INDORAMA VENTURES

Indorama Ventures: A circular economy narrative

Plastics are generally lightweight, hygienic, durable, inexpensive and often recyclable. Plastic packaging is essential for preventing food waste, a global warming accelerator, by keeping food fresh and sanitary. Since approximately one third of total global waste is organic, innovation in plastic packaging is a key area of interest. As observed during the rapid spread of the Covid-19 pandemic, plastics play an important role in food packaging, beverage personalization, and pharmaceutical delivery. During the world's emergence from this crisis, it is imperative that we collectively make a stronger commitment to improving plastics waste management.

While waste affects everyone, we must look at the larger context to understand:

"What would happen if we had to live without plastics entirely?"

Let us start with an historical example. In 1959, Swedish engineer Sten Gustaf Thulin decided to save trees by designing a bag that would be even more durable than a paper bag. Thus, the plastic bag was born. Although the plastic bag was initially made to stop forests from being eradicated, similar early uses of plastic were to replace natural ivory in billiard balls, combs and hairbrushes, thereby saving elephants.

This has largely been because plastics are inexpensive and easy to produce. They are now embedded in our lives, not just in the bottles and cups we drink from or in the bags we get from grocery stores, but in our clothes, cars, homes and the packaging of goods distributed all over the world. This should be enough to answer our first question: we would find it very difficult to eliminate plastics entirely without massive repercussions on the way we live.

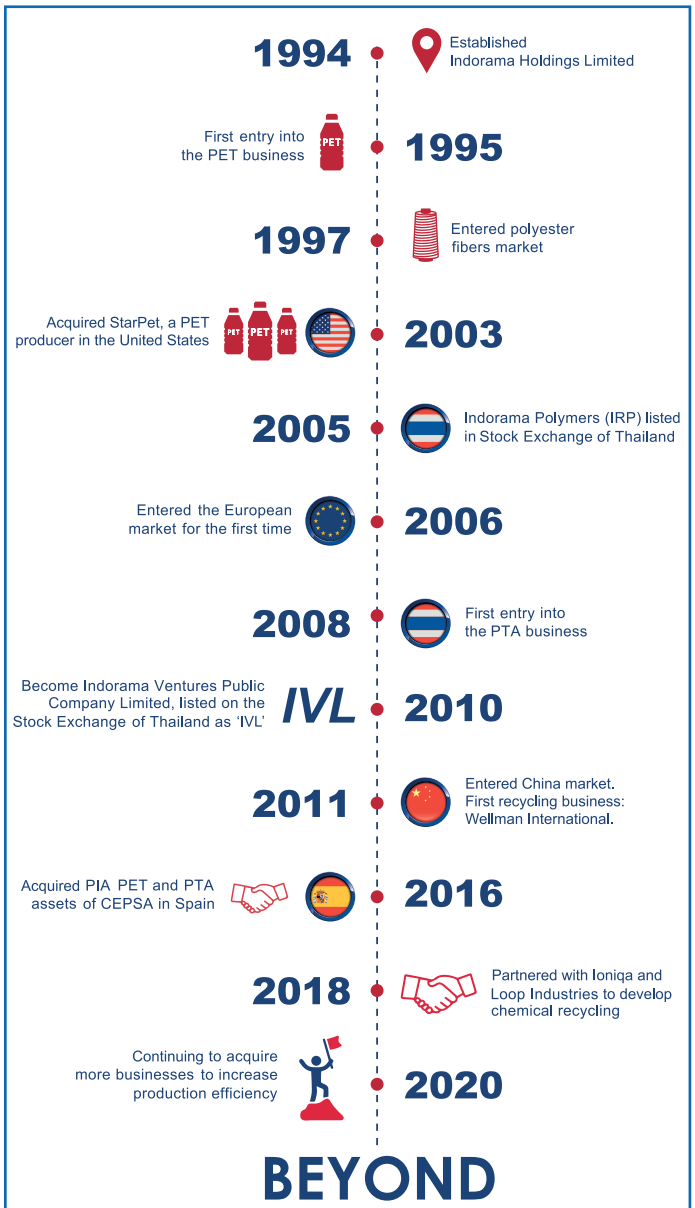
Indorama Ventures believes in turning risk into opportunity and recycled PET (rPET) has become a new engine for growth. Despite challenges, there is tremendous potential for rPET with its lower carbon footprint than other packaging materials.

