WHITE PAPER

CIRCULAR PLASTICS ECOSYSTEMS

PLASTIC DIVERSION INITIATIVE

CIRCULAR PLASTICS ECONOMY IS

BROKEN

79%

of all plastic waste ever produced has been disposed in landfills or dumped to the natural environment.

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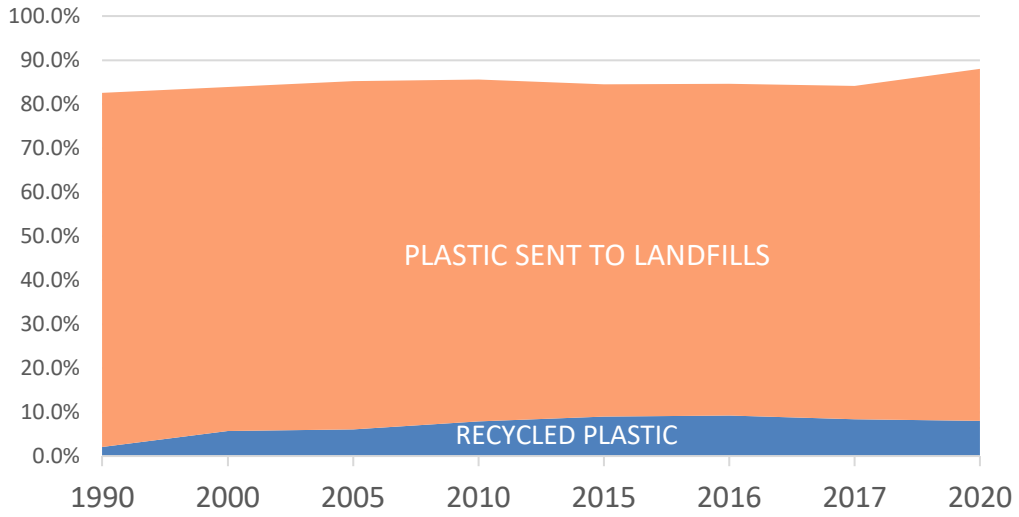
INTRODUCTION

Only 9% of the plastic that's ever been produced has been recycled - meaning 91% has been buried in landfills, burned, or dumped into oceans. The Ellen MacArthur Foundation states that by 2050 there will be more plastic in the ocean than fish. At the same time, hundreds of world's largest corporations who produce more than half of all plastic packaging claim that only 6% of their demand for recycled plastic is currently met. While we wait for this gap to be filled, over 35 million tons of waste are produced annually in the United States alone. The world wastes hundreds of millions of tons of plastic resources, and then produces even more virgin plastic.

The plastic recycling system, and the dominant paradigm for how it operates, is broken. We find these current and future realities to be simply unacceptable and take them as a call to action.

INEFFICIENCIES OF THE CIRCULAR PLASTICS ECONOMY

The percentage of plastic recovered across the United States has barely changed over the last 30 years.



In spite of a plethora of technological breakthroughs in the resource recovery industry, nearly 80% of all plastic still ends up in landfills because of market inefficiencies that are driving up the cost of recycled material. These costs can be traced to the four following areas:

SORTING

It is simply cheaper to dispose of plastic than to recover it, especially when markets are highly volatile. 66% of all plastic waste in landfills is post-consumer. While over 30% of plastic bottles (plastic types #1 and #2) are

usually disposed of in landfills because the cost of sorting is much higher than the price of the recovered material. Some Material Recovery Facilities (MRFs) stockpile mixed post-consumer plastic to wait for higher prices, while most simply cannot afford it and therefore send unsorted plastic directly to a landfill.

Plastic products, especially plastic packaging, also often contain different plastic types that are difficult to separate from each other. This makes the sorting of these products very expensive or nearly impossible. This material is either burned in incinerators or disposed of in landfills.

TRANSPORTATION

Transportation cost is the number one determining factor affecting the price of recycled plastic.

35% of plastic waste in landfills is industrial scrap and commercial plastic waste. This typically high-quality material still ends up in landfills because it often is in less-than-truckload quantity per location, which makes transportation to processors inefficient and costly.

