

Circularity of All Waste

PACKAGING'S SUSTAINABLE FUTURE

Mike Ferrari

Here's the problem: Landfills are reported by the Environmental Protection Agency (EPA) as being the third-highest contributor of methane gas warming the planet.

Once land is polluted, it is not returned to residential housing, farming or industrial use and requires monitoring even after reaching capacity and closure. There is potential for ground water contamination despite newer landfills having liners.

Residents living in the surrounding area are subjected to odor and biological hazards. Beside health and environmental issues, landfills pose a social justice issue. People in the lower economic bracket are the ones living in close proximity and are most exposed to these risks.

THE CHARGE

We should do better with our municipal solid waste (MSW) and end the practice of landfills and incineration.

Many stories in the media attest to the fact that the current recycling infrastructure is inadequate. Less than 9 percent of plastics are getting recycled (actually “down-cycled” to lower-specification applications). Paperboard is the most recycled of all the material classes according to the EPA, but this “success” only captures 68 percent. One-third of cartons are thrown away, rather than recycled. Perhaps this is why so much is being said about banning plastics, alternate materials to plastics, compostability, biodegradable plastics and boosting current recycling.

Maine, Oregon, Colorado and California have all passed legislation to implement Extended Producer Responsibility (EPR) that will impose a tax burden onto producers for the “end of life” of products and packages.

“...the packaging industry must now compete in this emerging market for robust conversion of waste into valuable products.”

While all of this is well intended, we must step back and ask, “What problem should we be solving?”

Some landfills have reached capacity and are closed, driving trash to facilities further away. One example is New York City, that now sends its trash to Ohio, Pennsylvania, West Virginia and upstate New York. This practice adds more CO₂ in transport. Many other urban centers are reaching capacity and will face the same challenge of transporting to a distant location or incinerating the waste. Neither is a good solution.

It is critical to define the problem correctly and follow the adage, “if the premise is wrong, the solution will be wrong.” For packaging, the problem is that traditional recycling methods are designed for specific, individual materials. Our ability to recover pure streams of just these few materials is poor, despite decades of investment in education and technology to sort waste.

We have proven that recycling based upon sorting waste is destined to fail. But what if we could recycle everything without relying on sorting? What if we could employ robust recycling processes that can accept everything in waste

