

A SEA CHANGE FOR PLASTIC RESOURCE RECYCLING

– TRENDS AND CHALLENGES AMID THE GROWING DEMAND FOR RECYCLED PLASTICS —

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SUMMARY

- Global plastic waste export regulations are creating a need to devise domestic recycling systems in both plastic waste importing countries and exporting countries. Many countries are responding by focusing on policies that promote recycling and the use of recycled plastic, mainly for containers and packaging.
- Leading Fast Moving Consumer Goods (FMCG) companies are responding by setting recycled plastic material content targets. However, they face challenges such as supply shortages of recycled plastic.
- For proper recycling of recycled plastic resources, there must be adequately designed sorting and collection processes, along with advanced recycling technologies.
- As new investment demand for recycling is expected, moves by leading recycling companies and producers of chemical materials need to be watched closely. For stable supply and demand, these companies also likely need to create systems with bridging functions that bring suppliers together and match them to the demand.

1. GLOBAL EXPANSION OF POLICIES FOCUSED ON PLASTIC RESOURCE RECYCLING

Countries around the world being forced to create domestic recycling systems

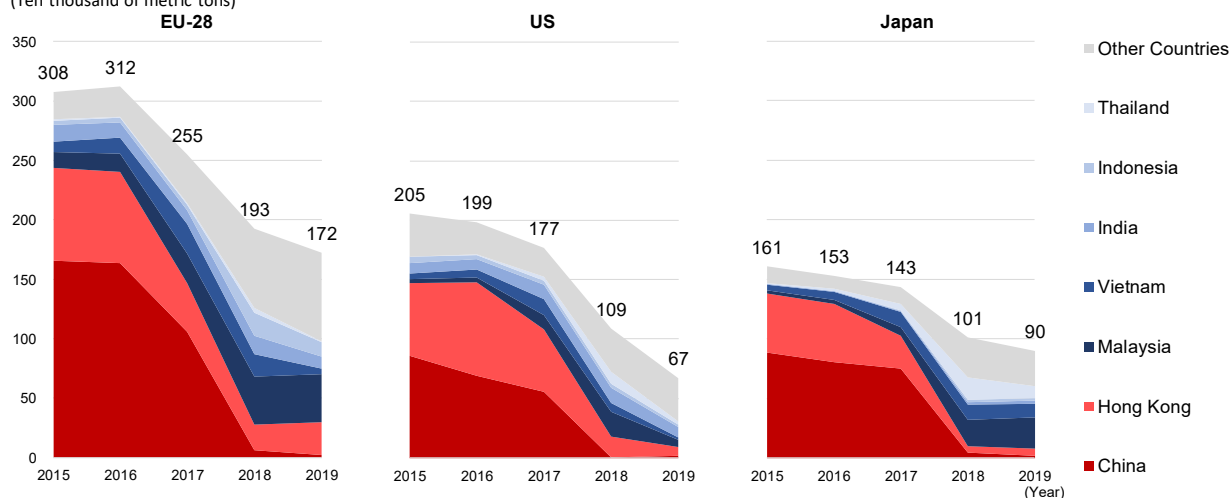
In 2018, China implemented a policy to ban the import of plastic waste, ending its history as a plastic waste importer. Plastic waste that temporarily lost its destination were sent to countries in Southeast Asia and elsewhere. However, with increasing environmental problems and growing awareness of environmental issues of local populations, many countries have successively followed China's lead in regulating or banning plastic waste imports. In addition, amendments to the Annexes of the Basel Convention set to take effect in January 2021 will add soiled plastic trash unfit for recycling to the list of regulated items, creating more stringent regulations on the cross-border movement of plastic waste.

Japan, and the West have previously exported unsorted plastic waste—unprofitable materials given the sorting and recycling processes—to countries with keen demand for recycled plastic such as China. However, the global expansion of import regulations has significantly reduced plastic waste exports from these countries (see Figure 1), forcing them to create recycling systems that do not rely on exporting.

