MOSBACHER INSTITUTE
POLICY BRIEF

Importing Trash?

How a Deposit Refund System Could Reduce Trash Imports and Help Clean Texas

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Executive Summary

The United States and Texas have high levels of plastics production, consumption, and waste. To meet consumer demand for recycled content, producers resort to importing trash from China, Mexico, Canada, and others. The academic literature evaluating deposit refund systems (DRS) as a potential solution is extensive and shows that a DRS significantly increases recycling rates and significantly reduces waste. Despite the success of DRS internationally, the United States, particularly Texas, faces considerable challenges in implementing such a system. Tariffs on imported trash fell to zero in the middle of the 2010s, the availability of cheaper virgin plastics, and the complexity due to multiple layers of agents involved in the recycling process are three of the most important challenges. Additional challenges include regulatory barriers, insufficient infrastructure, and a lack of public awareness. Implementing a DRS would significantly reduce trash along Texas highways and waterways, boost demand for recycled materials, and decrease reliance on virgin plastic production and imports.

Our key recommendations include:

1. **Invest in Public Awareness Campaigns:** A robust educational campaign is essential to inform the public about DRS operations, covered products, and economic and environmental benefits. Such campaigns should involve partnerships with schools, local governments, and community organizations.

2. **Develop a Robust Recycling Infrastructure:** Convenience for consumers (e.g., return to retailer) increases return rates, implying a network of accessible return points is key to DRS effectiveness. State funding and reinvesting unredeemed deposits into building recycling infrastructure are critical.

3. **Provide Retailers Optionality for Collection Returns:** To mitigate the lack of dedicated storage spaces and staff for return operations, particularly for retailers, it is necessary to provide alternative convenient consumer options near the premises, bag-drop services, and other standalone return points.

4. **Set Higher Minimum Deposit Values:** Deposits incentivize consumers to return, and higher deposits enhance the financial incentives, leading to better return rates.

5. **Introduce Incentives for Recycled or Domestic Plastics:** Financial incentives for businesses that use at least a set minimum recycled content requirements and additional incentives for using domestically sourced recycled plastics promote the effectiveness of DRS. These financial incentives can be tax credits for using recycled content or import tariffs on primary forms of plastics and plastic waste.

6. **Strengthen Regulatory Support:** Clear legislative frameworks that mandate participation in DRS and regulate its operation are required to ensure transparency, compliance, and efficiency. Engaging stakeholders, especially early in the process of developing the legislative frameworks, is key to streamlining roles and ensuring the system's economic feasibility and public support.

Regarding implementation, the DRS could begin with a focus on single-use plastic bottles and then expand to other products in phases. For a time before the DRS is implemented, installing a system for the public to return bottles for financial reward would encourage awareness about the upcoming deposit program and its return points. By demonstrating the positive economic and environmental outcomes of recycling, policymakers can build the necessary momentum for a successful DRS implementation and ensure widespread compliance.

1. Introduction

Plastic waste is one of the most urgent environmental challenges today. Every year, millions of tons of plastic end up in landfills, oceans, and waterways, threatening both the environment and public health. The widespread use of single-use plastics, such as packaging and beverage containers, has significantly contributed to this crisis. With global plastic production exceeding 400 million metric tons, much of it is not properly recycled, worsening the environmental impact (UNEP 2021). The United States and Texas have high levels of plastics production, consumption, and waste. To meet consumer demand for recycled content, U.S. producers resort to importing trash from China, Mexico, Canada, and others.

Given the scale of the problem, more effective recycling solutions are crucial. Traditional methods, particularly single-stream recycling, have proven inefficient due to contamination and quality issues. Single-stream recycling can result in material losses of up to 27%, with even greater losses occurring after materials leave the materials recovery facility (Container Recycling Institute). This inefficiency, coupled with confusion over recycling practices, highlights the need for better systems.

