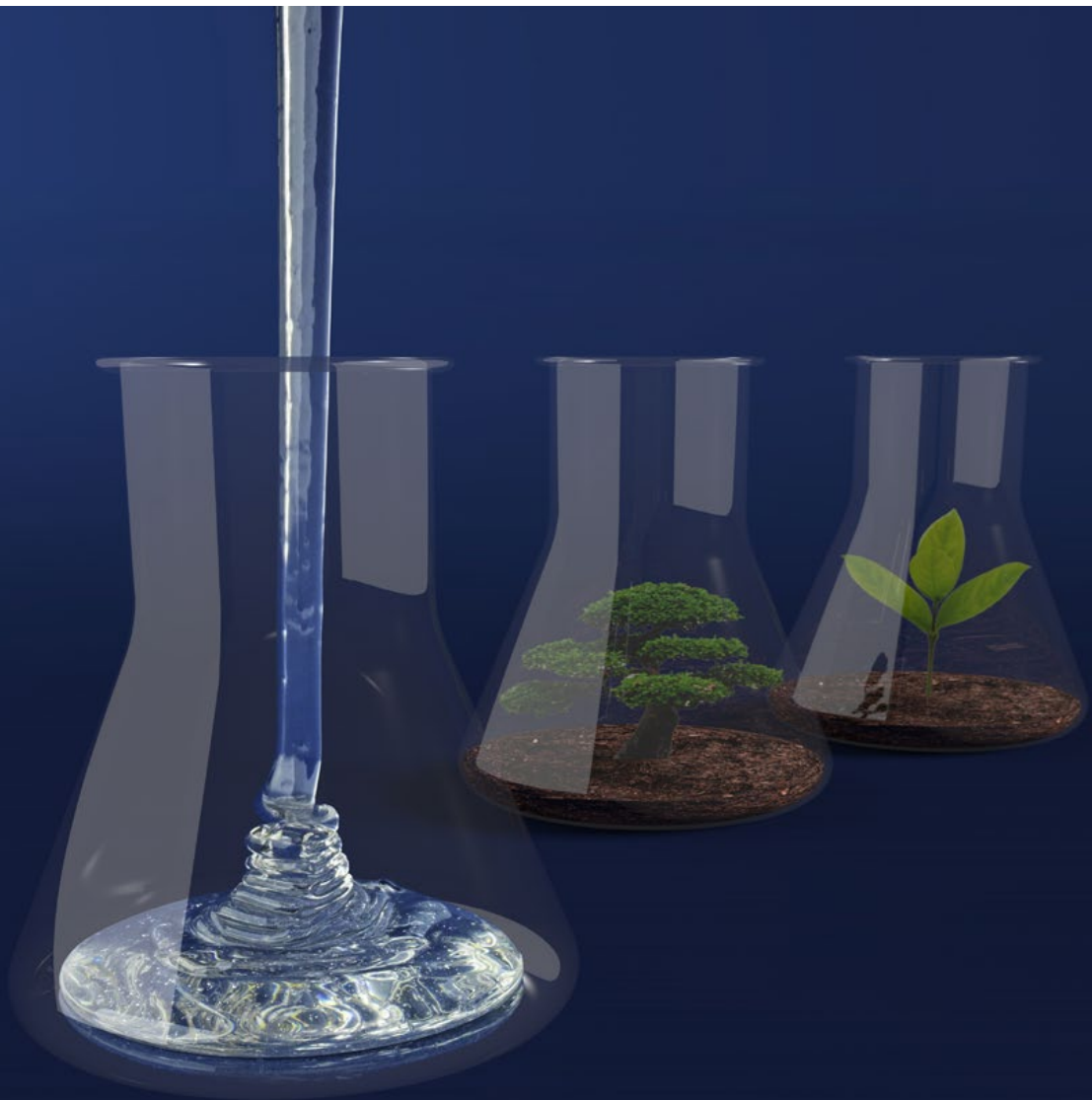


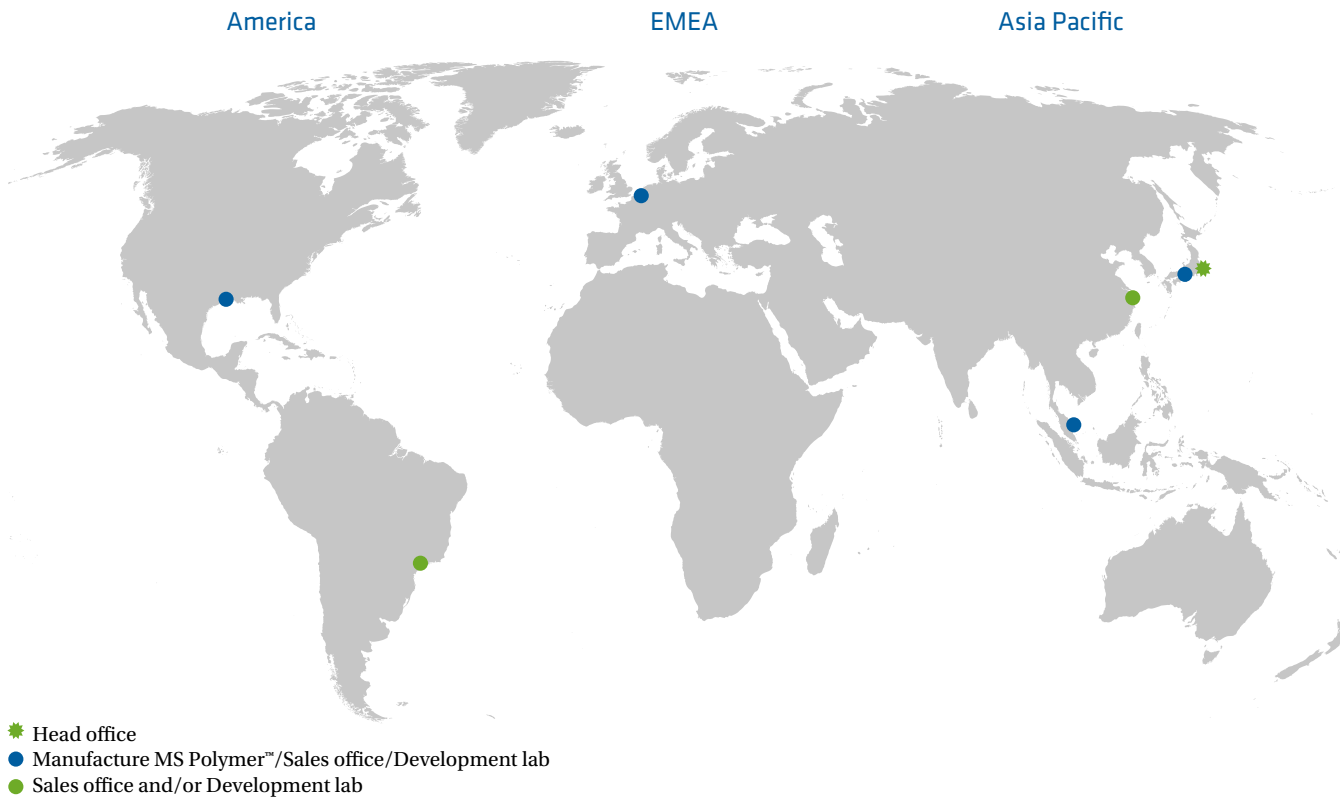
Kaneka MS Polymer™

A sustainable technology



Creating a dream

With people and technology growing together into creative fusion, we will break fresh ground for the future and tie into exploring new values. We are also committed to challenging the environmental issues of our planet and contributing to upgrading the quality of life.



Kaneka

Our science makes wishes come true.

At Kaneka, we turn dreams into science. Innovative developments enable us to create a variety of unique products and technologies that support people's lives. We look at the future with materials for a wide range of fields, including functional plastics, electronics and life science. Our efforts contribute to protecting the global environment and enriching people's lives. The cogeneration unit in our production facilities, but also projects on biobased materials are proof of our efforts to minimize our impact on the environment. We are a company that realizes dreams through science.

We are Kaneka!

Kaneka MS Polymer™

Your Premium Polymer of Choice!

Kaneka MS Polymer™ is widely recognized as the premium choice of base resin for producing sealants, adhesives and coatings. Its unique properties enable Kaneka MS Polymer™ based products to deliver outstanding performance for a broad variety of markets, such as construction, industry, transportation, flooring, waterproofing, DIY and many others. Kaneka's continuous pursuit of innovation is reflected in our broad product portfolio, covering these various applications. Our high-strength technology is Kaneka's latest proof of innovation, pushing the boundaries of technology even further.