The growth of a petrochemicals powerhouse

Indorama Ventures (IVL) has a positive effect on the world through its recycling efforts. Listed and headquartered in Thailand, the company operates a thriving global chemical business with the vision of becoming a world-class chemical company making great products for society. Established in 1990, IVL is effectively the world's largest producer of Polyethylene Terephthalate (PET) which is used for food and beverage packaging. The company built Thailand's first PET facility in 1995 and expanded to the USA in 2003 before going global. From its early days as a PET producer in 1995, backward integration into key feedstocks and diversifying into polyester fibers have led to tremendous growth.

As a leading petrochemical player, growth remains at the center of the company's business strategy as it seeks to leverage its strength in acquiring and integrating assets, making it more valuable to customers seeking a strong partnership. With a consolidated revenue of US $11.4 billion in 2019, the company remains stable and sustainable.

In the preceding decade, the company had a localized business focus, increasing its operations footprint and expanding its business into regions where there is potential for growth, especially in emerging markets. This proximity to customers promotes supplier-customer intimacy and business continuity while minimizing any tariff actions on imports, thus permitting the company to serve customers from convenient local locations. Today, the company's subsidiaries manufacture goods in 33 countries on six continents and serve global brand



Since its first PET facility in Thailand in 1995, Indorama Ventures has invested in businesses globally to become one of the largest petrochemical groups in the world.

names around the world with a market in more than 100 countries.

Embracing the future through integration and diversification

Over time, the company has become a vertically-integrated and diverse business while continuing to stay close to its key segments. IVL continues to consolidate and gain leadership in existing businesses while diversifying its portfolio over adjacent businesses in a disciplined manner. While the majority of PET is still used in water and carbonated soft drink bottles, it has growing applications in films and trays. IVL produces a wide range of PET resins to serve a variety of market applications – today one in five PET bottles worldwide is made from IVL resins.

The personal hygiene segment also provides sustainable growth opportunities in a stable business model driven principally by population growth, increasing life expectancy, and consumer preferences, all leading to greater demand. IVL has been able to maintain its lead in this segment by focusing on improving products, such as bi-component "air-through" solutions and introducing fibers that are free of heavy metal compounds.

IVL has secured an important position in premium baby care products, providing comfort and improved fluid management solutions, with 50% of premium diapers now containing IVL fibers. Developing markets will continue to provide growth in baby care and feminine care segments, driven primarily by rising income levels, changing demographics, and higher per capita consumption.

In the home and apparel segment, Indorama Ventures focuses on premium recycled and active-wear applications that require advanced manufacturing capabilities and allow for a more sustainable business. Growing preference amongst the younger generation for casual wear has formed the new apparel subcategory of "Athleisure." Sports-inspired apparel with convergence of performance and fashion has garnered a significant share of the apparel business, constituting 30% of this segment.

With 90% of IVL's home and apparel segment manufactured in Asia, the company has a competitive edge and leadership in an oversupplied market. Over 40% of IVL's home and apparel business revenue is derived from high value-added products. This is achieved through continuous innovation resulting in a vitality index of 23%.

"The world needs plastics and we will ensure that we play our part in ensuring the world's climate is protected while serving consumers' needs.

As the pandemic spread in 2020, the importance of plastic in food packaging, food delivery and hygienic beverage packaging has become more important to our lives. Moreover, its usage in the medical sphere, such as for gowns and Personal Protective Equipment (PPE) became critical. This was a reaffirmation that plastic is an important material to mankind and what matters as we emerge from this crisis is an even stronger commitment by everyone to plastic waste management.

Going forward we reaffirm our commitment to plastic bottle recollection (with a budget of US$1.5 Billion 2019-2025); also to chemical and mechanical recycling of plastics aided with societal education and to conducting our business as one of the leading global PET producers with sustainability at the core of our values."

Dr. Deepak Parikh, Chief Strategy Officer.

"Recycling is at the heart of the sustainable economy of the future and we at IVL believe that it is a critical innovation for growth.

The linear economy of the past was about "make, use, dispose". The circular economy of the future is about "make, use, collect AND recycle". We are building the recycling infrastructure the world needs to make that future a reality, closing the loop and delivering a truly circular economy for PET packaging."

Mr. Yashovardhan Lohia - Executive Director and Chief Sustainability Officer.