In this regard, a deposit refund system (DRS) has proven to be effective. By providing a financial incentive for consumers to return empty beverage containers, DRS encourages recycling, reduces litter, and promotes a more sustainable, circular economy. By charging consumers a deposit upfront and offering a refund upon return of the empty containers, DRS directly engages consumers in the recycling process.

DRS offers significant environmental and economic benefits. Environmentally, it reduces litter and diverts waste from landfills by ensuring high return rates for beverage containers that would otherwise pollute. Countries such as Germany, Norway, and Sweden have implemented DRS and achieved significantly high return rates for beverage containers. Recycling materials like aluminum and plastic also conserves energy—recycling aluminum, for example, saves 95% of the energy needed to produce new aluminum from raw materials (EIA 2022). In addition, the recycled material from the DRS is of better quality and has less contamination.

Economically, DRS creates jobs across recycling, logistics, and retail sectors while stimulating local economies through the infrastructure required to manage container collection and recycling. The cost savings from reduced waste management and lower carbon emissions also benefits both municipalities and businesses by reducing the need for virgin resources while limiting environmental impact.

Despite the significant consumption of plastic items, particularly single-use plastics, the adoption of DRS in the United States has been limited to only ten states, with Texas not among them. This presents a major opportunity for the state to improve its recycling efforts. Texas, a leader in plastic bottle production, faces challenges in recycling, as it lags behind most other states in terms of the number of bottles collected and processed. This gap in recycling leads to increased littering along roadways and waterways, exacerbating the plastic pollution problem.

Moreover, U.S. producers often resort to importing plastic waste from countries like China, Canada, and Mexico due to lack of reliable domestic recycled materials. These features indicate the inefficiencies of current

recycling in Texas but also the potential benefits of implementing an effective program like DRS that could increase collection, reduce contamination, enhance the quality of recycled materials, and decrease imports of plastic waste while promoting the use of domestically recycled materials.

This policy brief draws on lessons from international case studies and U.S. states and offers actionable recommendations for DRS implementation in Texas.

2. Prospects of Introducing DRS in Texas

Untapped Potential for Recycling

In 2021, 23.7 billion beverage containers were sold in Texas. Only 5.2 billion of these, however, were recycled—2.6 billion aluminum cans, 1.8 billion plastic bottles, and 603 million glass bottles-- leaving the majority discarded as waste (Container Recycling Institute). A mere 878.6 million plastic water bottles out of the 4.6 billion sold are recycled annually. This underperformance, coupled with a lack of robust statewide recycling programs, leads to increased litter and pollution, negatively impacting the state's agriculture. Organizations such as the Texas Farm Bureau and the U.S. Cotton Trust Protocol are working to enhance sustainability efforts, including expanding recycling programs (Texas Farm Bureau 2019, U.S. Cotton Trust Protocol 2022).

In 2019, recycling supported nearly 23,000 jobs across Texas, including 6,843 jobs in material collection, 3,717 in sorting and processing, and 128 in transporting recyclables. The industry contributed over $4.8 billion to the state's economy through wages, benefits, and the value of recycled materials. Additionally, it generated more than $166.1 million in state and local government revenue (Burns & McDonnell and Circular Matters 2021). Currently, Texas' landfill system also supports approximately 9,900 jobs, with an average salary of $47,000 (Angelou Economics 2022). Existing recycling efforts also save approximately 9 million MBtu of energy each year, which is enough to power 116,973 Texan households annually.

With a 75% recycling rate goal in 2035, Texas has the potential to recycle about 17 billion containers each year, including 7.5 billion aluminum cans, 6.7 billion plastic bottles, and 2.3 billion glass bottles. Such an improvement in recycling efforts could save roughly 27 million MBtu of energy annually, equivalent to powering 343,998 Texan households each year. The economic impact of this waste is equally significant. Texas missed out an estimated $372.6 million in lost scrap value in 2021 by not recycling these containers: $165.13 million from aluminum, $122.61 million from Polyethylene Terephthalate (PET) plastic, $67.29 million from High-Density Polyethylene (HDPE) plastic, and $17.55 million from glass (Container Recycling Institute).

