of a reported or calculable recycling rate for relevant materials.[99]

Table 4. Assumed U.S. state recycling rates for PPP materials based on existing recycling rates in EPR for PPP jurisdictions.

Materials	BC	Quebec	Spain	Belgium	Netherlands	Assumption
Cardboard	95%	65%	80%	92%	89%	85%
Mixed Paper	95%	71%	80%	92%	89%	85%
Plastic	25%	40%	76%	52%	52%	-
PET	—	—	—	—	—	80%
HDPE Natural	—	—	—	—	—	80%
HDPE Colored	—	—	—	—	—	80%
#3-7	—	—	—	—	—	60%
Other*	—	—	—	—	—	5%
Steel	83%	42%	85%	105%	90%	85%
Aluminum	83%	42%	85%	94%	90%	85%
Glass	85%	79%	77%	114%	80%	80%
Aseptic	—	70%	—	73%	89%	75%

**"Other" was only applied to films and flexibles in each state analysis*

The recycling rates in the "Assumption" column of Table 4 were then applied to the current recycling rates in Washington, Connecticut, Maryland, Wisconsin, and Colorado for the specific material class to estimate the potential increase in overall recycling rates in each state. Plastic recycling rates required additional assumptions as EPR for PPP programs outside the U.S. tend to combine all plastic into one category for reporting. The Recycling Partnership assumed that PET and HDPE containers would be recycled at least at the rate of glass containers. Category #3-7 is difficult to estimate given the variability across the combined materials, but PP makes up the majority of the category by weight, and The Recycling Partnership expects PP recycling to increase dramatically under EPR policies in the U.S.[100] The Recycling Partnership assumed a modest 5% recycling rate for films and flexibles under EPR for PPP, although the policy will ideally increase recycling of this category. Given the outsized weight of films and flexibles in U.S. generation, increasing the recycling rate for films and flexibles would have a large impact on the overall recycling rate performance of each U.S. state.

The additional tons of newly recycled PPP in each state were then calculated by the 3-year national average commodity revenue of each material, as reported by recyclingmarkets.net.[101] The three-year average of material values was used given the volatility of commodity markets over the past few years. Depending on which month's values The Recycling Partnership used, the economic value of the additional recycled tons could swing by millions of dollars. The calculated material values are listed in Table 5.

[99]The EPR jurisdictions used were British Columbia, Belgium, Spain, the Netherlands, and Quebec. General application of EPR rates was modified where needed to reflect the exclusion of materials collected through deposit return systems. For instance, British Columbia's plastic recycling rate does not reflect PET plastic recycled through deposit return. British Columbia's plastic recycling rate would likely produce a lower-than-expected EPR recycling rate if applied to Wisconsin's disposed plastic, as Wisconsin's plastic waste includes large quantities of PET plastic containers which would be recycled at a higher rate than other types of plastic.

[100]*APR National Mixed Resin Bale Analysis Report (2015)*

[101]3-year rolling average commodity revenue helps smooth market fluctuations.

Table 5. Residential PPP 3-year Average Commodity Values (9/19-8/22)

Commodity Type	36-Month Average Value (9/19-8/22)
OCC	$92.24
Mixed Paper	$39.08
PET	$317.16
#3-7	$6.42
PP	$357.75
HDPE Natural	$1,228.97
HDPE Color	$446.44
Film	$0.00
Aluminum	$1,306.44
Foil	$0.00
Steel Cans/Ferrous Metal	$179.27
Aseptic	$13.06
Glass (3 mix)	-$24.48

Lastly, EPA's WARM was used to estimate job creation opportunity and greenhouse gas reductions associated with the additional recycling activity. The additional recycled tons calculated under the EPR for PPP assumptions in each state were transitioned from landfill or waste-to-energy to the recycling pathway in EPA's WARM model. Roughly one-third of Maryland's MSW is managed through waste-to-energy while the remaining two-thirds are disposed of in landfills, and The Recycling Partnership divided the disposed PPP in Maryland between the pathways.

The Recycling Partnership recognizes that under EPR for PPP, some fraction of generated PPP may be source reduced rather than recycled, which would moderately change the WARM benefits. Including source reduction was beyond the scope of this report, but source reduction would slightly increase the GHG reductions and reduce the jobs created.

Appendix D

State Data Sources

The Recycling Partnership used a number of data sources from each state to compile the U.S. state recycling rates. Those data sources are listed here.