China, meanwhile, continues to have high demand for recycled plastic, and many Chinese companies have shifted to importing plastic recycled from plastic waste in Southeast Asia or other countries. The country's volume of imported recycled plastic surged from about 2 million metric tons in 2018 to about 3.5 million metric tons in 2019. That said, regulations on the cross-border movement of plastic waste will reduce the inflow of plastic waste used as raw materials to Southeast Asian and other countries which China imported recycled plastic from. Therefore, procurement of recycled plastic from overseas is expected to be only temporary.

Figure 1 Plastic waste exports from the EU, US and Japan (2015 to 2019; breakdown by major export destination)

(Ten thousand of metric tons)



Source: Created by MGSSI using data from the UN Comtrade database of the United Nations Statistics Division

Global regulations on plastic waste exports are forcing both plastic waste importing countries and exporting countries to create domestic recycling systems, and this is the beginning of a sea change in plastic waste resource recycling.

Use of recycled plastics gaining momentum worldwide

Today there is growing interest in plastic waste problems such as marine pollution caused by plastic trash. In this context, following the expansion of policies to ban plastic waste imports/exports, a string of major countries have released plastic-related regulations as well as policies for promoting resource recycling. In several countries, their policies call for reducing plastic usage, eliminating plastic, and developing biodegradable plastic or other alternative materials. However, since there are still issues with performance, cost, and supply capacity, many of these policies emphasize plastic waste recycling, promoting the use of recycled plastic. Plastic containers and packaging account for the largest share (36%) of the global plastic production volume. Because these items also have a short life cycle until being scrapped, many countries have made them a policy focus and set targets for the proportion of recycled plastic used in their manufacture (Figure 2).

Figure 2 Recycled plastic utilization targets of major countries/regions

Country/region	Main policy	Targets for using recycled plastic in plastic products such as containers and packaging (extract)
EU	EU Plastics Strategy	10 million metric tons of recycled plastic to be used annually in new product manufacture by 2025
	Voluntary targets of Union of European Soft Drinks Associations	Proportion of recycled plastic used in PET bottle manufacture of at least 25% by 2025
US	Voluntary targets of American Chemistry Council	100% of containers and packaging to be recyclable or recoverable by 2030 100% of containers and packaging to be reused, recycled or recovered by 2040
Japan	Resource Circulation Strategy for Plastics	60% of containers and packaging to be reused or recycled by 2030
China	Guidance on Accelerating the Development of Recycling Industries	23 million metric tons of waste plastics to be collected/recycled domestically by 2020

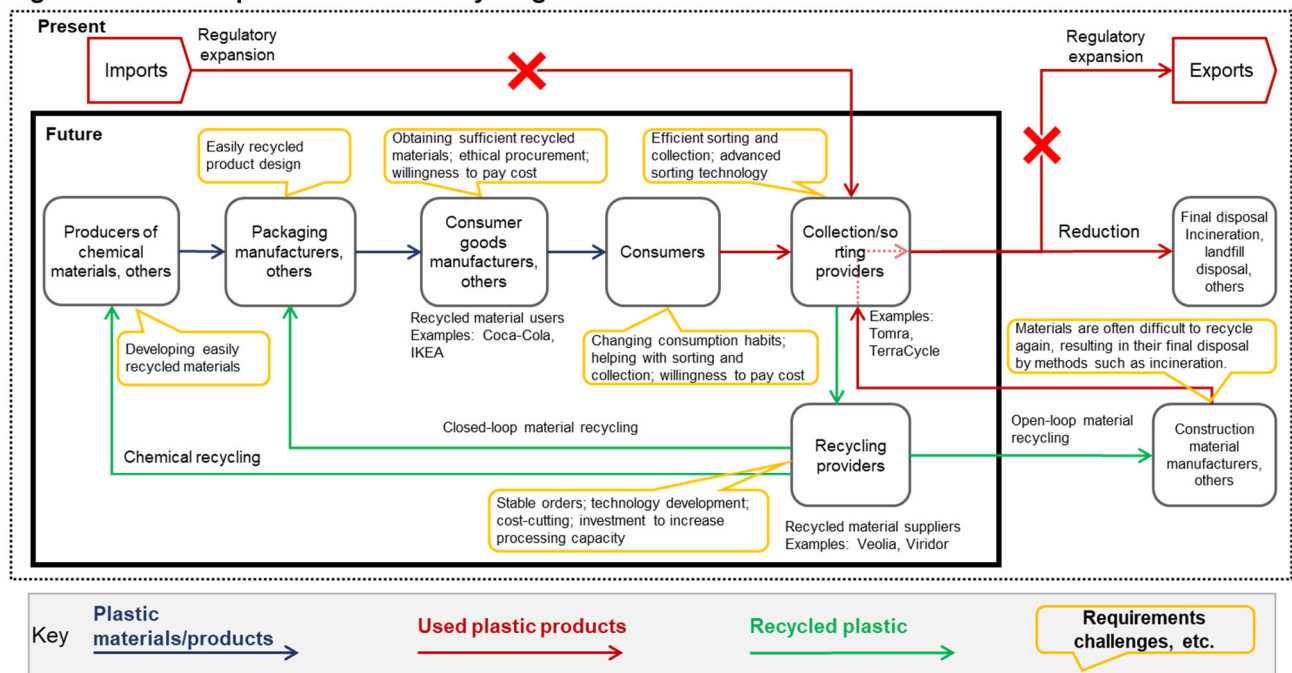
Source: Created by MGSSI using publicly released materials

