

# Enhancing Markets for Post-Consumer Materials through Derivatives: Connecting New Jersey Recycling Programs to the Broader Market

White Paper  
Summer 2021

Jordan P. Howell<sup>1,2,3</sup>  
Jordan S. Moore<sup>4</sup>  
Daniel Folkinshteyn<sup>4</sup>

- 1) Dept. of Management & Entrepreneurship, Rohrer College of Business, Rowan University
- 2) Dept. of Geography, Planning & Sustainability, School of Earth & Environment, Rowan University
- 3) Rowan Center for Responsible Leadership, Rohrer College of Business, Rowan University
- 4) Dept. of Accounting & Finance, Rohrer College of Business, Rowan University

*This project was funded by the New Jersey Department of Environmental Protection “Recycling Enhancement Act (REA) – Institutions of Higher Education 2019 Research Grant”. The opinions and perspectives expressed in this paper are those of the authors and do not represent the views or positions of the NJDEP or its staff.*



*"Recycling 7" by timtak is licensed under CC BY-NC 2.0*

### The problem: How can we increase recycling efficiency?

Considerable time, energy, and money has been expended on recycling in New Jersey and many places around the world. Recycling can prevent huge volumes of material from heading to landfills and incinerators. Yet, for decades, the realities of municipal and commercial recycling in the US have not lived up to the promises of finding new value for old materials. Most frustratingly, there are two simultaneous realities facing recycling and post-consumer materials (PCMs) in the US: (1) Excess supply, evidenced by a large volume of recycled material that ultimately goes to the landfill (2) The absence of an efficient process to match supply and demand. Consider the following: The United States Environmental Protection Agency (USEPA) reported that 48.2% of the 292.4m tons of municipal solid waste generated in the US in 2018 was recyclable: paper (23.05%), plastic (12.20%), metal (8.76%), or glass (4.19%). Yet, only 69m tons of material were actually recycled that same year, 48.9% of the total eligible material. This included 45.95m tons of paper (68.18% of the total amount of paper disposed), 3.02m tons of plastic (8.47% of plastic disposed), 8.71m tons of metals (34.0% of metals disposed), and 3.06m tons of glass (24.98% of glass disposed).<sup>1</sup> In other words, about half of the material that could be recycled ends up in a landfill, incinerator, or illegal dump site.

At the same time, many large buyers of PCM complain that they are unable to secure an adequate supply for their manufacturing processes. For instance, both Coca-Cola and PepsiCo -- two of the largest companies on the planet -- have committed to increasing the recycled content of their bottles in the coming years, but have pointed out the tremendous difficulties they have had in securing adequate supplies of recycled plastic.<sup>2</sup> This state of affairs suggests there is considerable failure in America's recycling markets. Even as our overall volumes of waste increase, the amount actually recycled has remained stagnant for some time. A lot of research has rightly focused on the engineering and materials science dimensions of the problems facing recycling. However, in our project we chose to focus on some of the problems facing PCMs that are rooted in the marketplace for their exchange.

The supply chain of moving PCM collected from homes and businesses, to processors, to end users making new products is different from the types of flows typical for other commodity materials. Unlike most other commodities, which are traded on centralized markets with fairly transparent mechanisms for reporting prices and volumes, PCMs are traded "over-the-counter" through the personal and professional networks of processors, brokers, buyers, and sellers. As most readers will know, many careers in the waste management industry have been made - and lost - over the ability to move PCM volume, and there is no shortage of illustrations of the

---

<sup>1</sup> USEPA. 2020. "National Overview: Facts and Figures on Materials, Wastes and Recycling". Facts and Figures about Materials, Waste and Recycling. Available from: <https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/national-overview-facts-and-figures-materials#main-content>

<sup>2</sup> See DeSocio, M. 2021. "Coke and Pepsi eye new sustainability goals after years of failed promises". *Forbes* online ed. Available from: <https://fortune.com/2021/06/22/coke-pepsi-sustainability-goals/>

dumping, warehousing, incineration, and landfilling schemes that have been hatched to gloss over periodic market collapses, both in New Jersey and elsewhere.<sup>3</sup>