Kaneka around the world

Kaneka operates globally with four production plants for Kaneka MS Polymer™, strategically located in Belgium, Japan, the USA, and Malaysia.

At the beginning of 2019, our production facilities in Belgium significantly expanded, resulting in a 50% capacity increase. This investment was essential to ensure our suppliability due to the growing demand for Kaneka MS Polymer™. As a forward-thinking company, we are executing our next expansion, which will be operational in 2024. Thanks to our global presence and focus on operational excellence, we can reduce the lead time for delivery to a minimum.

Silane terminated polyethers (STPEs) were already introduced on the market about 40 years ago, by Kaneka. As a pioneer, Kaneka launched the first commercial product, Kaneka MS Polymer™, in 1978 in Japan. While the early products were mainly used in low elastic modulus construction sealants, Kaneka has, as an innovator, developed its portfolio over the years into many other markets and applications. Since the introduction of the first polymers, new STPEs with improved or new properties have continuously been added to the portfolio.

What are the milestones of Kaneka MS Polymer™?

In 1978, the first Kaneka MS Polymer™ grades were launched for application in low and high elastic modulus sealants. Eight years later, in 1986, the blending of Kaneka MS Polymer™ with random silylated polyacrylates or epoxies was introduced. The latter opened up new markets, as the acryl modified pre-polymers showed enhanced UV-stability, weather resistance and improved adhesive properties, while the epoxy blends combined the elasticity of STPE with the typical high strength and water resistance of epoxies. In 1997 and 2003, silane terminated polymers with an alternative backbone, polyisobutylene and polyacrylate, were developed and launched onto the market. These polymers enabled better chemical and thermal resistance, gas tightness, etcetera.

One year later, in 2004, the more reactive trimethoxysilyl-(TMS) Kaneka MS Polymer™ technology was introduced, enabling faster curing products to be developed. In 2009, the blending of these Kaneka MS Polymer™ and random silylated polyacrylates was the logical sequel for this faster curing technology. In 2012, based on many years of experience and Kaneka's pursuit of innovation, the high-strength Kaneka MS Polymer™ technology was launched.

High Strength Kaneka MS Polymer™

The Kaneka high-strength technology is based on the modification of the polyether backbone and is our latest unique development. Both acryl modified and pure polyether systems are available. This novel high-strength technology will lead to an increased number of branching points on the backbone, which results in more entanglements and a denser polymer matrix after curing. The increased number of siloxane bonds will provide the higher strength. In Figure 1, a schematic overview of Kaneka's various sealant and adhesive polymer technologies is given to demonstrate the potential and target of the new Kaneka high-strength polymers. New opportunities are now at your fingertips!

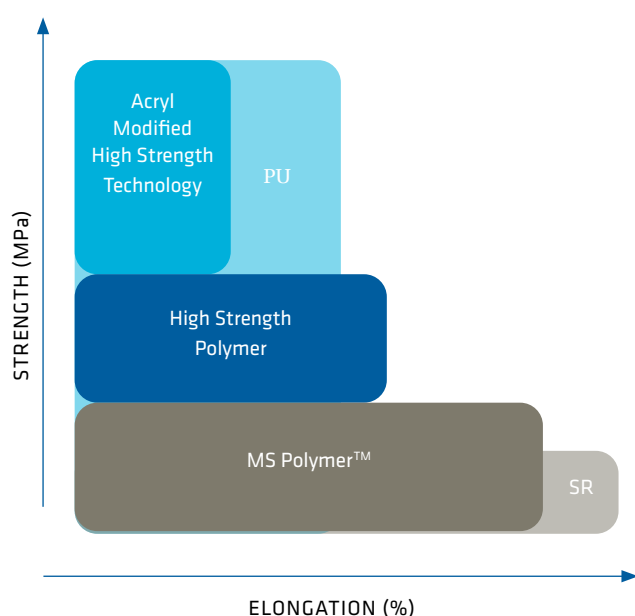


Figure 1 Technology mapping



Kaneka MS Polymer™

Your dreams, our technology.

Being the dreamology company, Kaneka strives to provide state-of-the-art technology, but in a different, creative way. Our flexible polymer technology platform enables us to offer over 20 different polymer grades (DMS types and TMS types are available), all designed to overcome specific existing technological hurdles.

