ESG ***in Depth***

Fourth Quarter 2020

Sustainable Packaging: Risks to the Plastic Value Chain

Summary:

Problem: We have all seen pictures like the one above. Plastic bottles and other plastic trash floating on the ocean surface or washing up on beaches. Ocean waste has made society take notice of the problems associated with plastic. Ocean waste and other forms of plastic pollution are serious problems but they are not the whole story. The plastic value chain has a large and damaging carbon footprint as well, and ecological and human health risks related to plastic waste and microplastics are compounding. Plastic packaging — as it is created, used and discarded today — is simply not sustainable. Nonetheless, plastic production is expected to triple by 2050.[1] We are not suggesting plastics have no positive benefits. Plastic is arguably the most versatile material ever invented and clearly still has an important role to play. However, society's view on plastic, especially single-use plastic packaging, is changing rapidly.

Development: For much of the past century, we have been operating in a linear economy. Something gets produced — maybe it gets recycled once or twice — then it enters a landfill. This "take-make-dispose" approach is becoming increasingly unacceptable to society as the problems of waste, polluting emissions and resource depletion continue to loom. Moreover, recycling over the past few decades has been about lengthening the path to the garbage dump, not eliminating it. Looking forward, we anticipate that society will increasingly expect companies to offer products that fit into a circular economy. The circular economy represents a total shift in mindset that requires a product to *never* hit a landfill. In this regard, it seems clear that the next 10 years is going to look markedly different than the last.

Materiality: Virgin plastic has a much larger carbon footprint than recycled plastic. However, the environmental risk externalities (emissions and pollution) associated with virgin plastic manufacturing are not currently reflected in its price, which has fallen well below that of recycled plastic as a result of lower oil prices and reduced demand resulting from single use bans and other factors. Given the increasing likelihood of carbon pricing regulations in the United States and Europe, the cost of virgin plastic is likely to increase. As carbon regulation proliferates globally, resin

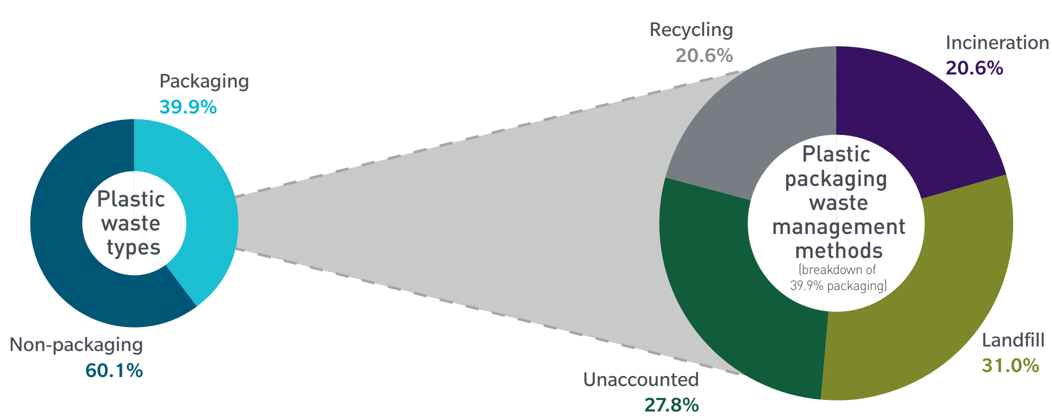
producers will lose their pricing advantage. Additionally, regulators are stepping in with a variety of measures to reduce plastic consumption and pollution. Examples include single-use plastic bans (*e.g.*, grocery bags, drinking straws, etc.), extended producer responsibility (EPR) laws and plastic packaging taxes. This puts pressure on companies across the packaging value chain to adapt their businesses while managing structurally higher costs.

Next steps: Look for stranded assets risks from regulatory changes and higher consumer demand for more sustainable packaging.[2] Reevaluate commodity costs, pricing power and capital investment arising from a shift from virgin to recycled plastics or other substrates such as paper, aluminum or glass. At a minimum, model carbon pricing scenarios in downside analyses and increase engagement with affected companies in the plastic value chain.