Efforts to encourage plastic recycling have recently been gaining momentum, led by the EU and China. The EU published a new Circular Economy Action Plan in March 2020, a document that provides tougher mandatory requirements for containers and packaging permitted in the EU market. By 2021, the region will finalize policies aimed at encouraging designs that promote packaging reuse/recycling and improving the complexity of packaging materials made from multiple components. China released its Opinions on Further Strengthening the

Control of Plastic Pollution in January 2020, a document that calls for banning or restricting the use of some plastic products and promoting recycling. An amendment to the country’s Law on the Prevention and Control of Environmental Pollution by Solid Waste, which is planned to take effect in September 2020, is intended to promote the widespread use of recyclable plastic products. Even during the COVID-19 pandemic, the momentum of efforts to respond to the problems of plastic has shown no sign of waning.

As shown in Figure 3, countries will have to work on a number of efforts to promote recycling and increase the use of recycled plastic. For example, they will need to develop easily recyclable materials, expand closed-loop material recycling¹ that enables nearly waste-free resource recycling, and create collection systems to support these efforts. From upstream producers of chemical materials to downstream recycling providers, all stakeholders should work actively on adopting circular economy-based business models and partnering with other industries.

Figure 3 Future of plastic resource recycling



Source: Created by MGSSI based on various materials

2. GROWTH AND CHALLENGES FOR RECYCLED MATERIAL PROCUREMENT BY LARGE USERS

Large users required to take measures

In order for countries to achieve the targets set in their respective policies, it is necessary that large users of containers and packaging to increase the use of recycled plastic. In this regard, one focus of attention is the activities of leading Fast Moving Consumer Goods (FMCG) companies with a global presence. Companies such as Coca-Cola and Nestlé have set voluntary targets for activities, e.g., switching to recyclable materials and improving the proportion of recycled plastic that they use. They are working with their outsourced manufacturers and other suppliers, while taking action through international organizations and partnerships between companies. The New Plastics Economy Global Commitment—a public-private partnership project for promoting plastic reduction led by the United Nations Environment Programme (UNEP) and Ellen MacArthur Foundation—has been joined by over 400 organizations and companies worldwide, including the above two FMCG

¹ Japan’s Ministry of the Environment defines material recycling as the use of discarded plastic waste as raw materials after they have undergone processes such as crushing and melting. Material recycling is classified into closed-loop and open-loop types. Closed-loop material recycling generates raw materials for the same product they came from. Open-loop material recycling generates raw materials for lower-grade products, when use in the same product they came from would not satisfy the quality requirements.

companies. With its participants handling over 20% of the world’s total plastic volume, the project serves as a venue for activities that bring large plastic users together.