Examples are our very low viscosity grades, which are unique in the market and can be used to develop plasticizer-free products. Likewise, our acryl modified grades differentiate Kaneka polymers from others.

Kaneka does not just provide polymers or state-of-the-art polymer technology. The experience we gained throughout the years is offered as a rock-solid technical service to our customers.

An idea for a new product or application? Kaneka will go all the way to make it happen!

Why MS Polymer™?

- 1** Kaneka MS Polymer™ shows a superior primerless adhesion to various substrates.
- 2** The long-term elastic behavior and recovery from deformation make these polymers the premium choice for applications with vibrations, thermal expansion or fluctuating tension and compression forces.
- 3** The resistance to natural weathering, such as rain and UV, make them ideal for outdoor sealant materials, even in harsh environments.
- 4** Cured sealants can be painted with most paint technologies.
- 5** MS Polymer™ respects the environment and people's health by being solvent- and isocyanate-free, minimizing the ecological footprint and health impact of the product.



Unique technology

Kaneka MS Polymer™ combines the positive properties of both silicones and polyurethanes. It differentiates itself from these technologies as it consists of a functionalized polyether backbone with silane terminal groups, without the need for harmful isocyanates.

It is a moisture curing system, however the curing mechanism will only initiate if both the catalyst and water are present. Blending MS Polymer™ with only one of these two ingredients will render an unreactive mixture. This ensures a very robust and stable raw material over a long period of time.

Once MS Polymer™ is added to a formulation, moisture should be managed properly to avoid curing in the cartridge, bucket or other packaging material.

Compared to silicone

Although the name MS Polymer™ is derived from Modified Silicone, the backbone itself is completely different. After curing the MS Polymer™ backbone will only consist of 2 silicone bonds separated by a polyether whereas the silicone backbone consists of multiple siloxane bonds.

Silicones can be used for sealing jobs, but the adhesion to substrates is poor. MS Polymer™ based products can do both, sealing and bonding.

The UV stability of silicones is better than MS Polymer™, but with the introduction of Kaneka's acryl modified grades, this has been improved remarkably.

The paintability of silicones is very poor, but with products based on Kaneka MS Polymer™ this is no problem.

Compared to PU

The backbone of PU is similar to Kaneka MS Polymer™, but it has urethane bonds in between. The main benefit of MS Polymer™ against PU is the lack of harmful isocyanates and solvents.

PU is slightly stronger, but the material is not as elastic as Kaneka MS Polymer™. Elasticity is important as the movement of different substrates might cause a bond to break, also at very low temperatures.

The UV stability of PU is not good compared to other technologies. Bubbling is also not seen with MS Polymer™. This could cause an inhomogeneous sealant surface, leading to cohesive failure in time.

Performance comparison of MS Polymer, PU and Silicone, 10 = excellent, 1 = very poor			
Property	MS Polymer	PU	Silicone
Environmental friendliness	10	5	9
Non-bubbling	10	6	10
Low temperature gunnability	10	8	10
Slump resistance	10	10	10
Quick cure	10	7	10
Storage stability	10	7	9
Body (tooling)	8	10	8
Weather resistance	8	6	10
Adhesion to various substrates	10	5	8
Mechanical properties	10	10	10
Heat resistance, mechanical stability	9	8	10
Non-dirt pick up	10	10	5
Stain resistance	8	8	5
Paintability with water-based paint	10	10	3
Totals	133	110	117

Figure 2 Table from MS Polymers in "Hybrid" Sealants by Edward M. Petrie

Research and Application Development

Processing MS Polymer™

In order to produce sealants or adhesives with Kaneka MS Polymer™, all state-of-the-art mixing processes can be applied. The flexibility and ease of handling in the production environment are another important asset of the Kaneka MS Polymer™ technology.

Moreover, inline feeding techniques for additives or catalysts can be applied for Kaneka MS Polymer™ based processes, decreasing production time and facilitating the necessary cleaning of the mixer.