Detail

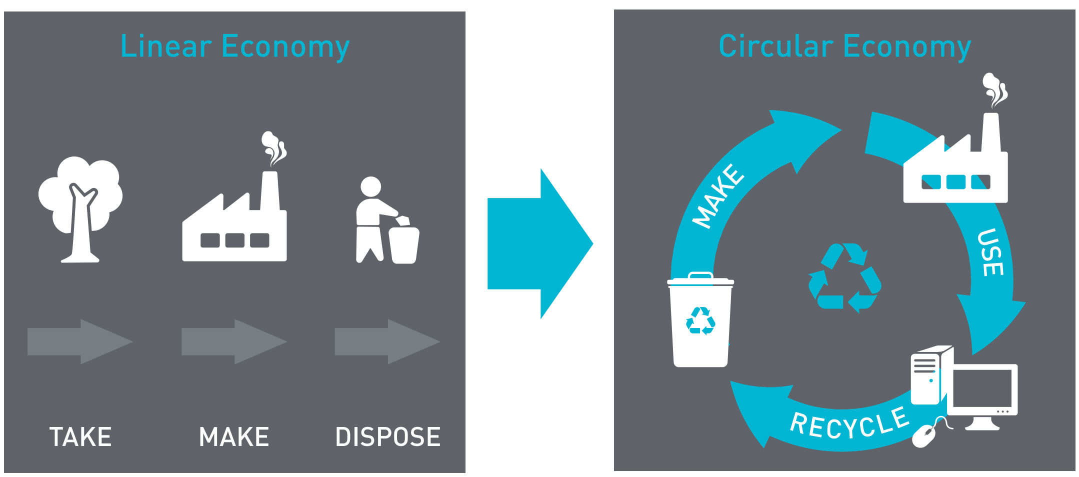
Problem: Society's views on plastics are changing rapidly. The issue of ocean waste, in particular, has caused society to focus on the growing problem of plastic accumulation in the environment. Eight million tons of plastic waste finds its way into the ocean each year. At this rate, by 2050 there will be more plastic in the ocean than fish.[3] Ocean waste, however, is not the only risk associated with plastics. Plastic production has a large and damaging carbon footprint and other environmental impacts, such as water and air pollution. Plastic waste is a major threat to biodiversity as habitats degrade and animals mistakenly consume it, and the impact on ecological and human health of microplastics, which now permeate the environment, is uncertain. Although society increasingly views this situation as unsustainable and unacceptable, global plastic production is expected to triple by 2050, with packaging representing 40% of the demand.[1] There is no clear alternative to plastic packaging. Biodegradable and bio-based options are not currently viable. Paper and aluminum may be part of the solution, but neither is a fully effective replacement. Solving this issue will require the collective efforts of legislators, companies and society, and the solutions will have wide-ranging impacts for companies across the plastic packaging value chain.

Global Plastic Packaging Waste Management



Source: CIEL, Plastic & Climate: *The Hidden Costs of a Plastic Planet*, 2019

Development: The direction and magnitude of the trend away from unsustainable plastic consumption is probably not appreciated by many investors. For much of the past century, our society has been operating in a linear, "take-make-dispose" economy. Raw materials are sourced, and goods are manufactured and consumed — maybe recycled once or twice — then disposed of in a landfill. Society is finding this approach increasingly unacceptable and will require solutions. Companies will be expected to produce products that fit into a circular economy, which means everything created must be reusable or infinitely recyclable, and governments will be expected to enact legislation to incentivize this transition. Additionally, in a linear economic model, growth is constrained by resource availability. In a circular economy, growth does not require resource depletion and waste is eliminated. This represents a total shift in mindset and requires that all products be designed for an infinite useful life. Much of the cost of this transition will fall to companies, and their ability to pass those costs downstream will likely be limited.



Although recycling has steadily increased over the past several decades, it really has not helped solve the problem of waste, and specifically plastic waste, all that much. In the US, only 9% of total plastic waste is recycled,[4] and much of that is "down-cycled", which means it is made into a carpet or some other product that will eventually end up in a landfill. Recycling as we know it is about lengthening the trip to the garbage dump, not eliminating it. We expect this to change substantially.

