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What's up With Advanced Recycling?

A Hot Market With Increasing Activity in Asia

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Introduction

Interest in the advanced recycling industry continues to flourish. Despite growing criticism from various sources, we have once again seen plenty of activity during 2021. This activity includes: trials with new traceability solutions; announcements of new plants, partnerships, acquisitions, or equity stakes; and new players entering the industry, especially from Asia. One thing is for sure: this industry is still hot.

Despite Detractors, Advanced Recycling Is Not Slowing Down

In March, we published a [snapshot](#) of what the advanced (or chemical) recycling industry might look like in 2025. We argued that advanced recycling is a hot industry with a steadily and rapidly growing number of project announcements. In the report, we concluded that by 2025 there could be 140 advanced recycling plants worldwide operating a total capacity of 3m to 4m metric tons. In this article, we comment on the key developments since our last report with a view to determine in what direction this industry is going.

Critical Voices Are Growing

There are many opponents of advanced recycling. They argue, for example, that the technology is still unproven and too costly, that it has a worse-than-advertised environmental performance, that there is no traceability in the system, and that planned investments are delayed again and again. Some critics argue that this technology is a greenwashing tool with the sole purpose of serving as an expensive circumvention for waste-to-energy treatment (incineration of plastic waste). The latter argument is mainly vented in the US.

Partly in response to the traceability concerns, players are increasing their focus on making advanced recycling supply chains more transparent (*see Box 1*).

Box 1: Project TRACKCYCLE Blockchain Technology Application

In August of this year, Circular (a provider of digital traceability solutions), energy company TotalEnergies, and Recycling Technologies (advanced recycling player) announced a partnership aimed at developing a blockchain-enabled traceability solution for hard-to-recycle plastics (HTRP). Innovate UK (the UK government's innovation agency) is supporting the project called TRACKCYCLE.

The TRACKCYCLE solution will include all of the steps that the plastic waste would take from its origin to the end product leaving the advanced recycling plant. The system will "confirm compliance with predefined manufacturing parameters, such as elapsed time, mass balance calculations, responsible sourcing standards, or energy usage." Today's traceability solutions are cumbersome and vulnerable to mistakes due to the frequent handling required to organize the

paper trail. Using this new solution should lead to full transparency of the entire chain of the plastic waste being treated in an advanced recycling plant.

“The ultimate goal of the TRACKCYCLE project is to link plastic waste suppliers, plastic recyclers, polymer manufacturers, and consumer goods companies together into a closed-loop plastic waste recycling ecosystem.”

Source: Rabobank, www.cryptelicious.com, company information 2021

Many NGOs are critics of advanced recycling, but there are also more frequent media reports (for example Reuters) and investors that are critical of advanced recycling. Last year, Loop Industries felt the brunt of a condemning report written by Hindenburg Research. As a result, the image of Loop Industries was seriously dented, its share price fell substantially, and the company was forced to hire advisors to ward off the report’s allegations. This year, the same investor published an equally damning report about PureCycle Technologies, questioning the management’s integrity and accusing the company of inflating projections and having a doubtful technology. As a result, PureCycle Technologies’ share price dropped by almost 40% on the day of the report’s publication (Nasdaq, Yahoo Finance) and has since experienced significant fluctuations. The company is also facing a class action lawsuit by investors. PureCycle Technologies is accused of making “false and misleading statements” about financial and operational metrics. Nonetheless, the company continues to announce new business partnerships and plans, for example with SK Geo Centric¹ and Mitsui. The same is true for Loop Industries.

But Advanced Recycling Is Still a Hot Market

Despite the critical voices and many practical, financial, and economic hurdles that still must be dealt with to develop advanced recycling into a large-scale and commercially viable industry, it remains a highly attractive investment opportunity for key industry players and investors. During the past six months, plans to build a large number of different types of facilities were announced (see Table 1). Although any announcement should be viewed with a pinch of salt, the number of notices still provides a good indication of how this new industry will develop.