Research

The Kaneka MS Polymer™-division has a modern, fully equipped laboratory to provide a high level of technical assistance to customers. The provided service can be manifold:

- Tailor-made polymer development (in close cooperation with Kaneka Corporation)
- Providing a specific technical training in Kaneka MS Polymer™ for new customers and/or newly hired staff at customers
- Formulation development in close cooperation with customers
- Support with upscaling and industrial trials by testing properties of products
- Limited in-house scale-up of formulations
- Providing information on raw materials for formulation
- Evaluation of products according to a range of ISO-/EN-/DIN-/ASTM-standards
- Technical support to evaluate and solve specific problems



Climate change and environmental degradation pose a critical threat to our world. The EU has taken a proactive approach in addressing this global challenge by implementing the European Green Deal. The goal is to promote sustainable and resource-efficient growth while keeping the economy modern and competitive. The EU Green Deal aims to reduce greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels, with the ultimate goal of achieving climate neutrality by 2050.

To support this transition towards sustainable and safe products, Kaneka has developed a range of innovative products.



Sustainable chemicals

- Life Cycle Assessment
- Label- and tin-free formulations
- Biobased products
- Non bleeding sealants
- High weatherability products



Renovation wave

- General purpose adhesive/sealant
- High Tack adhesive
- Flooring adhesive
- D4 wood adhesive
- Repair adhesive
- Weathering solutions
- Low modulus sealant
- Glazing sealant
- PSA



Smart mobility

- Plastic adhesive
- Assembly adhesive
- High strength/high elongation adhesive
- Thermal Interface Material (TIM)

Towards a green future

Kaneka's vision is centered on a sustainable future for the planet. Corporate responsibility is deeply ingrained in our values. Through the power of our chemistry and solutions, we are dedicated to creating a better and more environmentally-friendly future for both people and the planet..

Global sustainability strategy

The Kaneka Group's commitment to sustainability and long-term value creation and innovation is anchored in the heart of our corporate strategy. Kaneka's four area solutions positively impact society by addressing challenges such as climate change, energy, healthcare, and nutrition. We explore new business development opportunities to address challenges, such as reducing microplastic litter and increasing recycling loops.

Sustainability at Kaneka Belgium

At Kaneka Belgium, our mission is to use our innovative technologies and expertise to create safe and high-quality materials. We are determined to continuously optimize our product portfolio, technical developments, and production processes with the greatest attention and respect for society and the environment. We believe partnerships and cooperation are vital to accelerate decarbonization and build toward a sustainable future for our people, customers, communities, and shareholders.

Responsible Care®

As a signatory of the Responsible Care® Charter, a global voluntary initiative of the chemical industry, Kaneka is committed to driving continuous improvement in health, safety, and environmental performance, as well as effective communication with key stakeholders.

Kaneka Integrated Report

Kaneka Corporation communicates to stakeholders through a yearly Integrated Report. The full report covers Kaneka Corporation's financial, environmental, social and governance performance and provides information on how Kaneka is creating value for its stakeholders over the short, medium and long term.

Support for the UN Global Compact and Sustainability Development Goals

We recognize the Kaneka Group's participation in the UN Global Compact, in which we endorse the ten principles of human rights, labor, environment, and anti-corruption. By embedding these principles into our strategies, policies, and procedures and fostering a culture of integrity, we fulfill our responsibility towards people and the planet and lay the foundation for sustainable long-term growth.

Kaneka Corporation is contributing to the United Nations Sustainability Development Goals through various initiatives and actions.



[Download here Kaneka Integrated Report 2021](#)



