Market Study: Bioplastics

World Report (9th Edition)

Ceresana
Market Research Since 2002

This brochure provides further information on the study: "Bioplastics – World (9th Edition)"

Executive Summary

The latest and already ninth edition of Ceresana's bioplastics market report anticipates market growth: Market researchers forecast that the global bio-based and biodegradable plastic market size will reach around USD 12 billion by 2034. The bioplastics market report primarily analyzes the global market for thermoplastics made from renewable raw materials that are biodegradable i.e. can be decomposed by microorganisms in nature or at least composted in industrial plants. PHA from sugar and TPS from starch, for example, are bio-based and biodegradable. However, there are also plastics made from biogenic raw materials that are not compostable, such as PEF made from fructose or bio-polyethylene based on sugar cane. The market study also covers petrochemical, biodegradable plastics such as polycaprolactone (PCL), polybutylene adipate terephthalate (PBAT), or polybutylene succinate (PBS). This study does not cover biobased elastomers, thermosets, natural fiber-reinforced plastics (NFRP) as well as composites such as wood-plastic composites (WPC). In addition to market data and forecasts, the study also contains information on the regulatory framework as well as on the general economic environment and the situation in the packaging industry (including key companies, market size, recycling rates) in each country.

Innovations for Sustainable Applications

The packaging industry is the largest consumer of plastics today. The advantages of the following bioplastics, which are currently by far the best-selling materials, are particularly evident in flexible packaging: Polylactic acids (PLA) and starch polymers (especially TPS) offer higher permeability, biodegradability, and a good "green" image among consumers. For the starch-based bioplastics and polylactic acid market, Ceresana's latest market report expects further volume growth of 7.7% per year until 2034. For bio-based but non-biodegradable plastics, such as bio-polyethylene, bio-PET, or bio-PA, growth is expected to be lower at 5.3% per year. Like conventional petrochemical plastics, the various polymers made from biogenic raw materials each have areas of application for which they are particularly well suited. Biocompatibility, for example, is an advantage for medical implants. Compostability is required for agricultural films and flower pots. In 3D printing, biofilaments are valued not least because they do not smell of burnt plastic. The analysts at Ceresana are currently registering the highest growth rates for innovative bioplastics in the automotive and electronics sectors.

Current Global Bioplastics Market Report:

Chapter 1 of the new market study provides a comprehensive presentation and analysis of the global bioplastics market with forecasts up to 2034: The development of demand (in tonnes), revenues (in USD and EUR), and production (in tonnes) is shown for each region. In addition, 6 bioplastic applications are examined individually. Demand is also analyzed for 7 types of bioplastics, while 4 product groups are considered for the analysis of production.

In Chapter 2, the 11 most important sales markets are examined individually: Demand and revenues, demand in the individual application areas, and demand per product type.

To give an overview of the bioplastic industry, chapter 3 provides useful company profiles of the 60 largest bioplastic manufacturers, such as BASF, Evonik, Cargill, Eastman, FENC, Hengli, Mitsubishi Chemical, PTT GC, and TotalEnergies.

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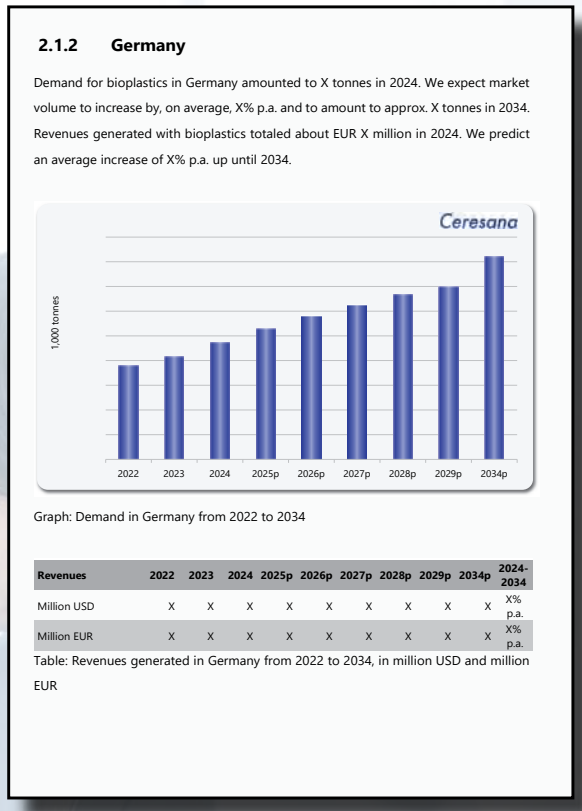

2.1.2 Germany

Demand for bioplastics in Germany amounted to X tonnes in 2024. We expect market volume to increase by, on average, X% p.a. and to amount to approx. X tonnes in 2034. Revenues generated with bioplastics totaled about EUR X million in 2024. We predict an average increase of X% p.a. up until 2034.