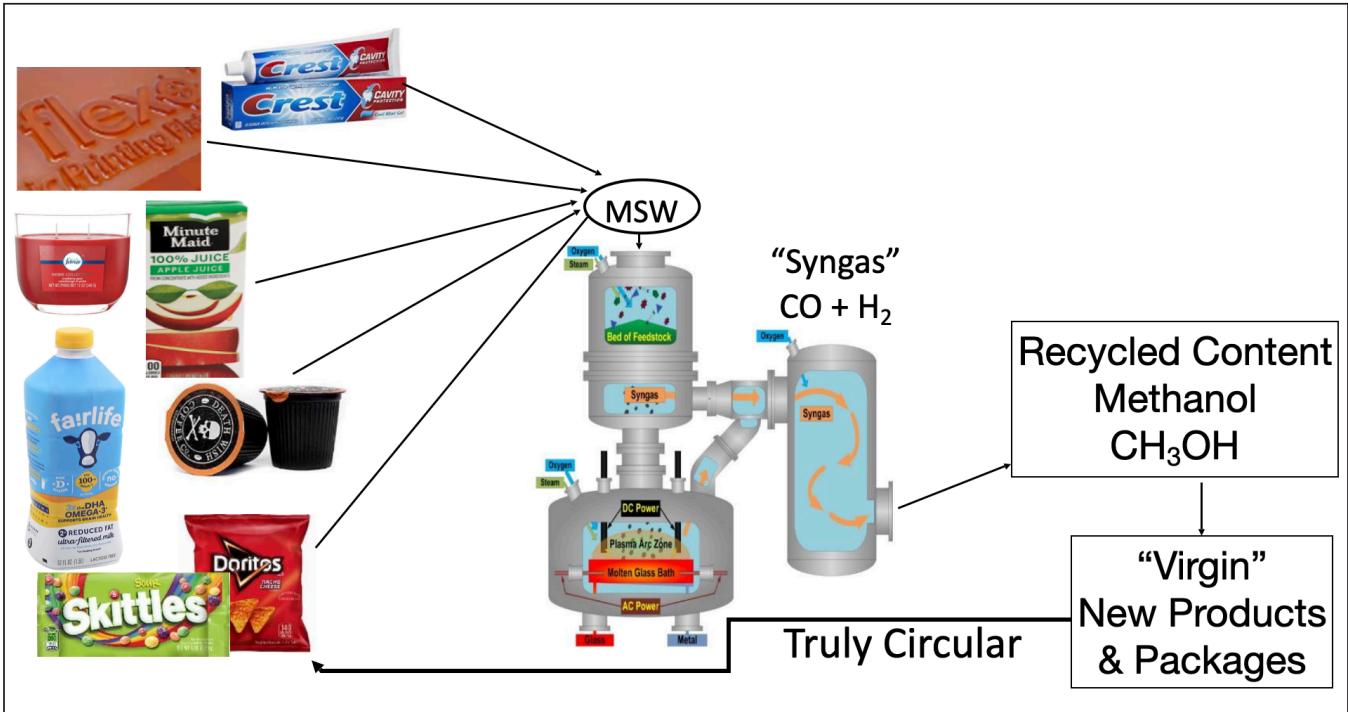


Figure 1: Regenerative Robust Gasification (RRG) produces valuable Syngas that is as versatile as fossil fuels for production of new products, plastics and packaging. RRG does not require smokestacks, produces very low emissions and is recognized as safe for the environment.

ALL ARTWORK COURTESY OF THE CONSORTIUM FOR WASTE CIRCULARITY

and convert it into a primary building block for new products, plastics and packaging? If sorting waste is the problem, robust recycling is the solution. The key to a successful recycling ecosystem is robustness.

Many forms of recycling can thrive, so long as robust recycling processes are available to process what can't be sorted or recycled by other means.

PROCESSING MSW

Through trials on the packaging industry's most difficult-to-recycle materials, Professor Bruce Welt of the University of Florida's Packaging Engineering Program is showing that Regenerative Robust Recycling can accept everything found in MSW, including spent, cross-linked photopolymer used in flexographic printing plates.

Gasification is a technology whose origin began more than 400 years ago. Gasification produces Syngas ($\text{CO} + \text{H}_2$) and was later commercialized as "Producer's Gas" for lighting streets before electrification. Gasification technology continued to advance to produce Syngas, which is a clean chemical feedstock for subsequent production of many products—fuels, fertilizers, pharmaceuticals and other chemical feedstocks such as methanol, useful for production of plastics.

Today, Syngas is primarily produced from coal, natural gas and petroleum. But what if the feedstock was MSW, which is 85 percent organic waste, much of that produced from fossil fuels?

Regenerative Robust Gasification (RRG) (see *Figure 1*) is the most-advanced gasification technology that can accept everything in MSW without exception. Contamination is not an issue for RRG, whether food, chemicals, mixed materials, etc. This process is not to be confused with incineration, which fully

"Maine, Oregon, Colorado and California have all passed legislation to implement Extended Producer Responsibility (EPR) that will impose a tax burden onto producers for the 'end of life' of products and packages."

extracts the chemical energy of waste, while emitting copious amounts of carbon dioxide and other emissions that must be mitigated.

In contrast, RRG produces valuable Syngas that is as versatile as fossil fuels for production of new products, plastics and packaging. As a result, RRG does not require smokestacks, produces very low emissions and is generally recognized as safe for the environment.

The conversion of waste (all waste) into Syngas and then into Eco-Methanol is the pathway to create new “virgin” products, plastics and packaging. These become waste and the end-of-life processing back through RRG makes this circular.

TRANSFORMATIVE FOCUS

After several industry gatherings with brands, printers and packaging suppliers, a motivated group of “founders” came forward to fund the creation of the Consortium for Waste Circularity (CWC). CWC is a nonprofit (now 501(c)(3) status) whose purpose is to advance the concept of transforming landfills by using the carbon and hydrogen-rich content to create valued end products. CWC has the interest of brands, print and packaging suppliers as members and sponsors to align on a common long-term comprehensive transformation.

The print and packaging industry needs to look to the airline industry for inspiration on a sustainability path forward. The airline industry has aligned in a non-competitive approach to a

common sustainability goal and is pledging to become carbon neutral by 2050. It is also aligned to a common plan to create fuel from waste. The first commercial facility is already up and running outside of Reno, NV using gasification technology to produce Syngas that is then converted to “Sustainable Aviation Fuel” (SAF).

This demonstrates the technological viability of robust waste processing. It also speaks to why the packaging industry must now compete in this emerging market for robust conversion of waste into valuable products. The airline industry has other sites in construction in Europe and Canada to get ready to meet the 2050 goal.

BUSINESS MODEL

The CWC vision is to transform landfills by co-locating Regenerative Robust Gasifiers and changing the forever burial ground approach into waste processing facilities (see *Figure 2*). The logistics are already in place transporting waste and that which is not recycled from curbside to landfills, adding no additional transport and avoiding dumping waste into the ground.

RRG converts all organic waste—food, yard waste, rubber tires, medical waste, paper, corrugate, plastic film packages, with fitments, foils, PVC, flexographic plates, ink, sleeves, etc.—into Syngas.