Prioritizing improved recycling systems in Texas could therefore yield significant economic opportunities and environmental benefits. Implementing DRS could be an effective strategy.

Weak Supply of Recycled Inputs

A key challenge to implementing DRS is the availability of cheaper virgin plastics, which

undermines the economic feasibility of recycling. Simultaneously, there is no sufficient supply of recycled material from domestic sources, which has forced manufacturers to rely on imported plastic products and waste.

Data from UN Comtrade show that between 2017 and 2022, plastic waste imports to the United States showed a fluctuating trend, although plastic waste imports in 2022 were still 24.2% higher than in 2017. Starting at 252 million in 2017, plastic waste imports declined over the following years, reaching 217 million in 2020 (about 14% decrease). Imports rebounded sharply in 2021, rising to 331 million, a 53% increase from 2020. In 2022, imports slightly decreased to 313 million.

During the same period, U.S. plastic waste imports shifted significantly. Mexico and Canada remained the dominant suppliers, with Mexico increasing its share from about 35% in 2017 to nearly 40% in 2022, and Canada rising from approximately 30% to around 35%. Notable changes occurred among other suppliers: in 2017, China was the third-largest contributor, accounting for about 10% of U.S. imports, but its share dropped sharply by 2022. Meanwhile, Thailand emerged as a significant supplier in 2022. Countries like Honduras, Ecuador, and Germany maintained relatively small but steady shares, while Bangladesh, Czechia, and Australia became main sources in 2022. These shifts reflect a reorientation of U.S. plastic waste import, with reduced reliance on China and increased reliance on neighboring countries and other emerging economies.

The growth in plastic waste imports is partly driven by the absence of import tariffs on plastic waste and low tariffs on other plastic products. In 2022, the applied tariff rates were 3% for primary forms, 4.5% for intermediate forms, 8% for intermediate manufactured goods, and 6% for final manufactured goods.

Another challenge toward increasing the domestic source of recycled material is related to lack of infrastructure. The absence of a robust network of collection points is another key challenge in many U.S. states. The implementation of an effective DRS requires a substantial investment in infrastructure, such as reverse vending machines, retail collection points, and sorting and recycling facilities. Texas, with its vast geographical spread, faces additional logistical challenges in ensuring that return points are accessible to all residents.

Incentive Incompatibility

A primary obstacle to implementing DRS is incentive incompatibility due to multiple agents involved in the process such as consumers, producers, retailers, and collection entities. This complexity can lead to coordination issues and slow down the rollout of the program. This is exacerbated by concerns over additional costs for consumers and businesses, along with fears it could create undue burdens on the beverage industry and retailers. Evidence from the academic literature on beverages such as beer, sparkling and non-sparkling bottled water, however, shows that demand for beverages is less sensitive to price changes (Nelson 2014; Ruhm et al. 2012; Zheng et al. 2018). Some evidence shows no significant adverse effect of implementing or expanding a DRS or increasing deposit levels on beverage sales (Reloop & Container Recycling Institute 2023). This implies that even when prices rise, consumers still buy almost the same amount and are largely unaffected by price changes.

Better cooperation among stakeholders would align incentives in DRS participation. For example, beverage producers could be encouraged to take financial responsibility for funding the DRS program, while retailers could be incentivized to participate by increased foot traffic and consumer participation. Additionally, if the collection points are located at retail locations, it becomes easier for consumers to return empty containers, and

they are more likely to use the deposit from the return towards future purchases at the retailers. An arrangement could also be made where retailers receive a small fee if consumers choose to redeem the deposit elsewhere or receive cash. At the same time, lawmakers should set clear recycling targets and penalties for non-compliance.

Overall, Texas faces significant challenges in recycling and lags behind most other states in the number of bottles collected and processed. This recycling gap contributes to increased littering along roadways and waterways and exacerbates plastic pollution. Texas is, however, well-positioned to reap substantial economic and environmental gains from implementing a DRS given its high consumption and production of plastic products and waste, growing population, and strong economic growth.