The company has been focusing on the automotive fiber industry in response to rising demand driven by requirements for light weighting, comfort, safety, and noise reduction. Typically, while demand for automobiles is synchronized with economic growth, demand for tires is more stable. Over 80% of consumption is for replacement tires, several times more than tires for new vehicles. The airbag segment is also on the rise as the number of airbags per automobile has increased to 12 to 14 airbags in high-end vehicles. There is also growing demand for acoustic-suppressant fibers in modern electric cars to reduce ambient noise. These trends are expanding total consumption of automotive fibers, which is currently 30 kg per car, to around 35 kg within two to three years.

Strategically, IVL grew its high-value portfolio in 2018 with the acquisition of Kordarna, a well-known tire cord producer in Europe. In the airbag segment, IVL is integrating downstream through the acquisition of a leading airbag fabric producer in Europe and Mexico, UTT and expanded the capacity in China of Performance Fibers, making IVL the world's second largest producer of tire cord fabrics, with a global market share of 21%.

Innovation remains at the core of the company, evident in its continuous generation of new products and use of technologies from acquired subsidiaries. The company has its own research and development platform with 17 R&D labs around the world housing over 533 patents. The company is firmly committed to providing innovative solutions to its customers, in combination with many high value-added businesses that require R&D, resulting in a customer-centric approach to innovation.

As a high-growth chemical company with a proven track record, IVL's strategy and operations are shaped by megatrends including collaborative ecosystems, waste as an asset, innovating to zero, renewable energy, smart automation, artificial intelligence and contextual marketing. These trends, together with changing societal needs for clean air, comfort and safety are forcing the industry to push the innovation agenda and commercialize new solutions for consequent consumer demand and experience.

Over 25% of IVL's revenues are protected by patents or proprietary rights. IVL is running

over 100 collaborative programs that have helped the company deepen its relationship with customers and improved our joint speed-to-market.

Recycling Journey

Indorama Ventures understands that there is pressure on plastics in response to the demands for a sustainable environment for future generations. Amidst the effort by several governments to ban "single-use" plastic, the answer to whether or not there should be an indiscriminate moratorium is far from straightforward.

Several countries have proposed banning single-use plastics, but coincidentally, not PET bottles. Unlike other plastics, PET is 100% recyclable and fully circular: it is the only type of plastic that can be recycled for food-grade use. This creates an opportunity for governments and society to promote PET recycling.

The European Union has already drafted regulations to commit the industry to increase recycling rates, stating that from 2025, beverage bottles manufactured from PET should contain at least 25% recycled plastic, and by 2030 must contain at least 30%.

Indorama Ventures was a pioneer in incorporating recycled PET flakes into the virgin polymerization process. The company currently has PET resin blends with up to 30% recycled content and up to 50% will be available by 2030, 20% higher than the EU target.

While alternatives to plastic do exist, most do not come without an environmental charge of their own. For instance, the production of paper bags consumes four times the energy used to produce a plastic bag and upon degrading, generates 70% more air pollutants. Glass and aluminum, on the other hand, have an even greater impact on the environment due to the additional gasoline used in their logistics, as they are heavier than plastic. Furthermore, aluminum cans are often lined with plastic containing BPA, which is believed to be harmful to health.

Focus on Circularity through Recycling

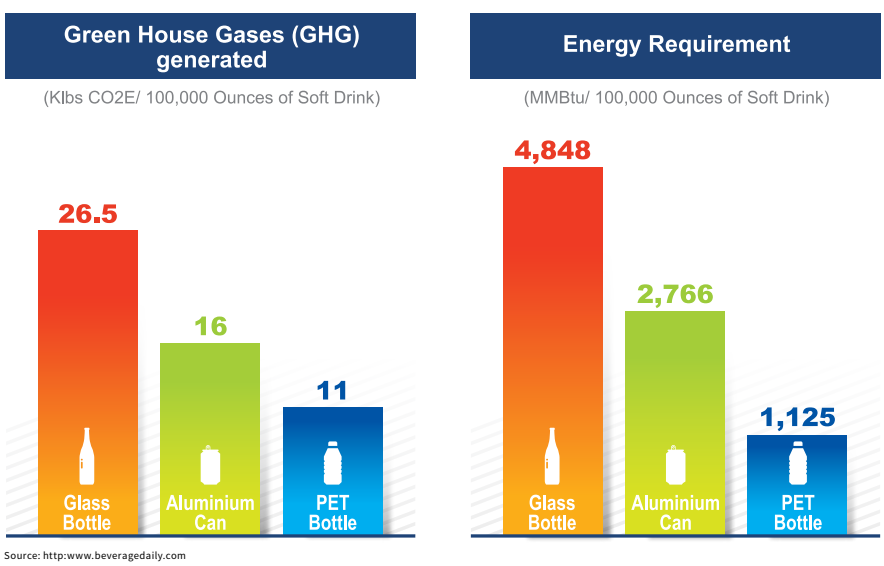
Indorama Ventures committed itself to the recycling business in 2011 with the acquisition of Wellman International, Europe's largest recycler of PET bottles and leading producer of polyester staple fiber and rPET. That acquisition propelled IVL much closer to its objectives of long-term sustainability through the use of proven recycling technologies and their adaptation to assets globally with a reduced learning curve.