Washington

2020-2021 Washington Statewide Waste Characterization Study

Waste Generation and Recovery Data (2018)

Connecticut

2015 Waste Characterization Study

Wisconsin

2020-2021 Statewide Waste Characterization Study Report

Florida

2021 MSW Collected by Material Chart

Maryland

2016 Maryland Statewide Waste Characterization Study

Maryland Solid Waste Management and Diversion Report – 2021 (CY2020 data)

Colorado

Waste Composition of Municipal Solid Waste Disposal

2021 Colorado Recycling Totals

Boulder County Waste Composition Study

2016 Larimar County Waste Composition and Characterization Analysis

Appendix E

Waste Characterization Study Categories

Packaging and printed paper materials categories are not standardized across waste characterization studies. The Recycling Partnership used material categories from each waste characterization study in the U.S. state recycling rate analysis. Only waste characterization study material categories were used which match the material categories in The Recycling Partnership's capture studies. All tons and compositional fractions were for residential MSW only.

Washington	Connecticut	Wisconsin	Maryland	Colorado
Newspaper Packaging	OCC/Kraft	Newspaper	Newsprint	Cardboard
Cardboard Packaging	Offshore Cardboard	High Grade Office Paper	Corrugated Cardboard	Mixed Paper
Other Groundwood Packaging	High Grade Office Paper	Magazines/Catalogs	Magazines	Aseptic & Gable Top
Mixed/Low Grade Paper Packaging	Magazines/Catalogs	Uncoated OCC	Paperboard	PET Bottles
Aseptic and Polycoat Packaging	Newsprint	Coated OCC	High Grade Office Paper	HDPE containers
Compostable Packaging	Other Recyclable Paper	Boxboard	Other Recyclable Paper	Glass Containers
R/C Paper Packaging	R/C Paper	Cartons	Non-recyclable Paper	Steel Cans
	Aseptic Boxes	Mixed Paper - recyclable		Aluminum Cans
Newspaper		Other Paper	PET #1 Bottles and Jars	Aluminum Foil & Trays
Cardboard Products	#1 PET Bottles		PET #1 Other	Other Plastics (~#3-7)
Magazines	#1 PET Containers	PET Beverage	HDPE Natural	Films and Flexibles
High-grade paper products	#1 PET Deposit	Natural HDPE	HDPE Colored	Bulky Rigid Plastics
Other groundwood products	#2 HDPE Bottles	Colored HDPE	#3-#7 Bottles	
Mixed low grade paper products	#2 HDPE Containers	PP bev	#3-#7 Packaging	
R/C Paper Products	Plastic Containers #3-7	Other Bottles	EPS	
	EPS non-food grade	PET Non-bev		
#1 PET Bottles	EPS Food Grade	HDPE Non-bev	Dirty Film and Shopping Bags	
#1 PET Non-Bottles	Other Film	PP Non-bev		
#2 HDPE Natural Bottles	Flexible Plastic Pouches	PS Non-foam	Aluminum Cans and Containers	
#2 HDPE Colored Bottles		Other non-bev	Other Aluminum	
#2 HDPE Plastic Jars	Aluminum Bev	PE Recyclable Film	Tin/Steel Containers	

Washington	Connecticut	Wisconsin	Maryland	Colorado
#2 HDPE Colored Bottles		Other non-bev	Other Aluminum	
#2 HDPE Plastic Jars	Aluminum Bev	PE Recyclable Film	Tin/Steel Containers	
#3 PVC Packaging	Aluminum Foil	Pouches		
#4 LDPE Packaging	Tin/Steel Containers	Other Flexible Films	Clear Glass	
#5 PP Packaging		PS Foam	Brown Glass	
#6 PS Packaging	Clear Glass	Bulky Rigids	Green Glass	
#7 Packaging	Green and Other Colored Glass			
EPS Packaging	Glass Deposit	Alum Bev		
PLA Packaging		Other Alum		
Packaging Film Plastic		Ferrous Cans		
Flexible Plastic Packaging				
R/C Plastic Packaging		Clear Glass		
PLA/Compostable Plastic Products		Colored Glass		
Bulky Rigid Plastic Products		Glass Food cont		
Aluminum Beverage Cans				
Aluminum Foil				
Tinned food cans				
Coated food cans				
Clear Glass				
Green Glass				
Brown Glass				

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