Brokers and international traders who primarily deal with industrial scraps prefer or demand full-truckload quantities of properly packaged, sorted and ready for shipping material, whereas this material is most often unsorted and non-baled. Local recyclers who pick up less than truckload quantities of material are required to store it for several months before they accumulate a full truckload quantity to make shipping to processors economically viable.

The residential waste stream is also plagued by transportation costs, which as even more steps than the commercial/industrial side. The plastic picked up from curbside residents is taken to a Material Recovery Facility (MRF) and sorted. It is then shipped to a recycling processor to be mechanically recycled into resin. From there it is shipped to manufacturers to be made into new products.

The total cost of shipping is usually a multiple of the cost of material at the source. When brokers are included in this supply chain, it is shipped a few more places (warehousing, etc). This system usually creates a result where the highest value plastic resources can be recovered, processed, and remanufactured into new products, but the less valued plastic resources end up going to landfill.

STORAGE

Continuous collection without a stable market for material leads to stockpiling of plastic in MRFs and recycling centers. With finite storage capacity, unsorted and low-priced plastic is usually disposed, and plastic with higher market potential is temporarily stored. But market instability,

constant disruptions and changing macroeconomic trends create incentive to get rid of plastic as soon as possible, especially when landfill cost is cheaper than storage.

SEARCH AND INTERMEDIATION

End-users of recycled plastic are constantly searching for quality feedstock.

The gap between buyers and sellers of recyclable plastic is most commonly filled with brokers who charge a premium for their services. Brokers usually prefer to deal with certain types of easy-to-market material. They also protect information about their sources and customers, which contributes to the lack of transparency in the market and increases the cost of matching supply with demand.

GLOBAL ECONOMIC TRENDS

ARE ACCELERATING THE PROBLEM

In addition to the physical, technical, and micro-economic factors challenging the plastic recycling industry, global economic factors and trends are also exacerbating the problem:

VOLATILE PRICES

Plastic recycling markets are one of the most volatile global commodities because of their correlation with constantly changing crude oil prices. When the price of crude oil goes down, it brings down the cost of virgin plastic (a substitute for recycled plastic), which then drags down the price of recycled plastic. Because the cost of recycling is fixed, any drop in recycled resin prices puts enormous pressure on the recycling industry.

When recycling markets are so volatile, this adds uncertainty and any long-term investments in infrastructure are considered risky. This causes short-term thinking to prevail and reduces long term investment and innovation.

PRICE ARBITRAGE

International traders take advantage of price differences in various markets, which provides an incentive for recyclers to export more than recycle domestically. The more that plastic is exported, there is less incentive to invest in domestic recycling infrastructure. With weaker domestic infrastructure there is even more incentive to export.

IMPORT BANS

Import bans are devastating for countries that primarily export plastic waste. In 2017/18 China banned the import of most plastic waste, which dramatically impacted the United States. These bans particularly painful when the domestic recycling industry is not strong enough to handle domestic waste and, therefore, so much dependent on exports. We have seen a drastic increase in landfilling of plastic waste since China's ban was implemented.

PLASTIC PRODUCTION GROWTH

Plastic demand and production is expected to triple by 2050. Such steep growth, especially in countries with poor waste management infrastructure, will dramatically increase the amount of plastic disposed of in the natural environment.

WHERE DO WE GO FROM HERE?

It's clear that plastic, due to its durability, flexibility, and low price will remain a dominant material resource. However, when a plastic manufacturer is deciding between virgin and recycled feedstock, the main consideration is the cost of a material. Given the quality of recycled plastic is usually lower than that of virgin plastic, the cost-efficiency of using recycled material must be significant enough for plastic manufacturers to choose the circular option.