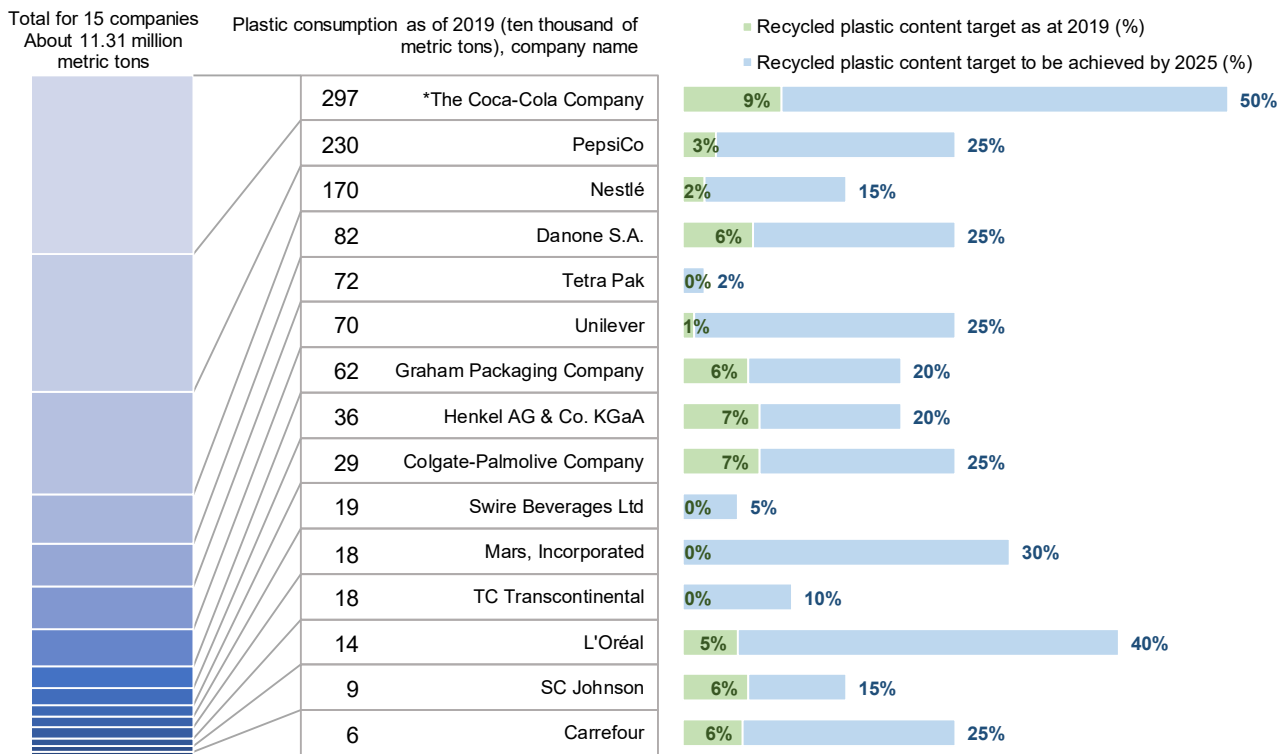
Meanwhile, in China, the government is urging relevant companies to take necessary measures. The agriculture, home delivery, and food delivery industries have been designated as priority sectors because they make extensive use of plastic products such as agricultural mulch film, packaging materials, and single-use food containers. For example, producers of agricultural materials are being asked to use recycled plastic, while major home delivery companies are being requested to publish their packaging consumption figures and create packaging collection facilities at their distribution centers.

Supply-demand gap for recycled plastics poses a challenge

Although the increased use of recycled plastic is being prioritized as a measure for encouraging proper plastic waste resource recycling, recycled plastics are in short supply, and this shortage is seen as a pressing issue.

Figure 4 shows the recycled plastic content target (for 2025) and current status (for 2019) for the top 15 plastic consumers among the companies participating in the New Plastics Economy Global Commitment project mentioned above. None of the companies has made much progress. Assuming the companies maintain their 2019 consumption level through 2025, they will need an estimated 3 million metric tons of recycled plastic per year to achieve their targets. This level of demand exceeds the 2.11 million metric tons of plastic waste that were recycled (or exported) by Japan in 2017. Given that these companies are likely to grow their business in the coming years, the amount of recycled plastic actually required will likely be even greater. Growth in demand is already affecting markets. For example, procurement is becoming increasingly difficult in Japan, where growing demand for recycled PET has been raising the contract prices in bids² for waste PET bottles since the second half of 2019.