PCMs feature many of the same attributes as other commodity materials, like cyclical pricing and substitutability. The PCM business has also suffered from quality and contamination issues; most readers have undoubtedly heard stories about unscrupulous vendors mixing different grades of material, or even marketing trash as PCM. Taken together, the result has been considerable volatility in price, availability, and quality of PCMs, making these materials much more difficult to work with from the perspectives of large industrial users. These users instead turn to new materials, while recyclables head to landfills or incinerators. Efforts to reform markets for recycled materials and improve PCM-related infrastructure must focus on smoothing out these variabilities as much as possible, if recycling is to achieve its maximum economic and ecological potential.

### Our solution: Derivatives for PCMs

To achieve this outcome, we propose the creation of derivatives (and in particular, futures contracts) for buying and selling PCMs, as well as a marketplace for their exchange. In this structure, problems of variability in quantity and quality that have plagued markets for PCM for decades could be overcome. Assuming a world where the vast majority of PCM is traded through futures contracts, there would be tremendous standardization in volume, quality, contamination level, and so forth - all specified in the language of the contract - which together would foster greater consistency in material streams. Materials recovery facilities (MRFs), brokers and other market participants who did not abide by the terms of the contract would quickly be found out and excluded from the industry, or else clean up their compliance and return to the marketplace. Consistency in the materials stream, in turn, along with the potential for reduced price volatility, should be encouraging to any entity that is participating in the recycling industry and also attractive to firms considering making additional capital investments.

#### *What's an exchange-traded "derivative" anyway?*

*The two major types of exchange-traded derivatives contracts are futures and options. In a futures contract, two parties agree to exchange a specific quantity of an underlying asset for a specific price on a specific day and time. A commodity futures contract also mandates a minimum level of quality for the underlying commodity, such as the maximum amount of spoiled agricultural goods or the minimum grade of metal. The futures contract transaction locks in a future purchase price for the buyer and locks in a future sale price for the seller. Therefore, both the buyer and seller protect themselves from adverse price changes. Buyers or sellers can close out their positions at any time and realize*

---

<sup>3</sup> See the soon-to-be released book *Garbage in the Garden State* (Rutgers University Press) written by Jordan P. Howell, for much more detail about the history of waste and recycling in New Jersey.

*any gains or losses that result from changes in the underlying asset price, or they can roll over the position to a futures contract on the same asset with a later expiration date if they wish to maintain the same price risk exposure to the underlying asset.*

*Unlike futures, options contracts are asymmetric. For instance a “call” option contract gives the buyer of the contract the right, but not the obligation, to buy a specified quantity of the underlying asset for a specific price at any time until the contract expires. Conversely, a “put” option is the inverse, and the owner of a put option has the right to sell the underlying asset at a specified price before the expiration date. If the buyer decides to exercise his/her option, presumably to realize a gain, the seller is obliged to honor the transaction and incur a loss. Either the buyer or seller could realize their gains or losses by closing out their options position prior to expiration. While both futures and options could be beneficial to markets for PCMs, we feel that futures would be more successful and lead to more positive outcomes for the waste and recycling industry because (1) futures are a simpler contract, (2) virgin commodities are also primarily futures-traded, (3) commodity options trading volume and liquidity are much lower than same-commodity futures, and (4) commodity options are options on futures, so futures must exist first anyway.*

*The “exchange-traded” piece refers to the idea that these derivatives are traded on a centralized marketplace. Any two parties could in theory create derivatives and trade them over-the-counter. But “exchange-traded” derivatives would come with all the other benefits of market mechanisms, including centralized price and volume information. The exchange would serve as a clearinghouse for all trades, addressing concerns about counterparty credit risk for buyers and sellers alike. The presence of a centralized exchange would attract market makers and other liquidity providers, improving transparency and market quality.*

*The introduction of derivatives markets can improve the quality of the spot market in the underlying commodity because investors can use those derivatives to hedge risk exposure. On the other hand, derivatives have the potential to worsen the quality of the underlying spot market because speculators can use those derivatives to initiate highly leveraged positions that generate additional volatility. Although there is some evidence in favor of both effects, the overwhelming preponderance of evidence suggests that introducing derivatives has a significantly positive effect on the market quality of the underlying commodity.<sup>4</sup>*

---

<sup>4</sup> See, for instance, the conference presentation by Howell, JP, JS Moore, and D Folkinshteyn. 2021. “Resuscitating the Market for Post-Consumer Materials Through Exchange-Traded Derivatives” Presented at the International Conference on Solid Waste Technology and Management; hosted by Widener University.