3. How the DRS Works

The core structure of a DRS operates through key steps:

i. **Deposit Payment:** Consumers pay a deposit on top of the price when purchasing beverages in eligible containers. While the deposit is small, it is sufficient enough to encourage the return of empty containers.
ii. **Return Process:** Upon consumption, consumers return the empty containers to designated collection points. These collection points include retailers, reverse vending machines, or dedicated deposit centers.
iii. **Refund:** Consumers are refunded their deposit once the container is returned. Refunds can be provided in various forms such as cash, vouchers, or coupons. Unredeemed deposits are distributed per stakeholder agreements and may be used to cover operating costs and fund public awareness campaigns.
iv. **Recycling and Reuse:** The returned containers are collected, sorted, and sent to recycling facilities or refilled for reuse, depending on the container material and the recycling infrastructure.

Recycling rates in the United States are significantly higher in deposit states compared to non-deposit states (Eunomia, 2023). In deposit states, 46% of PET bottles, 53% of glass bottles and jars, and 71% of aluminum cans are recycled. In contrast, non-deposit states recycle only 10% of PET bottles, 21% of glass containers, and 22% of aluminum cans. This disparity highlights the effectiveness of deposit systems in boosting recycling rates for various materials. Additionally, there is a significant difference in recycling rates between deposit containers and non-deposit containers. In 2021, among deposit containers, aluminum cans had the highest recycling rate at 75%, followed by glass bottles at 66%, and PET plastic bottles at 56%, based on data on beverage containers sold in the United States (Container Recycling Institute). In contrast, recycling rates for non-deposit containers were considerably lower: 37% for aluminum cans, 19% for glass bottles, and 18% for PET plastic bottles.

Additionally, across different forms of DRS, recycling success depends significantly on their specific implementation and design, particularly with respect to financial incentives, convenience, and public awareness.

Minimum Deposit Value

Deposit values are a significant determinant of return rates. Higher deposit values are typically associated with higher return rates as it provides stronger incentives for individuals to return empty containers. Data from return rates on plastics, and specific materials such as PET and HDPE show that, on average, a higher minimum deposit value is strongly associated with improved return rates (Container Recycling Institute; Reloop). When the deposit is ≤$0.05, total return rates are 60.2%, but this increases significantly to 76.3% for deposits between $0.06 and $0.10 and further to 87.9% for deposits exceeding $0.10. Similarly, return rates for plastics, PET, and HDPE materials also see substantial gains with higher deposit values, emphasizing the importance of financial incentives.

Accessibility and Convenience

One driver for the effectiveness of DRS is the ease of returning empty containers and accessibility to collection points. There are three main types of returning models: return to retail, return to depot (redemption centers), and hybrid (a combination of the two). The return-to-retail model has higher return rates because retailers have to accept and refund deposits, which becomes convenient to customers while keeping retailers accountable (Reloop 2022). On average, retailer-based systems achieve the highest return rates, with plastics reaching 86.7%, outperforming both depot systems and hybrid models. Depots perform moderately well, achieving total return rates of 73.7%, while hybrid systems lag, particularly for HDPE recycling, which records only 50%.

Besides the DRS's returning models, automated return systems such as reverse vending machines simplify the process for consumers and increase convenience, which encourages more people to return their beverage containers. The level of automation in the return process further impacts recycling performance. Systems with >90% automation achieve a high total return rate of 90%, compared to 72.2% for systems with ≤90% automation. Relatedly, availability of recycling points (measured by the population per collection point) show that smaller populations per collection point (≤2000 people) achieve better recycling outcomes, with total return rates of 73.7% and plastics at 81.3%. In contrast, collection points serving larger populations (>2000 people) see slightly lower recycling rates, particularly for PET.

Public Awareness

Clear communication and public education about how the system works and its environmental benefits are crucial. In countries with high return rates such as Sweden, education campaigns have been a key component of DRS success. Even if a DRS is implemented, consumer engagement remains a challenge. Public awareness campaigns are crucial for educating consumers on the benefits of recycling and the mechanics of the DRS. In regions with lower rates of public awareness, return rates may be significantly reduced. Raising awareness not only helps increase participation but also ensures that consumers understand the broader environmental impact of their recycling efforts.