Figure 4 2025 recycled plastic content target and current status for top 15 plastic consumers among companies participating in New Plastics Economy Global Commitment



*The target shown for the Coca-Cola Company is to be until 2030.

Source: Created by MGSSI using materials publicly released by the Ellen MacArthur Foundation

² Bids made by the Japan Containers and Packaging Recycling Association to enable used PET bottles collected from households and other users to be transferred to recycling providers.

Rising concern for ESG activities and ethical procurement has caused many leading FMCG companies to adopt their own supplier assessment standards. As a result, simply meeting volume requirements is no longer enough. Manufacturers are now looking for recycled material suppliers not only of good-quality but also with legally compliant operations that incorporate adequate management systems. While seeking to secure suitable recycled plastic suppliers, manufacturers will have to aim for quantitative expansion, which is seen as more difficult than just meeting the target supply volume of recycled materials. Because of this, companies are rushing to find superior suppliers. In late 2019, for example, Unilever signed a five-year recycled plastic supply agreement with integrated UK recycling giant Viridor.

3. COLLECTION SYSTEMS AND RECYCLING TECHNOLOGIES NEEDED FOR PROPER CIRCULATION OF RECYCLED PLASTICS

Sorting and collection processes enabling plastic resource recycling

In order to ensure that plastic products are recycled after consumption, efficient sorting and collection should be made through urban waste collection systems. There is a need to design trash sorting and collection systems and provide recycling technology adapted to them. Mutual efforts and collaboration between the public and private sectors are essential in meeting this need.

The existing collection systems of developed countries still have room for improvement. The deposit systems³ already in wide use in northern Europe and other parts of the continent have attracted interest as an effective means of collection. A growing number of countries, including the UK and France, are planning to start deposit systems. Coca-Cola has announced that all its PET bottles used in Sweden will be made from 100% recycled materials starting in 2020, explaining that Sweden's world-class deposit system and collection system was behind the company's decision. This illustrates how sorting and collection systems that are adequately designed play an important role in supporting plastic resource recycling. However, for countries lacking trash sorting and collection systems, system creation is the first pressing issue to address. In 2019, China adopted a trash sorting and collection system that designates plastic waste as a resource to be collected, and some cities are collaborating with European recycling companies.

Technologies enabling advanced recycling

Figure 5 lists the plastic recycling methods commonly used today. Recycling technologies that can maintain the quality and value of the recycled materials is required to ensure a sustained supply of recycled plastic. Closed-loop material recycling generates raw materials that can be recycled back into the same product they came from. For example, it can turn used PET bottles back into PET bottle material again. This type of material recycling, which can maintain a high added-value for recycled materials and reduce the amount of scrap, is expected to create growing demand for it. Open-loop material recycling is used for recycling construction materials and other low added-value materials. It merely lengthens the material life cycle up to the point of final disposal and is therefore expected to have only limited demand in the future. Chemical recycling can produce recycled materials with the same quality as virgin materials. It attracts growing interest among users such as leading oil and chemical companies as can be used to recycle plastic waste that is difficult to sort.

Governments around the world are providing support for the development and implementation of these technologies. The EU is developing technologies in areas such as chemical recycling in the Horizon 2020 programs, and some of these technologies have reached the implementation phase. In late 2017, Japan responded to China's measures to ban plastic waste imports by implementing emergency assistance measures for the creation of plastic recycling systems. Since fiscal 2019, Japan has also been working on a project to create and demonstrate systems for recycling plastic and other resources that will help to create a decarbonized

³ A system for promoting the collection of used products and containers. It works by adding a fixed deposit to the price of the product at the time of sale. The deposit is then refunded when the consumer returns the product or container after use.

economy. The project is supporting the development of alternative materials and the creation of recycling processes. China is researching and developing areas focused on chemical recycling and technologies for manufacturing high-quality recycled plastic from used home delivery packaging and single-use food containers, among other items. The work is being done through outsourcing to researchers, including private-sector organizations. The US Department of Energy (DOE) announced a project called the Plastics Innovation Challenge in late 2019. The project will provide funding and other assistance for innovation projects of used plastics in collection, deconstruction, upcycling, recyclable design, and commercialization.