Table 1: Examples of recent advanced recycling project announcements, 2021

<i>Technology company</i>	<i>Country</i>	<i>Project description</i>
Brightmark	US	Plans to invest USD 680m in a plastic-to-fuel plant to treat all plastic waste (types 1-7).
PureCycle Technologies	US	Plans to invest USD 440m to build its first new cluster location in the US. The company also announced ambitions to build 50 additional polypropylene (PP) recycling facilities across the world over the next 15 years.
Loop Industries	Canada	Loop Industries made a remarkable comeback following the controversy last year. The company announced plans to build one more PET waste plant in Canada, supported by an equity injection from SK Geo Centric ¹ (see Table 3).

Source: Company announcements and interviews, Rabobank 2021

¹ SK Global Chemical changed its name to SK Geo Centric, effective September 1, 2021. Most of the partnerships included in this report were made under the previous name SK Global Chemical.

Oil companies are also highly active at the moment. Shell just announced their partnership with, and acquisition of a 21.5% equity share in, technology provider BlueAlp. The joint venture (JV) will explore opportunities to build two conversion units in the Netherlands and potentially two in Singapore. BP just announced a memorandum of understanding with technology provider Brightmark to jointly evaluate opportunities to develop plants in Germany, the Netherlands, and Belgium.

Next to concrete plans to invest in conversion capacity, a plethora of new partnerships with different scopes have recently formed (*see Table 2*).

Table 2: Examples of new partnerships in advanced recycling

<i>Scope of partnership</i>	<i>Example</i>
Testing or rolling out new technology	INEOS Styrolution and its competitor Trinseo have selected Recycling Technologies as their technology partner to build their advanced recycling polystyrene (PS) plants in Wingles, France and Tessengerlo, Belgium, respectively. Prior to building the commercial-scale plants, the three parties will build a pilot plant in the UK in 2022. Subsequently, the three parties will jointly develop the technology further.
Securing feedstock	Cyclyx International is a new, consortium-based feedstock management company. It has been set up by Agilyx in a partnership with ExxonMobil, Ineos Styrolution, LyondellBasell, Chevron Phillips Chemical, North American Plastics, Braskem, and AmSty. By 2025, Cyclyx International plans to develop systems with a capacity of 300,000 metric tons of plastic waste per year, growing to 3m metric tons of plastic waste per year by 2030.
Investments in new technology and infrastructure solutions	There are many investments in innovations focused on solving problems with plastic (packaging) waste in addition to advanced recycling solutions. One example is the Closed Loop Circular Plastics Fund that was set up in May by the Dow Chemical Company, LyondellBasell, and NOVA Chemicals. The fund "will invest in technologies, companies and infrastructure projects that enhance the recovery and recycling of target materials" (PP and PE) in the US and Canada.

Source: Company announcements and interviews, Rabobank 2021

Asia Is the New Playground

During 2021, Asian players, in particular from South Korea and Japan, have become exceedingly active in the advanced recycling industry. Companies like Mitsui (Japan), SK Geo Centric, and Kumho Petrochemical (both South Korea) are forming partnerships with technology companies to jointly explore opportunities for setting up advanced recycling plants, primarily in their home region.

SK Geo Centric is the most ambitious company among this group, having concluded a broad range of investments and partnerships during 2021 (*see Table 3*). These are driven by the company's recently announced ambition to transform itself into a "green company" and "become the world's largest urban oil field company using plastic waste." This would require the company to recycle 100% of its production by 2027, equivalent to about 2.5m metric tons of plastic waste.

Table 3: SK Geo Centric’s recent advanced recycling partnerships and plans

<i>Partner</i>	<i>Area</i>	<i>Description</i>
Loop Industries	Canada	Acquisition of a 10% share of Loop Industries for USD 56m, and creation of a JV structure to construct plants in Asia (PET)
Loop Industries	South Korea	JV partner to build one plant in South Korea of 83 kiloton per year (ktpy) capacity (PET)
Loop Industries	Asia	JV partner to consider building four plants across Asia with a combined capacity exceeding 300 ktpy (PET)
Brightmark	South Korea	JV partner to consider building one plant in South Korea (mixed plastics)
PureCycle Technologies	South Korea	JV partner to build one plant in South Korea of 55 ktpy capacity (PP)

Source: company announcements and interviews, Rabobank 2021

And Packaging Converters Are Increasingly Active

Plastic feedstock suppliers and packaging converters are the most active parties across the value chain in speeding up the rollout of advanced recycling. In recent months, the converter segment has become much more active in many different ways (see Table 4).