Trading PCM derivatives through a centralized market provides a number of benefits. In addition to the benefits of reducing price volatility, raising standards for quality, and improving transaction transparency, over time, an active market for PCM derivatives will clarify which materials are “recyclable” in practice and which materials are recyclable in name or concept only. For instance, we can imagine a scenario where the futures market for certain grades of plastic is highly liquid -- indicating strong interest in procuring these materials for some particular use -- while the market for other grades of plastic has no activity whatsoever. In this scenario, the market is sending a signal that the inactive grade of plastic is not truly recyclable: while the chemistry of the plastic may make it feasible for recycling, there is no real demand to use it in that way. Municipalities could use market information to determine the specific constellation of materials that they actually collect, more confident that there is a market for their sale and subsequent re-use. Similarly, haulers both public and private could justify the exclusion of certain grades of material from the waste stream. Regulators and environmentalists would take note, and demand that the type of plastic be excluded from lists of recyclable materials. Ultimately, packaging manufacturers might focus attention on other grades of plastic that have a stronger secondary market, rewarding firms for using materials that are actively traded and discouraging use of materials that have no real secondary market. Certain materials, like glass, might come back into fashion for packaging purposes while others would fade out.

#### In practice: PCM derivatives for New Jersey

What would the ideal PCM derivatives contract look like? Where and how would these contracts be traded? And how could the New Jersey recycling community take advantage of this concept?

The ideal futures contract for PCM could be crafted by essentially combining the Institute for Scrap Recycling Industry (ISRI) standards for quality and bale composition,<sup>5</sup> with the CME Group’s specifications for trading commodities.<sup>6</sup> ISRI guidelines specify the composition and quality standards for all sorts of PCM, but frequently leave terms of trade open for buyers and sellers to establish on their own. Futures contracts, or any derivative, wouldn’t work with that level of variability in quantity, timeline, and terms of trade. But combining ISRI’s specifications with CME’s standardization of quantity and terms of trade would lead to a widely accepted set of standards for actually making transactions for PCM.

While some derivatives are traded over-the-counter (privately, between parties), we feel that the most successful outcome for PCM derivatives would be to list the contracts on a centralized exchange. One of the largest exchange operators in the world is the CME Group, which owns and operates famous commodities markets like the Chicago Board of Trade (CBOT) and the New York Mercantile Exchange (NYMEX). Alternatives include exchanges operated by the Intercontinental Exchange (ICE), as well as smaller, more specialized exchanges focused on a

---

<sup>5</sup> ISRI. 2021. *Scrap Specifications Circular*. Available from: <https://www.isri.org/recycling-commodities/scrap-specifications-circular>

<sup>6</sup> CME Group. 2021. “Introduction to Futures: Learn About Contract Specifications”. Available from: <https://www.cmegroup.com/education/courses/introduction-to-futures/learn-about-contract-specifications.html#>

limited set of commodities or derivatives. We highlight CME Group's and ICE's exchanges here not as an endorsement of the firms, but only as an illustration of the fact that nowadays derivatives trading can be ubiquitous and easily accessible. Literally millions of derivatives transactions are facilitated by these firms alone, each day, through an advanced information infrastructure that ensures safety, reliability, and consistency. We feel that this would be an important aspect of any successful effort to launch PCM derivatives, because the market would only succeed if it has a group of eager participants.