Graph: Demand in Germany from 2022 to 2034

Revenues	2022	2023	2024	2025p	2026p	2027p	2028p	2029p	2034p	2024-2034
Million USD	X	X	X	X	X	X	X	X	X	X% p.a.
Million EUR	X	X	X	X	X	X	X	X	X	X% p.a.

Table: Revenues generated in Germany from 2022 to 2034, in million USD and million EUR

in 1,000 tonnes	2022	2023	2024	2025p	2026p	2027p	2028p	2029p	2034p	2024-2034
Rigid Packaging	X	X	X	X	X	X	X	X	X	X% p.a.
Flexible Packaging – Bags	X	X	X	X	X	X	X	X	X	X% p.a.
Flexible Packaging – Others	X	X	X	X	X	X	X	X	X	X% p.a.
Consumer Goods	X	X	X	X	X	X	X	X	X	X% p.a.
Automotive & Electronics	X	X	X	X	X	X	X	X	X	X% p.a.
Other Applications	X	X	X	X	X	X	X	X	X	X% p.a.
Total	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X% p.a.**

Table: Demand in Germany from 2022 to 2034 – split by application

in 1,000 tonnes	2022	2023	2024	2025p	2026p	2027p	2028p	2029p	2034p	2024-2034
PLA	X	X	X	X	X	X	X	X	X	X% p.a.
Starch	X	X	X	X	X	X	X	X	X	X% p.a.
Other Biodegradables	X	X	X	X	X	X	X	X	X	X% p.a.
Total Biodegradables	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X% p.a.**
Total Non-Biodegradables	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X% p.a.**
Total	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X% p.a.**

Table: Demand in Germany from 2022 to 2034 – split by product

General Economic Situation:

Crumbling infrastructure, capital flight, underinvestment, ever poorer scores in international education studies, generally declining competitiveness, and increasingly political polarization and uncertainty: Although Germany is still one of the richest countries in the world, it has a decade of slow but steady decline behind it. The increasing division of the world into West and East is undermining the essential foundations of the long-successful "German model": Export orientation (over 30% of economic output, around one in four jobs) and cheap energy resources. With the sanctions against Russia, imports of crude oil and natural gas are falling away, and China is increasingly developing from a customer into a competitor for German

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In 2024, Germany was the third trading nation in the world (after China and the USA, ahead of Japan). After falling by 1.2% in 2023, German exports shrank by 1% in 2024, reaching a value of EUR 1,556 billion. The most important export goods were motor vehicles and motor vehicle parts worth EUR 262 billion (4% less than in 2023), followed by machinery worth EUR 216.5 billion and chemical products worth EUR 138.6 billion. German imports fell even more sharply, primarily due to falling energy prices: After a decline of 9.9% in 2023, they shrank by 3% in 2024, reaching a value of EUR 1,316 billion. The most important imported goods were motor vehicles and motor vehicle parts for EUR 142 billion, followed by computers, electrical, and optical products worth EUR 134.3 billion and electrical equipment worth EUR 104 billion. The German foreign trade surplus thus reached around EUR 239.1 billion (compared to almost EUR 249 billion achieved in the previous record year of 2016). Germany achieved the largest surplus in trade with the USA (+EUR 70 billion), while the largest deficit was with China (-EUR 66.3 billion). China was Germany's most important trading partner from 2016 to 2023. In 2024, German exports to China fell by 7.6%, and China is now only the fifth most important market for German exports after the USA, France, the Netherlands, and Poland. In contrast, exports to the USA increased by 2.2%, and the USA was once again Germany's most important trading partner with a foreign trade volume of EUR 252.8 billion. The concerns in Germany caused by growing US protectionism are correspondingly high.