Wellman International has three production facilities in Europe with over 187,000 tonnes of output produced each year: a polyester fiber plant based in Mullagh in the Republic of Ireland and recycling plants at Spijk in the Netherlands and Verdun in France. With a broad European bottle sourcing network facilitating maximum supply chain efficiencies, both flake production facilities in Spijk and in Verdun serve the fiber production plant in Ireland, which produces a diverse and extensive range of polyester staple fiber products from rPET flakes for well-known brands. In 2018, IVL acquired another French recycler, since renamed Wellman Neufchateau Recyclage, consisting of three production lines: rPET, recycled HDPE (rHDPE), and food-grade pellets, with a combined capacity of 52,000 tonnes per annum.

Being headquartered in Thailand, having a recycling plant in the home country made sense, and IVL established its first recycling plant in Thailand using European technology in 2014. Conveniently, the site is directly adjacent to its polyester fibers plant, Indorama Polyester Industries, in Nakhon Pathom province. The site operates a post-consumer PET recycling facility to produce fiber as well as bottle-grade raw material and is also a model recycling facility that hosts regular visitors (prior to the Covid-19 pandemic) including business partners, the local media and groups interested in the recycling process. Here, the company can ensure consistently high standards of manufacturing and top quality recycled products to serve end markets for packaging, fabrics, filling, nonwoven textiles and industrial products. Food grade rPET produced in this plant is exported to produce rPET packaging.

In 2011, IVL acquired a PET polymers and resin manufacturing facility in Querétaro, Mexico, and one at Spartanburg, South Carolina, USA, that recycle PET. Indorama Ventures Polymers Mexico allows IVL to build upon its expanding platform and deliver on its strategy of entering into new higher growth regions. In 2014, IVL acquired another recycling facility in Mexico, Indorama Ventures EcoMex that was one of Mexico's foremost PET recyclers and was complete with a flake processing facility.

In 2019, IVL acquired two PET recycling facilities in the USA. Indorama Ventures Sustainable Solutions (IVSS) with a combined capacity of 40,000 tonnes per annum, operates in California to secure the company's position as a key PET recycler on the West Coast, furnishing brand name customers with high-quality food grade recycled PET flakes. With its particular strength in the drinking water and soft drinks industry, IVSS and its management are ensuring the operation of an expanding circular economy for bottles in the area. IVL's other U.S. recycling site is in Alabama. IVSS there operates two production lines of rPET flake and rPET food-grade pellets achieving a combined production capacity of



Source: http:www.beveragedaily.com

PET containers will emit lower greenhouse gas emissions and use less energy in the production process that competing packaging materials.

over 40,000 tonnes per annum supplying products used in recycled bottles, sheets, fiber, and strapping.

In that same year, IVL made a commitment to the Ellen MacArthur Foundation as part of the New Plastics Economy to help create a world where plastic never becomes waste. The company is now accelerating its efforts towards a very ambitious goal to increase recycled content volumes to at least 750,000 tonnes, while also allocating US$ 1.5 billion towards achieving this target by 2025.

In line with its recycling goal, IVL acquired a plant in Brazil in early 2020 and announced an agreement to acquire IMP Polowat in Poland. The acquisition consists of two assets, strategically located in Bielsko-Biala and Leczyca, which are close to the major population centers of Krakow and Warsaw. The production sites have a combined capacity of 23,000 tonnes of recycled PET (rPET) flakes and 4,000 tonnes of rPET pellets.