Converting Syngas into Eco-Methanol creates a valuable base chemical to achieve circularity for the packaging industry. The

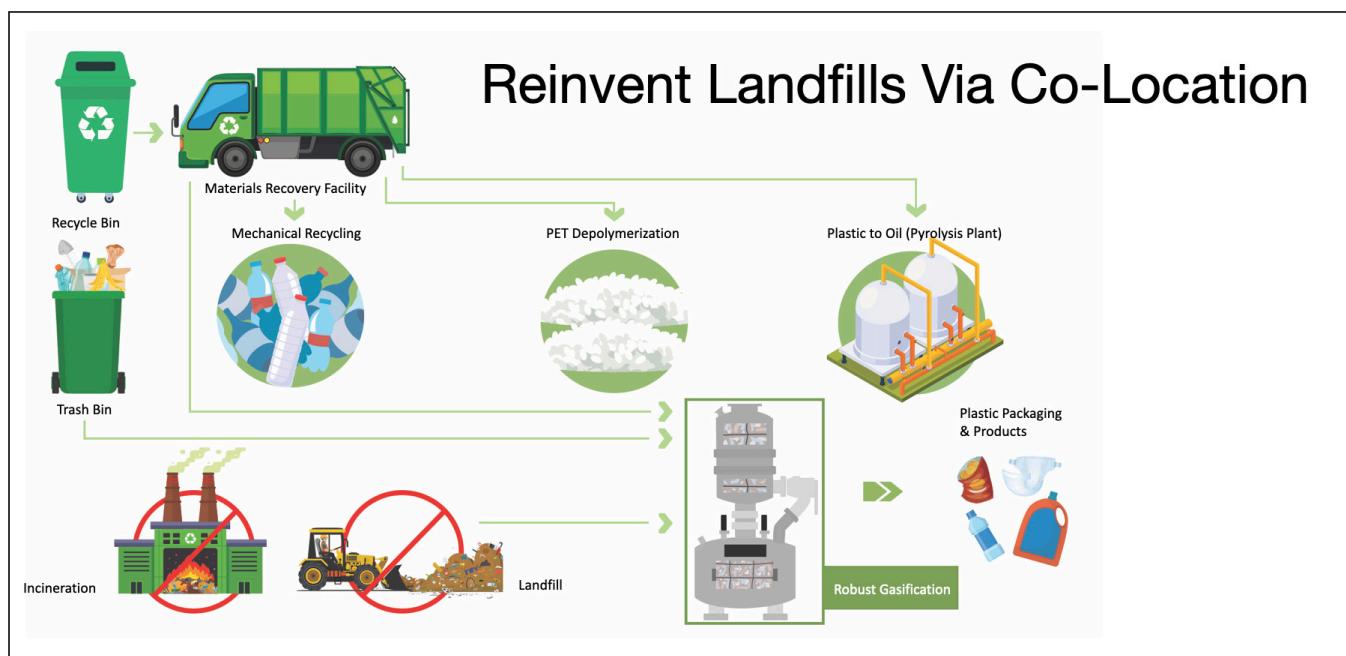


Figure 2: RRG serves as a “catch pan” for products and materials that are not recycled. RRG is complementary to all other recycling methods. Its adoption can reinvent landfills.