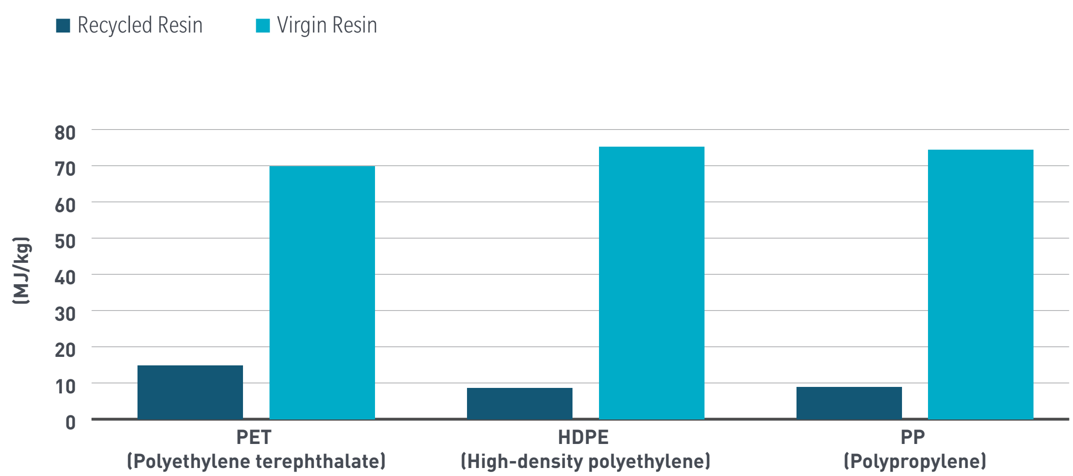
Historically, the economics of recycling have not really worked:

- It has generally been cheaper and easier to make new plastic out of oil than to make it out of post-consumer recyclables (PCR).
- Demand for post-consumer material has been negatively correlated with oil prices. When oil prices decline, recyclers' revenues suffer because their costs are largely fixed, while resin manufacturers can reflect lower oil prices in lower virgin plastic prices, making virgin plastics even more economical versus recycled plastic.
- Recyclers' revenue stability has also been impacted by insufficient PCR availability because until recently it has often been more profitable for waste management companies to export PCR to China than to develop a stable local recycling stream.
- Technology has been lacking. Historically, almost all processing of PCR has involved mechanical recycling, a process that is complex, inefficient and detrimental to the material, which leads to down-cycling.

Although virgin resin production has enjoyed a pricing advantage over recycling, that discount would likely be erased if the cost of environmental externalities were assigned to the producers. The bar chart, **Total Energy Use**, shows the energy involved in virgin plastic production versus recycling. Relative to virgin materials, recycling requires far less energy and results in lower emissions.[5]

Some form of carbon pricing is currently in place in 30 countries and either scheduled or under consideration in 18 more. In the US, carbon pricing has been implemented in California and Washington, is scheduled in Virginia and is under consideration in Pennsylvania and Oregon.[6] Should carbon pricing be broadly implemented in the US, virgin resin capacity would represent a significant stranded asset risk for producers — especially in light of capex already committed to expanding capacity to meet the expected growth in demand.[7]

Total Energy Use



Source: Association of Plastic Recyclers, *Life Cycle Impacts for Postconsumer Recycled Resins: PET, HDPE and PP,* 2018.

To illustrate this point, the Trucost analysis in the table below identifies areas of environmental damage exposure for a European virgin resin producer. The analysis shows that if the costs of offsetting the environmental damage associated with their business operations were assigned to the company they could represent more than half of EBITDA.[8]

Trucost Analysis	Env. Damage Exposure
Greenhouse Gases	High
Waste	High
Air Pollutants	High
Water	High
Land and Water Pollutants	Medium