Table 4: Selected advanced recycling partnerships that include packaging converters, 2021

<i>Partnership Type</i>	<i>Description</i>
Fund investments to accelerate innovation	Following its equity stake in Plastics Energy Global in 2020, Sealed Air recently announced its USD 5m investment in the newly-founded Closed Loop Circular Plastics Fund. These investments are part of Sealed Air’s strategy to accelerate the transition toward a circular economy for packaging, especially flexible plastics.
Securing (future) feedstock/offtake agreement	Berry Global has signed two supply agreements to secure chemically-recycled PP (rPP) in order to reach its target of incorporating 10% recycled content across its fast-moving consumer-goods packaging. The target is part of Berry Global’s Impact 2025 sustainability strategy. The first agreement with Repsol at the end of 2020 was followed by an agreement with Borealis in May this year to have “access to first volumes” of rPP.
Testing food packaging made from chemically recycled plastic feedstock	Swiss dairy group Emmi is partnering with Greiner Packaging and Borealis to package its ready-to-drink iced coffee brand Emmi CAFFÈ LATTE in plastic cups made partly of chemically-recycled rPP. This initiative is part of Emmi’s strategy of using packaging that contains at least 30% recycled content by 2027.
Jointly developing and testing technology	Scholle IPN and OBBOTEC announced a partnership to engineer and test new chemical recycling methods with a focus on flexible packaging like pouches and bag-in-box. The efforts will focus on OBBOTEC’s two advanced recycling technology solutions, SPEX and Hydrocat. SPEX is a plastic-to-plastic solution for PE and PP materials, including mixed plastics, multilayer films, laminates, and foils. Hydrocat is a plastic-to-fuel technology for turning a mix of biological and plastic waste into marine gas oil and naphtha crude oil, for example.

Source: Company announcements and interviews, Rabobank 2021

We expect the involvement of converters to continue to grow, as demand for packaging products with increasingly higher recycled content becomes the norm. By teaming up with partners across the advanced recycling chain, converters can gain valuable experience with, and strategic access to, chemically-recycled feedstock in order to comply with ever stringent demands from their offtakers and from regulations to supply packaging with high recycled-material content. This is similar to the trend that we have seen for a number of years in the [mechanical recycling segment](#).

Outlook: The Honeymoon Will Soon Be Over

The advanced recycling industry is still on a rapid growth path. There is absolutely no slowdown in interest in this industry. On the contrary, in the past six months, intentions to build more than 70 additional plants have been announced, if we include PureCycle Technologies' ambition to build 50 additional polypropylene-recycling facilities across the world. A large share of these announced plants are planned in Asia, in particular in South Korea. New players have entered the stage. These range from Asian feedstock companies with very firm sustainability ambitions to waste management companies and packaging converters. We still believe that collaborations are crucial to succeed in this new industry, and there have been countless announcements of such initiatives. As mentioned, these center on developing technology, testing products, building assets, or building platforms to secure feedstock. In our opinion, advanced recycling remains highly attractive for leading companies in the plastic value chain.

It's not all rosy, though. Since the end of 2020, a growing number of voices criticize the industry. The most noticeable example of the potential consequences of such criticism is the situation around the company PureCycle Technologies. On the one hand, the company has successfully attracted a strong shareholder and has become listed, and it continues to announce high-profile partnerships. On the other hand, the company's share price is suffering, and it's facing a class action lawsuit. The outcome of this process will be very informative for the whole industry.

Market players need to prepare to balance a growing level of criticism, including from the investor community. A reliable image will be crucial to continue to attract banks and investors that can provide the billions needed to finance and scale-up advanced recycling on its way to becoming a mature and commercially-viable industry.

Imprint

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