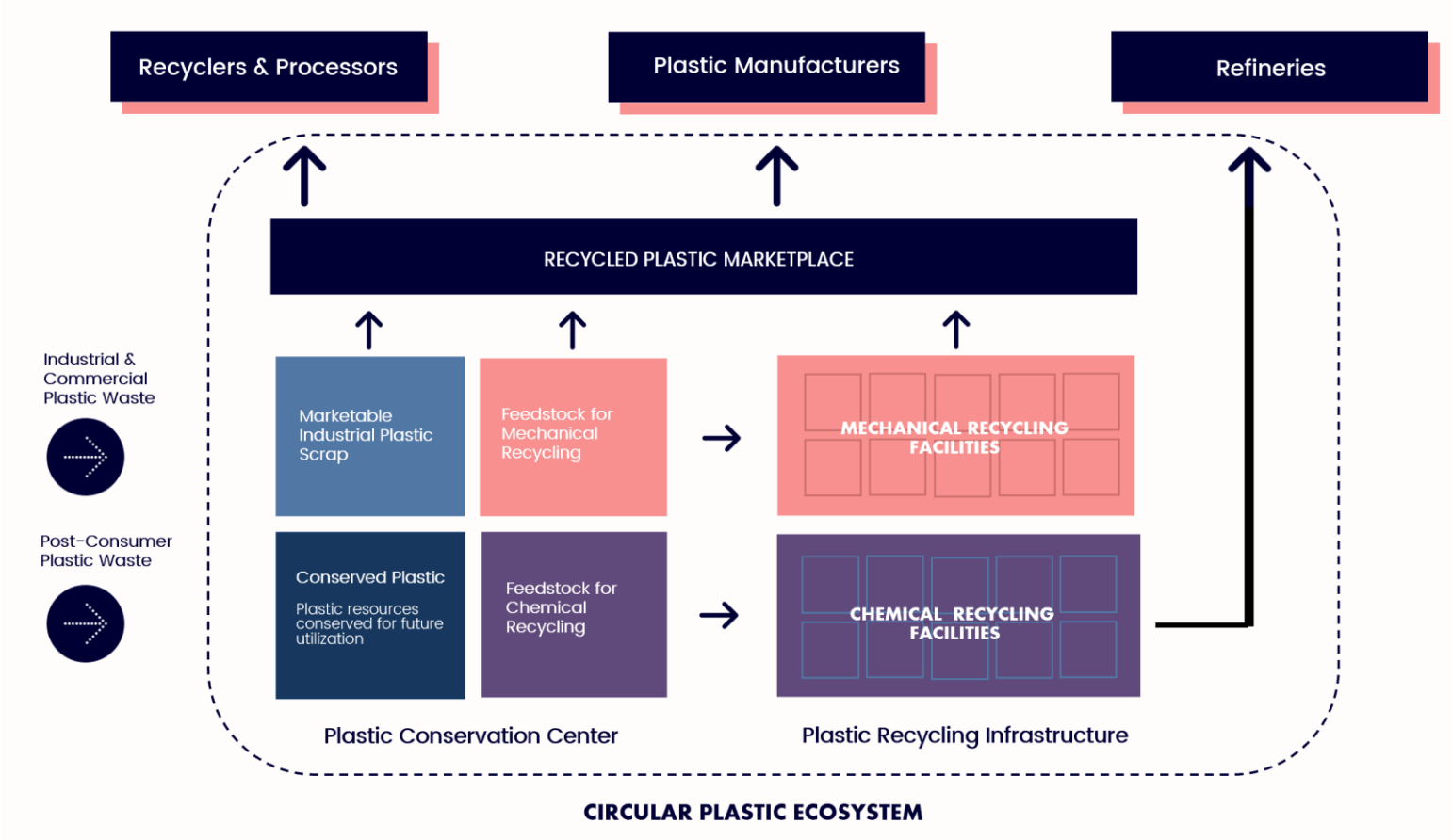
Today, recyclable plastic is treated more as trash than a valuable commodity.

With plastic production expected to triple by 2050, continued inefficiency of the plastic circular economy could lead to complete failure and collapse of the system with colossal economic and environmental consequences.

Fundamental and structural changes are thus required to stop plastic waste and increase the efficiency of the plastic circular economy before it is too late.