Source: S&P/Trucost

TOTAL ENV. DAMAGE COST AS A % OF EBITDA

53.58%

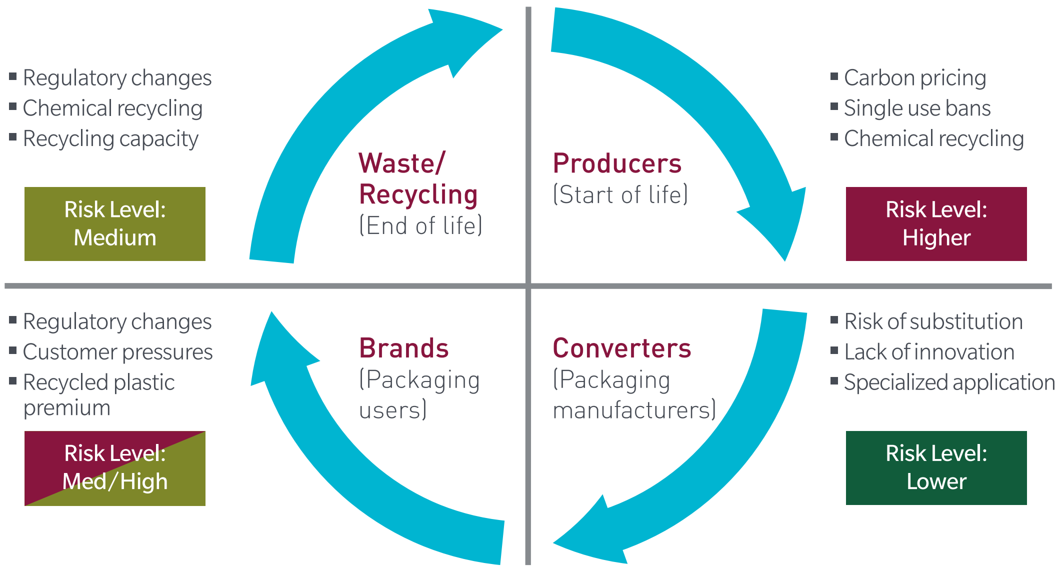
Recycling infrastructure is insufficient in the US and many other developed countries because years of exporting waste to China has reduced the need for local capacity to process PCR. With China's waste import ban going into effect in late 2017 and other countries where plastic manufacturing is concentrated, such as Malaysia, expected to follow, countries like the US are scrambling to increase recycling capacity and improve technology.

Mechanical recycling involves a number of steps, that include collection, sorting, washing, drying, grinding, regranulating and compounding. It is labor intensive and has a number limitations. Sorting, washing and drying are required because the process cannot accommodate different types of plastic simultaneously and all PCR must be free of contaminants such as food, which can compromise the purity of the end product. As plastic packaging has evolved, converters (manufactures of product packaging) have introduced additives, colorants, films and other elements that make it much more difficult to recycle mechanically. These factors greatly reduce the percentage of material that can be effectively recycled and increase processing costs. Additionally, grinding, regranulating and compounding have a degrading effect such that mechanically recycled plastics must typically be combined with 50% to 70% virgin resin to be reused and can only be recycled (or down-cycled) once or twice before they become unsuitable for remanufacture.

Chemical recycling could potentially solve many of the problems associated with mechanical recycling and is expected to play a major role in the shift to a circular economy. Chemical recycling methods de-polymerize plastic resins, producing monomers that can be isolated and collected while additives and contaminants are separated and removed. This eliminates the need for the sorting and cleaning of PCR and increases the range of products that can be recycled. Additionally, chemically recycled plastics do not suffer degradation. They can be recycled infinitely and do not require the addition of virgin resin to maintain integrity. However, while chemical recycling represents a promising step toward the circular economy, it remains a nascent technology that is energy and capital intensive and difficult to scale economically. Moreover, the chemical companies developing this technology are the same companies that produce virgin plastic. In the absence of carbon pricing, they earn such high returns from virgin resin production that they are not incentivized to scale their chemical recycling technology, which could lower near-term return on investment. These hurdles will need to be overcome for chemical recycling to fulfill its potential.

Materiality: Increasingly, secular changes in support of the shift to a circular economy are beginning to change the dynamics of plastic manufacturing and use. The graphic below illustrates the supply chain for the packaging industry and highlights what we believe are the primary risks to each part of the value chain.