With the shared goal of making a more sustainable future today, IVL and Coca-Cola Beverages Philippines, Inc., the local bottling unit of Coca-Cola, have signed a joint-venture agreement to establish PETValue, the largest bottle-to-bottle recycling facility in the Philippines. With cutting-edge technologies that employ the safest and most advanced recycling processes for PET bottles, it is expected to process 30,000 tonnes of bottles per year, or almost two billion plastic bottles, with an output of 16,000 tonnes of rPET resin per year.

New Technologies for the New Economy

The new economy requires new technologies and IVL has been investing in innovations that can realize its aspiration to make great products for society. It already has a joint venture with NASDAQ-listed Loop Industries to commercialize chemical recycling for sustainable PET packaging resins and polyester fibers. It also has a partnership with Netherlands-based Ioniqa Technologies, together with Unilever Europe, to unlock the potential of chemical recycling. This will pioneer a new approach to processing PET that would normally be rejected as being low-quality waste, and renewing it as feedstock for virgin PET.

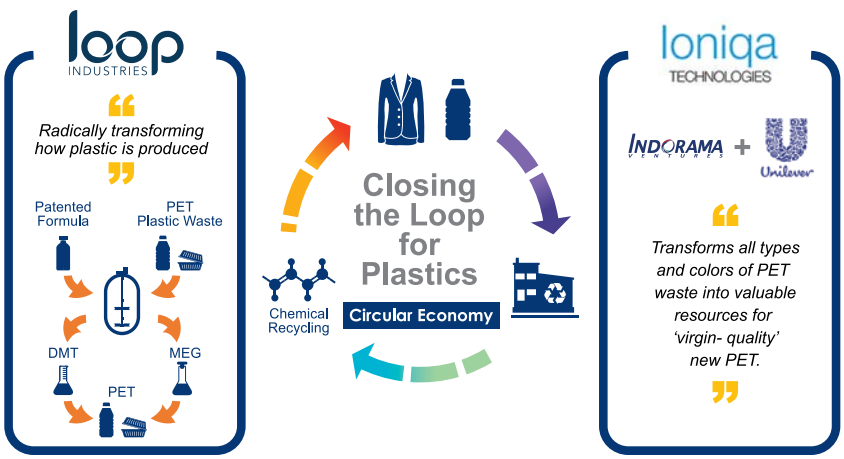
Besides working closely with its new technology partners, IVL is confident that it can achieve a circular economy for sustainable plastics and has joined with global efforts underway to achieve the United Nations' Sustainable Development Goals (SDGs). As the world's largest producer of PET, Indorama Ventures plays a key role in promoting the industry's support for a circular economy. Recycling PET packaging is one of the most responsible solutions for the preservation of resources and the reduction of PET in landfills. Indorama Ventures has been spearheading the recycling of post-consumer PET packaging, having processed over 50 billion post-consumer PET bottles from 2011 to March 2019, with a target of recycling 50 billion bottles per annum.

Competitive Differentiation for Recycling Leadership

The tremendous scale of IVL's virgin PET business is a huge advantage in the recycling business, providing both an extensive local footprint and distribution. With proprietary knowledge on mechanical recycling, the company is expanding with partners to develop and test next-generation chemical recycling technologies.

The company has built a relationship of trust with the world's largest beverage producers to enable it to serve both PET and rPET needs. IVL is focused on proactively building the circular ecosystem for PET across technology owners, packaging players, converters, companies, and waste management organizations. The company is also developing educational modules aiming to help society understand the recyclability of PET and how waste management can help save our environment.

By 2020, Indorama Ventures achieved a record 50 billion bottles recycled since it had commenced recycling in 2011. The company then went on to set a new target of recycling 50 billion bottles per year starting from 2025.



By partnering in projects to develop a highly efficient chemical recycling process, Indorama Ventures will close the loop of the make use recycle circular economy.