Industry still accounts for around 26% of GDP in Germany (in comparison: USA 18%, United Kingdom 17%, Japan 29%, China 40%). The country's strengths are "old" industries such as mechanical engineering, plant construction, and chemicals – it often lags behind when it comes to more modern technologies and digitalization. Germany's GDP shrank by 0.3% in 2023 adjusted for price and by 0.2% in 2024. At the beginning of 2025, Germany's total economic output is therefore roughly the same again as at the end of 2019. The German government expects meager growth of 0.3% for Germany in 2025. This forecast puts Germany at the bottom of the league in Europe.

Packaging Market:

In 2023, the more than 5,000 companies in the German packaging industry with 500,000 employees generated sales of around EUR 36.5 billion (EUR 22.6 billion in Germany and EUR 13.9 billion abroad), around 4% more than in the previous year. Broken down by packaging material, paper and cardboard accounted for around EUR 14.6 billion (40%) of this, plastic for EUR 12.8 billion (35%), glass for EUR 3.7 billion (10%), metal for EUR 3.3 billion (9%), and wood for EUR 1.5 billion (4%). Germany is the largest producer of paper and cardboard in Europe and accounts for over 23% of total European sales, twice as much as France. Around two thirds of the 750 or so companies that process paper are small businesses.

The largest packaging producers in Germany belong to foreign groups, such as Novelis (aluminum containers), Smurfit Westrock (cardboard), Mayr-Melnhof (cardboard), or Huhtamäki (food packaging). Gerresheimer AG, headquartered in Düsseldorf, specializes primarily in pharmaceutical and cosmetics packaging. Schütz GmbH & Co. KGaA in Selters is the world market leader for Intermediate Bulk Containers (IBC). More than 90% of German packaging manufacturers are SMEs. "Hidden champions" are increasingly being taken over by international corporations: For example, the spray and dispensing specialist Pfeiffer was absorbed by Aptar.

German manufacturers of food and packaging machinery export more than 85% of their production. Their exports reached a new record of EUR 9.85 billion in 2023 (the German mechanical and plant engineering industry association VDMA estimates the total global market for these machines at around EUR 52 billion). Krones AG, headquartered in Neutraubling near Regensburg, is one of the world's largest manufacturers of packaging and filling machines for beverages with a turnover of more than EUR 4 billion. The MULTIVAC Group in Wolfertschwenden and KHS GmbH in Dortmund are also among the world market leaders for packaging machines.

There are special associations, e.g. for manufacturers of plastic packaging (kunststoffverpackungen.de), metal packaging (metallverpackungen.de), paper and

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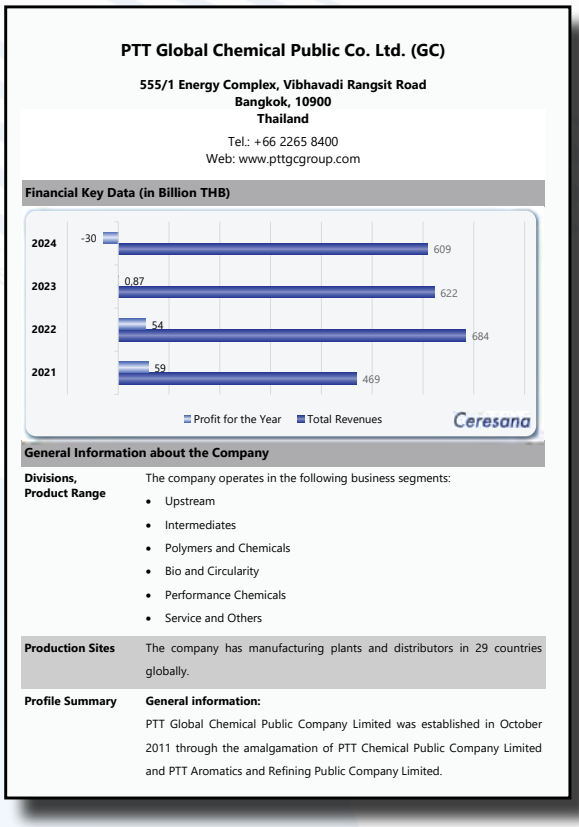
3 Company Profiles*



PTT Global Chemical Public Co. Ltd. (GC)