Figure 5 Main plastic recycling technologies

	Category	Typical methods	Features	Issues	Trends and outlook	Example companies
High	Material recycling Methods that use processes such as sorting, impurity removal, crushing and melting to recycle used materials into raw materials	Closed-loop material recycling: Recycling that generates raw materials for the same product they came from.	Requires a smaller plant size and consumes less energy than chemical recycling.	Obtaining good-quality waste plastic; recycled materials are more expensive than virgin materials of the same quality.	Use is growing for supply to leading FMCG Companies, mainly for recycled PET bottle raw materials.	EREMA (Austria)
		Open-loop material recycling: Recycling that generates raw materials for products of lower quality than the original product.	The treatment processes are easy and can be done with simple equipment. Used extensively in China and other developing countries.	Repeated recycling is difficult; easily affected by labor costs and virgin material costs.	Soliciting government support and new investment will be difficult. Future demand will be limited and concentrated among a few leading companies.	Longfu Recycling Energy Scientist (China)
Priority level for resource recycling	Chemical recycling Methods that chemically decompose waste plastics to obtain petroleum raw materials or others to recycle into product raw materials	Raw materialization/monomerization: A method that chemically decomposes waste plastic to restore it to raw materials or monomers.	Can recycle materials into monomers of nearly the same quality as the virgin material. Processes for PET are being commercialized.	Obtaining good-quality waste plastic; the initial investment is costly and the treatment processes consume a lot of energy.	Interest is high among leading beverage manufacturers and apparel manufacturers, and procurement volumes will grow.	Japan Environment Planning (Japan), Loop Industries (Canada)
		Gasification: A method that uses gasification melting or other chemical processes to extract flammable gas.	Can process mixed waste plastics containing PVC without sorting.	The investment and running costs are high; requires anti-dioxin and other measures.	Interest has grown recently due to expectations for mixed waste plastic processing.	Ebara Corporation (Japan), Ube Industries (Japan)
		Petrochemical extraction: A method that uses thermal decomposition or a catalytic reaction to heat the material, and extracts fuel or chemical raw materials from it with a chemical reaction.	Does not require precise sorting. Suited to PP and other thermoplastic resins, but not to PET.	Costs are high due to high energy consumption and other factors. There are also issues with safety and the quality of the refined products.	Leading global oil and chemical companies have recently become highly interested, and there has been brisk investment from many startups.	Plastic Energy (UK)
		Blast furnace raw materialization: Uses the material as iron ore reducing material in a blast furnace.	Can process industrial waste and waste plastic from containers and packaging.	Requires removal of PVC and metals; more expensive than coke raw material.	Relies heavily on the steel industry; is subject to regional restrictions from factors such as steelworks locations; use is limited.	JFE Steel (Japan)
		Coke oven chemical raw materialization: Mixes the material with a component such as coal for use as a raw material.	Can process a mix of discharged waste plastics. Emits no harmful substances.	Restricted by factors such as the waste plastic mixture ratio and plant intake capacity.		Nippon Steel (Japan)
	Thermal recycling (Energy recovery)	Waste incinerator power generation: A method that burns waste in a boiler and generates power from the high-temperature/high-pressure steam obtained.	Suited to processing mixed waste that is difficult to sort. Can reduce the amount of waste for final disposal.	Costly initial investment; requires anti-dioxin and other measures; not considered as resource recycling in some cases.	Has high demand in places such as countries where creation of waste sorting systems is underway. Automation and unmanned operation will expand in future.	Hitachi Zosen Corporation (Japan), JFE Engineering Corporation (Japan)

Source: Created by MGSSI using publicly released materials

4. FUTURE OUTLOOK

Growing demand for new investment in recycling

A report by Irish market research firm Research and Markets estimated the size of the global recycled plastic market at about USD 42 billion in 2018. This figure is expected to grow to about USD 67 billion by 2025. Demand for new investment in recycling is expected to grow globally as the recycled plastic market expands. By 2030, the European Strategy for Plastics in a Circular Economy aims to increase the region's plastic recycling capacity to four times its 2015 size. As for the leading US FMCG companies, to attain their 2030 recycled plastic content targets, they would require approximately USD 3 billion worth of new investment for building recycling plants, among other projects, according to global energy consultancy Wood Mackenzie. The world's financial institutions are viewing this investment demand as a promising financing opportunity. In March 2020, for example, Japan's Mizuho Bank arranged a 'sustainability-linked ninja loan' for Indorama Ventures (IVL), a global PET leader from Thailand. The loan has a provision for interest rate reduction contingent upon ESG targets being met. The EU's New Circular Economy Action Plan states that in the future mandatory requirements will be proposed for recycled plastic content and waste reduction policies regarding packaging, construction materials, and main products such as vehicles. Further growth in demand for new investment in recycling is also expected to arise from the increasing use of recycled plastic spreading to areas other than containers and packaging.