Risks to the Plastic Value Chain by Sector



- **Vertically integrated plastic substrate producers** are most at risk from carbon prices, single-use bans and increases in mechanical and chemical recycling rates. Single-use plastic bans have already led to a slowdown in demand for some virgin resins. Carbon pricing and scaled chemical recycling would devastate virgin production.
- **Traditional packaging convertors** face structurally higher research and development expenditures along with slowing volume from regulatory and consumer pressures and disruption risk if they fail to innovate.
- **Brands** (companies) face structurally higher R&D spend and cost of goods sold (COGS) over the medium to long term from customer pressure for innovative, eco-friendly packaging and regulatory measures such as extended producer responsibility (EPR) laws, which seek to shift a product's end-of-life costs or impacts to the original producer (these include producer fees, container deposits, take-backs, etc.).
- **Waste management companies** face substantial tail risk from chemical recycling as it scales up. Recycling is their lowest revenue stream relative to landfilling and incineration, and there is a risk of disintermediation from chemical recycling. EPR regulations could reduce waste volumes, which would substantially reduce revenues:

> "If wide-ranging EPR regulations were adopted, they could have a fundamental impact on the waste streams we manage.... A significant reduction in the waste, recycling and other streams we manage could have a material adverse effect on our financial condition, results of operations and cash flows."
>
> —Waste Management 2019 10-K

How does the coronavirus pandemic change the scenario?

- Reduces consumer interest in reusable products; there is a shift back to single-use plastic packaging
- Economic impacts of COVID-19 delay regulatory changes
- Opportunity for large brands to keep recent share gains from small disrupters through "green" packaging and formulation innovation

What stays the same post-COVID?

- The case for recycling and a circular economy
  - Environmental impacts are still a long-term risk to the environment and economy.
- Brand commitments to hit recycled content targets
  - Companies have just made these commitments, and they will be hard to roll back.
  - Commitments to increase recycled content use in packaging are not linked to oil price, which could lead to more stable recycled plastic prices and improved economics for recyclers.
- Greater focus on optimizing capital expenditures and capital returns across all stakeholders
  - More capital will be spent on R&D, less on share buybacks.

Next steps:

- Look for stranded assets risks from regulatory changes and higher consumer demand for more sustainable packaging.
- Reevaluate commodity costs, pricing power and capital investment arising from a shift from virgin to recycled plastics or other substrates such as paper, aluminum and glass.
- At a minimum, include model carbon pricing scenarios in downside analyses.
- Increase engagement with affected companies in the plastic value chain.

Appendix: Types of Plastic

Plastic packaging is present throughout our everyday life

1 PET	Water and soft drink bottles, salad domes, cookie trays, salad dressing and peanut butter containers
2 HDPE	Milk bottles, freezer bags, dip tubs, crinkly shopping bags, ice cream containers, juice bottles, shampoo, chemical and detergent bottles
3 PVC	Cosmetic containers, commercial cling wrap
4 LDPE	Squeeze bottles, cling wrap, shrink wrap, trash bags
5 PP	Microwave dishes, ice cream tubs, potato chip bags, dip tubs
6 PS	CD cases, disposable cups, plastic cutlery
6 EPS	"Styrofoam" coffee cups and fast food clamshells, meat trays, packing peanuts
7 OTHER	Water cooler bottles, flexible films, multi-material packaging

Endnotes

[1] CEIL: https://www.ciel.org/wp-content/uploads/2019/05/Plastic-and-Climate-FINAL-2019.pdf

[2] Stranded assets are "assets that have suffered from unanticipated or premature write-downs, devaluations or conversion to liabilities".

[3] https://www.weforum.org/projects/global-plastic-action-partnership

[4] Source: Geyer et al (2017). https://advances.sciencemag.org/content/3/7/e1700782.full

[5] Source: https://plasticsrecycling.org/images/apr/2018-APR-Recycled-Resin-Report.pdf

[6] Source: https://carbonpricingdashboard.worldbank.org/

[7] Capital expenditures (CapEx) are funds used by a company to acquire, upgrade, and maintain physical assets such as property, plants, buildings, technology, or equipment. CapEx is often used to undertake new projects or investments by a company.

[8] EBITDA: Earnings Before Interest, Taxes, Depreciation, and Amortization.

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