OUR SOLUTION

Our solution is to divert plastic waste from landfills to highly efficient Circular Plastics Ecosystems designed to conserve, recycle, and redirect plastic resources back into domestic manufacturing supply chains.



CIRCULAR PLASTIC ECOSYSTEM

This ecosystem should contain the following elements:

PLASTIC CONSERVATION CENTER

Facility where plastic without existing markets or a lack of quantity can be recovered, conglomerated for processing and/or conserved for future use.

RECYCLING INFRASTRUCTURE

A network of cutting-edge mechanical and chemical recycling facilities built around PCC to fully recycle and/or convert recovered plastic resources.

RECYCLED PLASTICS MARKETPLACE

A platform that connects plastic recycling infrastructure with end-users of recycled plastic, develops new markets for reprocessed resin and sources the material for processors within the ecosystem.

PLASTIC CONSERVATION CENTER

Post-consumer, industrial and commercial plastic waste will be diverted from landfills to the Plastic Conservation Center (PCC). PCC will occupy central position within circular ecosystem and will provide the recycling infrastructure with inexpensive or free feedstock, while also conserving some part of unrecycled resources for future use.

Unlike MRFs, the PCC facility will be accepting only one type of material – plastic. In fact, PCC will stand between MRFs and landfills and will help recover what MRFs couldn't or didn't want to recover. The PCC will accept mixed rigid post-consumer plastic, as well as industrial and commercial plastic waste (except heavily contaminated and hazardous solid waste that must be landfilled by the law). PCC will increase the volume and range of plastic it accepts gradually, in line with increases in conservation and recovery capabilities of the ecosystem. PCC's focus will be on landfill plastic, not on plastic that is otherwise recovered or recycled by the industry, in other words, not the 9% of plastic that is recovered, but the 91% that is being incinerated or disposed of in landfills.

PCC will develop and put into practice new methods and technologies for long-term “above ground” conservation of large quantities of plastic waste without jeopardizing health and safety standards. Such conservation technology will help keep plastic out of landfills and preserve it until scalable recycling solutions are developed and deployed.

Since landfill space is still available and is relatively inexpensive, conservation technology as an alternative to landfill disposal is being overlooked by the industry. While the industry is focused on collection and recycling technologies, PCC’s primary focus will be on innovations in long-term storage and conservation of plastic resources.

PCC will also utilize cutting-edge, AI-based sorting technologies to separate plastic for mechanical recycling. After recyclable plastic is recovered, the remaining resources (mechanically unrecyclable material) will be cleaned, shredded and conserved for chemical recycling. Plastic supply in excess of chemical and mechanical recycling demand will be conserved for future use. Plastic that cannot be sorted with the use of technology, will be sorted manually, which will create thousands of new jobs

PLASTIC RECYCLING INFRASTRUCTURE

Plastic Recycling Infrastructure (PRI) within the ecosystem will recycle the plastic sorted and conserved at the PCC. The infrastructure is the network of mechanical and chemical recycling facilities located in close proximity to one another and to the Plastic Conservation Center. The combination of mechanical and chemical recycling will help achieve a zero-waste output while recouping the maximum value from available resources.

Collaboration and interactions between all businesses within the ecosystem will create a synergy effect. Proximity to large and consolidated feedstock will help achieve “economies of scale” and increase the efficiency

MECHANICAL RECYCLING

Mechanical recycling facilities will process various types of post-consumer and industrial/commercial plastics sorted at the PCC. Recyclers specializing in mechanical recycling, especially #3 through #7 plastic, will operate within the ecosystem. In case the amount of plastic suitable for mechanical recycling exceeds the demand and capacity of the ecosystem, such mechanically recyclable plastic will be offered on an open marketplace to outside recyclers. The objective is to recycle as much as possible mechanically and conserve the rest for chemical recycling or further use.