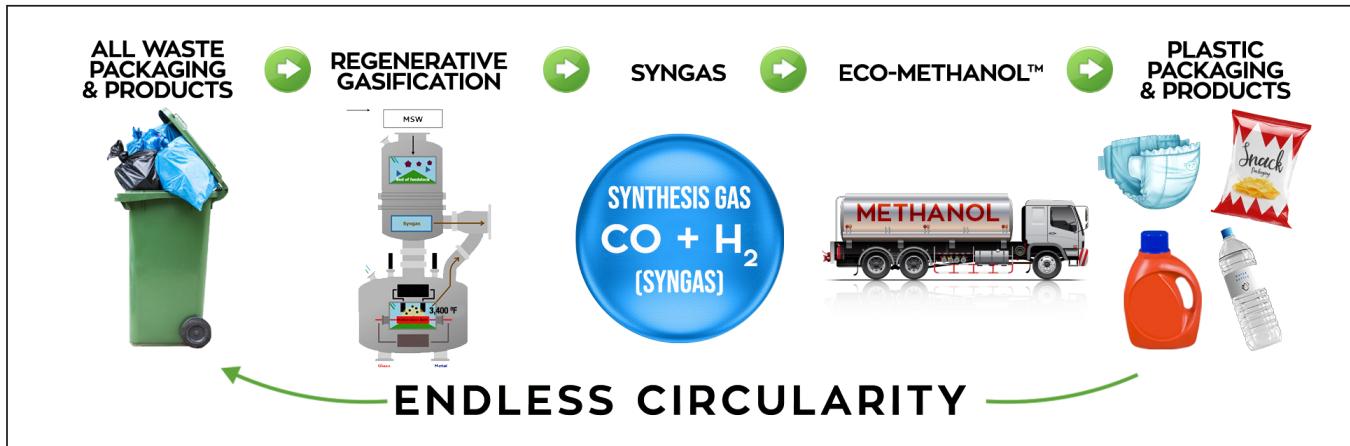


Figure 3: Endless circularity is achievable. Keeping waste out of burial in the ground is how to achieve sustainability. Eventually, the carbon- and hydrogen-rich landfills can be deconstructed into the RRG process to reclaim the land for restoration.

revenue streams include tipping fees, metals and vitrified glass and Eco-Methanol.

Eco-Methanol represents a fungible, globally demanded chemical feedstock that will carry post-consumer recycled content value back into the circular economy. Preliminary financial analysis indicates a net positive present value on investment, requiring no subsidies for economic viability. The emerging market for Eco-Methanol represents the proper approach for EPR, where

the market supports robust recycling by sourcing Eco-Methanol and/or subsequent products produced from Eco-Methanol.

RRG technology has been demonstrated at both the pilot and commercial scale accepting MSW and converting this into Syngas. A landfill has already agreed to host the first facility with a waste to Syngas to Eco-Methanol production. The packaging industry should look to the airline industry as an example to seek out such opportunities to participate in investment and

Designed for you, by you.

Maximize volume and
ink flow precision.



apexinternational.com

“For packaging, the problem is that traditional recycling methods are designed for specific, individual materials. Our ability to recover pure streams of just these few materials is poor, despite decades of investment in education and technology to sort waste.”

financing. Keeping waste out of burial in the ground is how to achieve sustainability (see *Figure 3*). Eventually, the carbon- and hydrogen-rich landfills can be deconstructed into the RRG process to reclaim the land for restoration.

TESTING TRIALS

Early in 2022, Professor Welt began a testing program endorsed by the Flexible Packaging Association (FPA) and CWC, allowing brands, printers and packaging suppliers to test their hard-to-recycle manufacturing waste and/or post-consumer waste. The program is a low-cost way to validate the capability of RRG.

Packaging industry stakeholders were instructed to ship 350 lbs. to 500 lbs. of waste material for testing. A variety of print and packaging waste was successfully converted to high-quality Syngas using robust gasification technology. A number of industry stakeholders took advantage of this opportunity and attended the trials to learn more about RRG and how robustness will fix our recycling ecosystem.

MacDermid Graphics Solutions was one such company testing its waste and its customers' waste. According to Ryan Vest, director of innovation, “MacDermid is aggressively pursuing multiple routes to repurposing printing materials, but what we found the most appealing up front about RRG was the potential to address multiple elements of the printing supply chain. This drove our thought process toward the materials we provided for testing—We wanted to include more than just plates.

“From the testing, it became abundantly clear that the technology works, and can work for the larger supply stream of waste,” added Vest. “We were able to combine used plates and used non-woven material—a common combination for our customers who have invested in thermal plate processing technology—to produce high-quality Syngas very easily.

“MacDermid became an early sponsor of the CWC,” explained Vest, “and looks forward to being able to provide continued support for this technology as it evolves and expands into a true solution for the printing industry.”

LOOKING FORWARD

In this new year, brands, printers and packaging suppliers should take action and join the CWC. This is a long-term transformative approach to deal with all waste at “end of life” that isn’t recycled by current infrastructure. Joining CWC should be added to the short-term plans brands, printers and packaging suppliers are already undertaking. Testing continues to be available for anyone interested in trials with their manufacturing and/or post-consumer waste. ■

ABOUT THE AUTHOR: *Mike Ferrari is president of the Consortium for Waste Circularity, a nonprofit 501(C)(3) focusing on science-based solutions to return manufactured materials into an endless loop of circularity to create a world without waste. A former executive with the Procter & Gamble Co., his packaging career spanned 32 years. Active in FTA throughout his career, Mike is a past two-term member of FTA’s Board of Directors.*



Upon retirement from P&G, Mike founded Ferrari Innovation Solutions LLC, coaching CPCs to delight consumers and grow their brands through packaging innovation. Mike is a guest lecture professor at his alma mater, the University of Florida in its Packaging Engineering program, where he teaches Consumer Driven Innovation Methodology. Learn more about the CWC at wastecircularity.org.

Mike will return to the FTA stage as part of FORUM 2023's opening-day session, “Sustainable Business, Sustainable Planet.” Read session previews starting on page 26. Learn more about FORUM 2023 and register to attend at forum.flexography.org.