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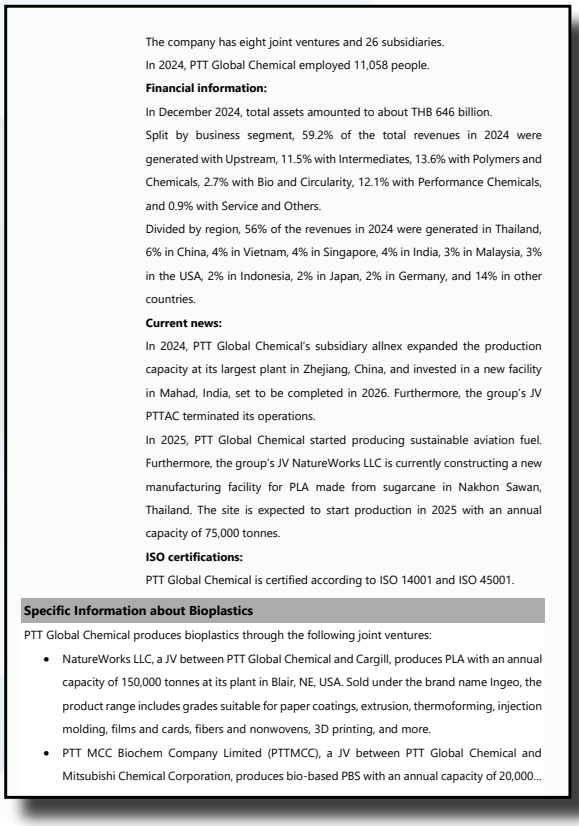
Financial Key Data (in Billion THB)

General Information about the Company

Divisions, Product Range	The company operates in the following business segments: • Upstream • Intermediates • Polymers and Chemicals • Bio and Circularity • Performance Chemicals • Service and Others
Production Sites	The company has manufacturing plants and distributors in 29 countries globally.
Profile Summary	**General information:** PTT Global Chemical Public Company Limited was established in October 2011 through the amalgamation of PTT Chemical Public Company Limited and PTT Aromatics and Refining Public Company Limited.



The company has eight joint ventures and 26 subsidiaries.
In 2024, PTT Global Chemical employed 11,058 people.

Financial information:

In December 2024, total assets amounted to about THB 646 billion.
Split by business segment, 59.2% of the total revenues in 2024 were generated with Upstream, 11.5% with Intermediates, 13.6% with Polymers and Chemicals, 2.7% with Bio and Circularity, 12.1% with Performance Chemicals, and 0.9% with Service and Others.
Divided by region, 56% of the revenues in 2024 were generated in Thailand, 6% in China, 4% in Vietnam, 4% in Singapore, 4% in India, 3% in Malaysia, 3% in the USA, 2% in Indonesia, 2% in Japan, 2% in Germany, and 14% in other countries.

Current news:

In 2024, PTT Global Chemical's subsidiary allnex expanded the production capacity at its largest plant in Zhejiang, China, and invested in a new facility in Mahad, India, set to be completed in 2026. Furthermore, the group's JV PTTAC terminated its operations.
In 2025, PTT Global Chemical started producing sustainable aviation fuel. Furthermore, the group's JV NatureWorks LLC is currently constructing a new manufacturing facility for PLA made from sugarcane in Nakhon Sawan, Thailand. The site is expected to start production in 2025 with an annual capacity of 75,000 tonnes.

ISO certifications:

PTT Global Chemical is certified according to ISO 14001 and ISO 45001.

Specific Information about Bioplastics

PTT Global Chemical produces bioplastics through the following joint ventures:

- NatureWorks LLC, a JV between PTT Global Chemical and Cargill, produces PLA with an annual capacity of 150,000 tonnes at its plant in Blair, NE, USA. Sold under the brand name Ingeo, the product range includes grades suitable for paper coatings, extrusion, thermoforming, injection molding, films and cards, fibers and nonwovens, 3D printing, and more.
- PTT MCC Biochem Company Limited (PTTMCC), a JV between PTT Global Chemical and Mitsubishi Chemical Corporation, produces bio-based PBS with an annual capacity of 20,000...

*Note: The profiles are assigned to the country in which the company or holding is headquartered. Profiles also include JVs and subsidiaries.

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Polyethylene (LDPE) – World
Polyethylene (LLDPE) – World
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