CHEMICAL RECYCLING

Chemical recycling facilities will be leveraged to recycle all other plastic within the ecosystem, i.e. plastic that is not suitable for mechanical recycling. Plastic-To-Fuel (PTF) facilities will help convert otherwise unrecyclable plastic waste to easily marketable “green” fuel. Another byproduct, the synthetic gas, will be used in generation of heat and power for the entire ecosystem. Chemical recycling facilities will benefit from access to free feedstock within the ecosystem. Multiple chemical recyclers can operate in the ecosystem simultaneously. With the increase in chemical recycling capacity (by adding more chemical recyclers), the ecosystem will be able to absorb more plastic waste without conserving resources at a PCC.

MARKETPLACE

To achieve a circularity, the recycled plastic produced within the ecosystem will have to reach end-users on the marketplace. The Marketplace can be realized as a technology platform that will market mechanically recycled plastic resources and “green” fuel to plastic manufacturers and refineries outside of the ecosystem. The marketplace will also serve the PCC by marketing aggregated industrial and commercial plastic waste and sorted post-consumer plastic. More importantly, the platform will help develop new markets for recycled resin. With only 6% of demand for recycled plastic being met, the marketplace will create easy supply and help meet growing demand

The platform will use blockchain technology for supply chain transparency and tracking of plastic resources from source to end-use. The government and the private organizations can then use this data to offer incentives/rewards and diversion credits to those who send resources to the ecosystem (instead of landfills) and those who use recycled material in the manufacturing of plastic products