Growing presence of leading recycling companies

As mentioned in Section 2, Unilever has signed an agreement with Viridor after searching for a superior recycled plastic supplier. Leading recycling companies are also viewing the growth in demand for recycled plastic as a business opportunity, and looking to grow their business from it.

Veolia, a French company touting the slogan 'We Are Resourcers,' acquired a top Chinese PET recycling company in early 2019. Veolia is also active in Japan, where it has teamed with companies such as Toyota Tsusho, a Toyota Group trading subsidiary, to work on one of the country's largest plastic recycling projects. Tomra is a Norwegian collection and sorting equipment manufacturer that has been setting new profit records since 2017. In 2019, the company made an ambitious goal to raise the plastic packaging collection rate worldwide from the current 14% to 40% by 2030, by using its sorting technology. Both Veolia and Tomra are members of the Alliance to End Plastic Waste (AEPW), an international organization created to solve the problem of plastic waste. The two companies are looking to partner with other AEPW members such as chemical producers and leading FMCG companies.

The Chinese government has decided to employ measures such as stricter requirements for market entry, as a way to respond to the country's worsening plastic problem, attributing the situation partly to a lack of management over the disorganized array of small and medium-sized recyclers. These measures will limit the number of recycling companies to a few dozen nationwide. New investment has been picking up, particularly by state-owned and publicly listed environmental companies.

Expectations for the chemical industry

Producers of chemical materials will be key to the development and adoption of recyclable materials. Their efforts will be indispensable to enable greater use of recycled plastic created by closed-loop material recycling. Oil market analyst S&P Global Platts Analytics is forecasting global recycled plastic demand of 20 million metric tons for 2020, an increase of 2 million metric tons from 2019, and equivalent to 8% of the virgin plastic demand. While the growing use of recycled plastic is expected to have only a limited impact on sales of virgin plastic at present, the coming growth in demand for recyclable materials is being viewed as a gateway to new business opportunities.

Exxon Mobil has developed a new easily recyclable full PE material for use in laminating pouch packaging. The company is also working on a project in China to develop and demonstrate recyclable agricultural mulch film. In late 2019, BP announced a chemical recycling project for used PET bottles in collaboration with Unilever and other FMCG companies, packaging manufacturer Alpla, and waste processor Remondis. In late 2019, Thai PET producer IVL acquired Green Fiber International, a US company that recycles used PET bottles into food container materials. In its own country, IVL has been lobbying the government to permit the use of recycled plastic for food packaging. Producers of chemical materials are expected to play a central role in making the plastic resource recycling system. In both developed and developing countries, they are stepping up their efforts to integrate raw material production and recycling by acquiring recycling startups and building up partnerships with leading FMCG companies.

Requirements for eliminating the supply-demand gap

As interest in domestic recycling schemes has increased in countries around the world, the plastic resource recycling market has seen growing demand for recycled plastic and a rise in recycling investment. These developments have created a market gap between the supply and demand for recycled plastic. The demand for recycled plastic comes mostly from large companies. They are looking for suppliers suited to meeting a combination of needs in the areas of technology, processing methods, and supply capacity. In contrast, the suppliers are mostly small and medium-sized companies. They want to carefully consider the cost-effectiveness and risks of expanding their production capacity or augmenting their management systems. Therefore, both sides do not necessarily see eye to eye. A requirement for bridging the gap between them will be to lower the capital investment risk of the small and medium-sized supplier companies to some extent by bringing suppliers together to ensure a supply volume that can then be matched with stable large-scale demand. Leading recycling companies and chemical materials companies must create systems designed to accomplish this bridging function.

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