Towards carbon neutrality in 2050

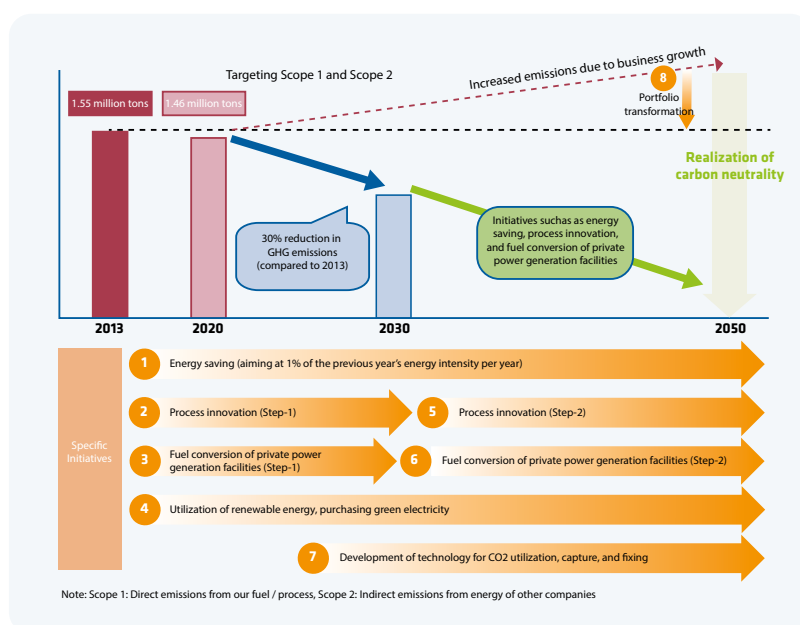
PERFORMANCE POLYMERS
SOLUTIONS VEHICLE

MS POLYMER
DIVISION

To achieve carbon neutrality by 2050, Kaneka is taking crucial actions such as reducing greenhouse gas emissions from energy use, transportation, and waste sources. Our continuous evaluation and improvement of our carbon reduction strategies must guarantee our progress towards carbon neutrality..

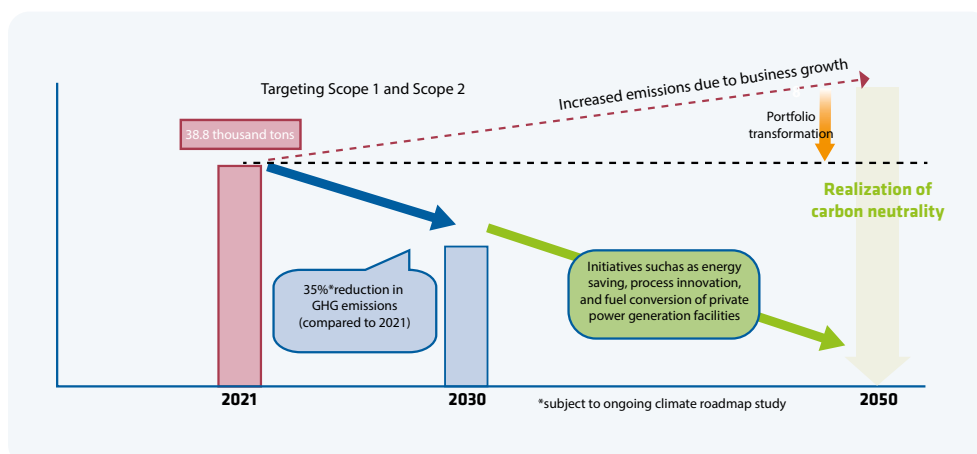
Kaneka Corporation's objectives towards carbon neutrality

To obtain carbon neutrality by 2050, Kaneka's initial goal is to reduce GHG emissions by 30% compared to 2013 levels by 2030.



Kaneka Belgium's objectives towards carbon neutrality

To obtain carbon neutrality by 2050, Kaneka Belgium's initial goal is to reduce GHG emissions by 35% compared to 2021 levels by 2030.*



Main sustainable development themes

KANEKA BELGIUM

Kaneka Belgium is making significant strides toward reaching climate change targets. We have implemented a series of actions and are developing plans to reduce our carbon footprint and increase sustainability. Our focus on renewable energy sources, energy efficiency, and reducing waste has already begun to pay off, and we are dedicated to continuing our efforts posed by climate change. To this end, we aim to achieve a 35% reduction in GHG emissions compared to 2021 levels by 2030*.

CLIMATE CHANGE APPROACH

Continuous energy saving in the existing manufacturing processes

In 2020, we have decreased our specific energy consumption by 35% compared to 2010 levels. Our goal is to achieve an additional 5% improvement by 2030.

Renewable energy sources and local production of green electricity

- Solar energy: expanding onsite solar panels on rooftops, buildings and other suitable locations.
- Wind energy: studying the potential of an onsite wind turbine and battery storage.*
- Upgrading the existing cogeneration installations with state-of-the-art combined heat and power (CHP) systems, including converting natural gas heaters to steam generators able to operate on hydrogen.
- Sun radiation systems: studying the potential of onsite solar thermal systems that use mirrors to concentrate the sun's energy to generate heat, which can then be used to produce steam and generate electricity.*
- We convey studies on rest heat potential and the reuse of low-temperature heat sources employing heat pumps, recovering and using waste heat that would otherwise be lost.*

Continuous water management practices improvement

- We are committed to responsible water management practices and are taking steps to minimize our impact on water resources. This includes measures such as reducing water usage in our operations, advanced wastewater treatment technology to reduce pollutants and make the water suitable for reuse, capturing sky water.*
- In the past 20 years, wastewater per metric ton of produced product could be reduced by 50%.