Stakeholder Engagement

Successful DRS's often feature strong government regulation and oversight, as well as collaboration among key stakeholders including beverage producers, retailers, system operators, and consumers. For example, producers are often financially responsible for funding the system, covering the costs of collection, sorting, and recycling. Government regulations help enforce compliance, establish performance targets, and ensure transparency in the operation of the system.

Overall, implementing a successful DRS requires higher deposit values, retailer-based return systems, high levels of automation, and accessible collection points. It also requires public awareness campaigns and mechanisms to incentivize participation and enforce compliance.

4. Policy Recommendations

DRS in Texas would be highly beneficial. Effective DRS implementation hinges on strong financial incentives, enhanced convenience for consumers, and a clear public education campaign.

The key policy recommendations include:

1. **Invest in Public Awareness Campaigns:** A robust educational campaign is essential to inform the public about DRS operations, covered products, and economic and environmental benefits. Such campaigns should involve partnerships with schools, local governments, and community organizations. Highlighting benefits of DRS and how to participate will not only appeal to businesses but also help to win over consumers and voters who may be skeptical about the changes. Furthermore, allowing the public to return bottles for a financial reward for a period prior to the initiation of the deposit could motivate people to learn about the upcoming deposit program and where to return bottles. Offering a reward before reverting to a deposit system will help reduce the initial financial burden on consumers and make it easier for them to adapt to the new system.

2. **Develop a Robust Recycling Infrastructure:** Accessibility and convenience for consumers (e.g., return to retailer) increase return rates, implying a network of accessible return points is key to DRS effectiveness. Building recycling infrastructure could be financed from reinvestment of unredeemed deposits and state funds like the excess balances in the Texas solid waste accounts, which particularly help defray costs to producers for initial program build out.

3. **Provide Retailers Optionality for Collection Returns:** To mitigate the lack of dedicated storage spaces and staff for return operations, particularly for retailers, it is necessary to provide alternatives such as convenient consumer options near the premises, bag-drop services, and other standalone return points.

4. **Set Higher Minimum Deposit Values:** Financial rewards for returning used plastic bottles and other recyclables incentivizes consumers to return. Higher deposits also enhance the financial incentives, leading to better return rates.

5. **Introduce Incentives for Recycled or Domestic Plastics:** Financial incentives for businesses that use at least a set minimum recycled content, and additional incentives for using domestically sourced recycled

plastics promote the effectiveness of DRS. These financial incentives can be tax credits based on the use of recycled input content or tariffs on primary forms of plastics and plastic waste. By reducing the cost advantage of virgin plastics, these measures can help make recycled materials a more attractive option for manufacturers, leading to greater demand for recycling.

6. **Strengthen Regulatory Support:** Clear legislative frameworks that mandate participation in the DRS and regulate its operation are required to ensure transparency, compliance, and efficiency in the system's implementation. Engaging stakeholders, especially early in the process of developing the legislative framework, is key to streamlining roles and ensuring the system's economic feasibility and popular support. Lawmakers should set clear targets for return rates, and penalties for non-compliance should be enforced to drive higher performance.

This combination of policy measures would promote return rates among consumers and boost demand for recycled materials while decreasing the reliance on virgin plastic production and imports among producers. Regarding implementation, the DRS could initially begin with single-use plastic bottles, which are among the most common waste items, and gradually expand to include other plastic products in phases, such as cans, food containers, and other packaging. This phased approach allows for adjustments to the system, ensuring that it is fine-tuned and scalable before extending to more products.

By demonstrating the positive economic and environmental outcomes, policymakers can generate the momentum needed for successful DRS implementation and ensure widespread compliance. Effectively communicating the benefits of the program will help build public support, making it easier to achieve greater adoption and contributing to the program's long-term success.

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