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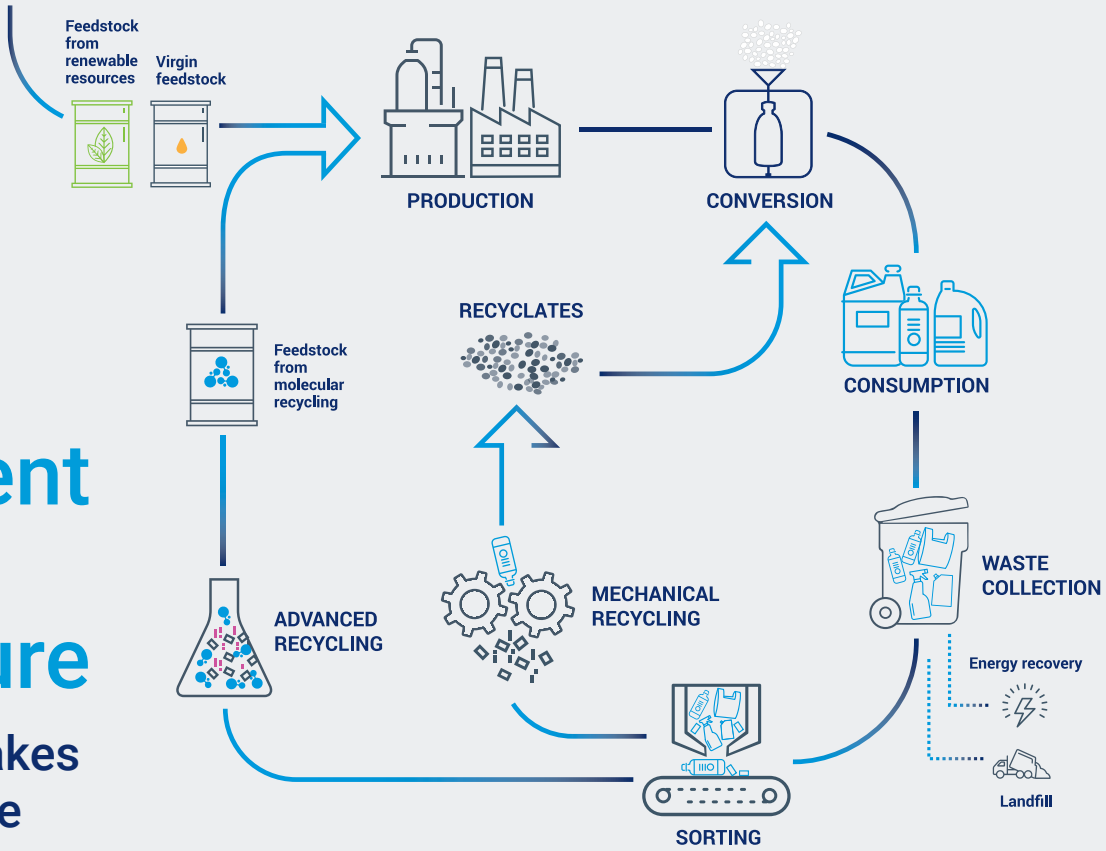
Advancing Possible



Our moment to build a better future

LyondellBasell makes circularity possible

Plastics make modern society possible and often have a lower environmental footprint than the alternatives. Our goal is to keep these valuable resources in use for as long as possible to maximize their value, and to eliminate plastic pollution.

This goal that can only be achieved with a variety of solutions and innovative collaborations. That is why, today, we are taking action to address some of the world's most pressing challenges. We are helping to eliminate plastic waste, reducing our carbon footprint and investing in the communities where we live and operate, to help them thrive.

We are developing new business models and technologies to **advance the circular economy**, writing the next chapter of innovation through our sustainable solutions.

LyondellBasell continues to invest in mechanical recycling, innovate in molecular recycling and create plastics from renewable feedstocks. With these combined efforts, more sustainable materials are being used and plastic waste is being utilized, contributing to a circular economy for plastics.

In 2017, LyondellBasell took the first step in leading the way within our industry with the mechanical recycling joint venture, Quality Circular Polymers (QCP), together with waste management company SUEZ. Today, LyondellBasell is exploring growth opportunities for QCP, to expand the market for mechanically recycled polymer materials.

To further advance our sustainability objectives, LyondellBasell recently announced the successful start-up of our *MoReTec* molecular recycling facility at our Ferrara, Italy, site. This additional step in advanced recycling will enable us to recycle multilayer and hybrid plastic materials, which can't be easily recovered by mechanical recycling, and return larger volumes of plastic waste back into the value chain. Our *MoReTec* technology will also enable us to produce new materials for applications that must meet strict regulatory requirements such as food packaging and healthcare items.

LyondellBasell is committed to continue production of high quality recycled plastics, but also to support efforts to collect, sort, recycle, and reuse plastic waste. By investing in projects like the Polypropylene Recycling Coalition, the Pacific Northwest Secondary Sorting Project, and the NEMO Recycled PE Project in the U.S., LyondellBasell is demonstrating our goal to end plastic waste through our own innovative solutions and the initiatives we support, that will help advance a circular economy for plastics.

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