Reduce waste and maximize recycling

- We are finding ways to reduce the amount of waste generated by our operations and ensuring that as much as possible is recycled or repurposed: reducing packaging, encouraging employee participation in recycling initiatives, and implementing new technologies to increase recycling rates.
- We are fully committed to the principles and objectives of **Operation Clean Sweep® (OCS)**, a program aimed at preventing plastic pellet loss to the environment. We are taking steps to minimize the potential of plastic pellets and powders to escape into the environment during the production, handling and transportation.

*subject to ongoing climate roadmap study.

Reduce carbon footprint in our supply chain

- In 2022, Kaneka Belgium was awarded the first **Lean & Green Star** for its logistics operations. We earned the precious Star for realizing a 20% logistics CO2 reduction in the past 5-year period. To realize this, we have implemented numerous measures, such as a modal transport shift from road to water and rail and cutting down on shuttle transport by maximizing onsite warehousing space.
- We expanded our quay to facilitate the unloading of raw materials by barge and installed a large-scale storage tank to receive substantial quantities of our primary raw material, thereby drastically reducing the need for road transport.
- For Kaneka MS Polymer™ bulk deliveries to Germany, we started to use LNG trucks, powered solely by liquefied natural gas, as step up to other fuel resources like hydrogen and electricity.

Cradle-to-Gate Life Cycle Analysis (LCA) & Environmental Product Declarations (EPD)

- In 2022, Kaneka Belgium performed cradle-to-gate Life Cycle Analysis studies for the three main product lines - Kaneka MS Polymer™, Kane Ace™ and Eperan-PP™ - manufactured at the site in Westerlo, Belgium. They enable us to demonstrate our commitment to sustainability and help us identify opportunities for improvement. Environmental Product Declarations (EPD) are available upon request to provide transparent and comparable information about the environmental impact of Kaneka's products throughout their entire life cycle.

Development of eco-friendly products

- In 2018, Kaneka's MS Polymer Division decided to start a CAMBIUM project to develop **biobased Kaneka MS Polymer™ based on bio-aromatic building blocks derived from lignin**. This 3-year cutting-edge research led to the development of non-reactive and reactive silane-modified lignin molecules, which can be incorporated up to 15% in the standard MS Polymer™, leading to enhanced thermal and UV properties. New applications could be developed, such as a hard topcoat or primer with high biobased content. Subsequently, in 2022, the research on biobased MS Polymer™ was continued with the start of a new 3-year funded research project named "BIOSEAL". The target of this project is to develop almost entirely biobased polymer backbones.
- **Green Planet™** (chemical name: PHBH) is a biomass polymer produced by microorganism biosynthesis using plant oils. With its superior biodegradability under a wide range of environments, Green Planet™ has the same functions as general-purpose plastics. Its use is growing in Japan and internationally as a material that can offer a groundbreaking solution to the environmental harm caused by single-use plastics. Green Planet™ is already used for straws, cutlery, coffee capsules, bags, films, etc. In Japan, the production capacity increase (15.000 tons/year) is scheduled to start in January 2024. It is expected to gradually increase in Europe and the United States under the policy of local production for local consumption. Through our Green Planet Project Team Europe, Kaneka Belgium is further developing Green Planet™ as the global benchmark for biodegradable applications for the EMEA market.
- Kaneka's unique access to both the foam particle technology and the natural polymer PHBH has prompted us to develop and produce a bio-based and biodegradable foam particle. Suitable for next-generation food and non-food packaging or other molded parts, **Green Planet Expanded Beads** can be molded with existing equipment and offer equivalent features to polyolefin foams.
- In the past, it was almost impossible to reuse recycled material from end-of-life expanded polypropylene (EPP) parts while maintaining all the mechanical properties of virgin EPP. Kaneka's scientific foam technology expertise changes this, making both possible simultaneously. We developed next-generation EPERAN-PP™ grades containing recycled material content of 25% from end-of-life EPP parts.

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