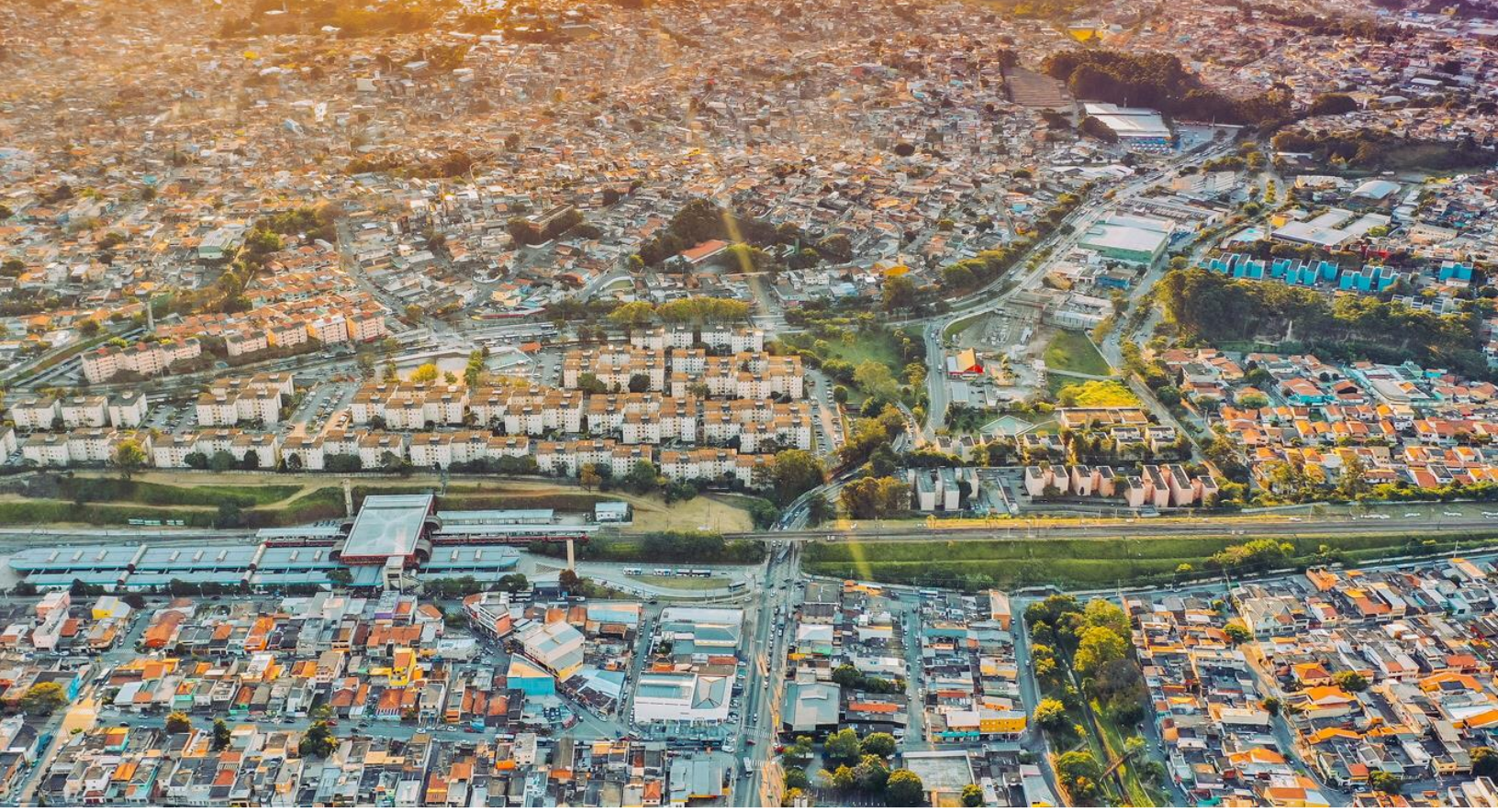
RESOURCE PARK

INTRODUCING

RESOURCE PARKS

The circular ecosystem will be efficient only when a Plastic Conservation Center, an integrated recycling infrastructure and a commodity marketplace are in close proximity because it's the only way to eliminate transportation and transaction costs, achieve economies of scale and operational synergy. Recycling infrastructure, especially chemical recycling, requires access to a huge feedstock, which will be available at the PCC. Conglomeration of plastic resources at PCC will make mechanical recycling of lack-of-quantity plastic economically viable. Similarly, a PCC will be efficient (will require less floor space) only if surrounded by the infrastructure that will help recycle conserved resources. The Marketplace will help close the loop by marketing recovered resources to end-users and developing new markets for recycled plastic.

The best application of the circular ecosystem is the plastic conservation and recovery Parks that can be built within specific geographic areas.



RESOURCE PARK

Plastic conservation and recovery Park can be branded as “RESOURCE PARK” and reproduced in multiple states and countries forming a national and global network of circular Resource Parks.

The Resource Park can initially include a Plastic Conservation Center, one mechanical and one chemical recycling facility, and the marketplace. The Park can then be expanded to include multiple recycling facilities and even plastic product manufacturers.

Resource Parks will also drive innovation and serve as a magnet for circular tech startups, entrepreneurs, and venture capital, which in effect may lay the foundation for a much larger, Silicon Valley-type ecosystem only for green technology.

CONCLUSION

More plastic will end up in landfills

High transportation, sorting, and processing costs exacerbated by market disruptions, low crude oil prices, and global pandemic will only increase the amount of plastic waste disposed in landfills and the natural environment.

Efficient Circular Ecosystem is a solution

Circular Plastic Ecosystems will help conserve and recover plastic resources. Efficiency will be achieved by eliminating transportation and transaction costs, as well as the cost of search and intermediation, while significantly increasing the output. Proximity to large and consolidated feedstocks will help achieve “economies of scale” and further increase the efficiency. Moreover, collaboration and interactions between a businesses in the ecosystem will create multiple synergies.

Resource Parks will create thousands of new jobs, attract innovation and investment

Resource Parks will employ thousands of workers in communities across America and will help bring back jobs that have been lost due to prolonged inefficiency of the circular economy. High concentration of technologically advanced recyclers will fuel innovation and attract green tech startups and venture capital.

ABOUT THE INITIATIVE

The Plastic Diversion Initiative was launched by a collective of organizations and individuals in celebration of the 50th Anniversary of Earth Day with a mission to divert recyclable plastic from landfills and the natural environment while creating thousands of jobs in America.

AUTHOR

Rashad Abbasov is the CEO of Scrapo, the world's largest plastic recycling marketplace and founder of the Plastic Diversion Initiative.

A serial entrepreneur, Rashad has founded and led multiple companies, from inception to exit.

Rashad holds degrees from Cambridge University and the London School of Economics.