Two additional sets of challenges must be overcome. The first is regulatory: derivatives in the US are regulated by the Commodity Futures Trading Commission (CFTC). Before a derivative can be traded on an exchange, it must pass through the CFTC's review process to ensure compliance with applicable US laws.<sup>7</sup> Derivatives like the ones we propose here are not subject to review by the State of New Jersey. Second, and much more substantial than the regulatory challenges, are the obstacles to market participation and participant education. These center on the challenges of convincing exchanges to list PCM derivatives for trading; and convincing stakeholders in the waste and recycling industry to trade!

It's likely that given the largely electronic nature of derivatives trading nowadays, potential exchange hosts would be interested in listing PCM products so long as some level of demand can be demonstrated. Clearly, the recycling industry is substantial. In 2020, the US recycling industry generated an estimated \$6.2b of revenue, and while the industry is dominated by a small number of national firms, there remain a number of regionally significant firms active in more limited geographic areas.<sup>8</sup> Major national firms like Waste Management or Republic Services are likely already comfortable with derivatives, as these tools are used to control risk exposure and plan investment timing for everything from fuel costs to facility financing. More sophisticated regional firms may also be quickly comfortable with using futures contracts to sell PCM they have collected and processed. On the other side of most transactions would be manufacturing firms. Many of the largest firms, like Coca-Cola or PepsiCo that we highlighted earlier, and the associated firms that create their packaging, are undoubtedly comfortable with using derivatives in their purchasing agreements. We are confident that the largest potential market participants on both the buy-side and sell-side of these transactions could be convinced to manage most if not all of their flows of PCM using futures contracts. However, considerable market participant education would be necessary to convince smaller market participants (e.g., standalone MRFs, municipal facilities) to participate in a centralized market and also, to trade successfully.

Along both dimensions of actually getting PCM derivatives off the ground -- the regulatory hurdles and the market participation challenges -- there is considerable opportunity for participation by many different types of actors. Waste & recycling, paper, plastic, glass, and packaging industry associations, environmental NGOs and interest groups, professional trading

---

<sup>7</sup> CFTC. 2021. "Contracts & Products". CFTC.gov. Available from: <https://www.cftc.gov/IndustryOversight/ContractsProducts/index.htm>

<sup>8</sup> Roth, Ryan and IBISWorld. 2020. Recycling Facilities in the US. Los Angeles, CA: IBISWorld Pty Ltd

firms, and even state and municipal environmental regulators could take the reins, as could a specialist private firm focused on securing regulatory approvals and educating market participants. For instance, the state of New Jersey's environmental regulator, the Department of Environmental Protection (NJDEP), in collaboration with the state's waste and recycling industry, could support the derivatives concept as a means of resuscitating the markets for recycled material without direct subsidy of firms operations or interfering with pricing. This would be in contrast with previous efforts undertaken by NJDEP (and the majority of other state governments) to support markets for recycled material either through grantmaking to municipalities, price supports, or extensive investment in state resident education.

To end this white paper on an imaginative and hopeful note, a derivatives exchange for PCM, located in New Jersey, could one day even tie together multiple states and geographic regions and create broad markets for PCM commodities with much deeper overall liquidity. In this ideal future scenario, one might imagine monthly or quarterly futures contracts for recovered plastic resin, textiles, EPS, OCC, glass, aluminum, or e-waste components – maybe having been handled in one of New Jersey's many processing facilities – being quoted to buyers in Michigan, Mexico, or Mongolia for shipment out of the Port of Camden or the Port Newark-Elizabeth Marine Terminal. Understanding derivatives exchanges for PCM could make New Jersey a supplier of recycled material to the entire country or even other countries. Support for the market mechanism itself - ensuring it is established and functions properly for all participants whether public or private and regardless of size -- would allow more experimentation within the industry and may encourage new participants.



"Recycling 7" by timtak is licensed under CC BY-NC 2.0

You can watch a panel symposium about this topic and also read the full research paper here: <http://pcm-derivatives.info/>

*The authors would like to thank the following individuals for their contributions to the research: Rostin Behnam (US CFTC), Michael Irgang (Global Risk Management), Stein Ole Larsen (NOREXECO), and Philip Roscoe (School of Management, University of St. Andrews)*