Yamada Consulting Group Co., Ltd.

Bioplastics Industry in Thailand

Summary

Environmental sustainability has been a mega trend amongst consumers and manufacturers in various industries. This trend also expands to the plastic industry by developing bioplastics components and products. Global bioplastics production capacity trend has been growing significantly. In Thailand there are plenty of agricultural feedstocks, such as cassava and sugarcane, which will be used as raw materials for bioplastics. With Thailand's competitiveness in resource abundance and players in supply chain from upstream to downstream, the Thai government saw opportunities in bio-related industries, including bioplastics and provides various support for Thailand to be the bio hub of ASEAN in 2027. Aside from this, BOI also provides both tax and non-tax incentives to investors. Thus, investing activities related to the bioplastics industry in Thailand are considered great opportunities for both domestic and foreign investors.

Content

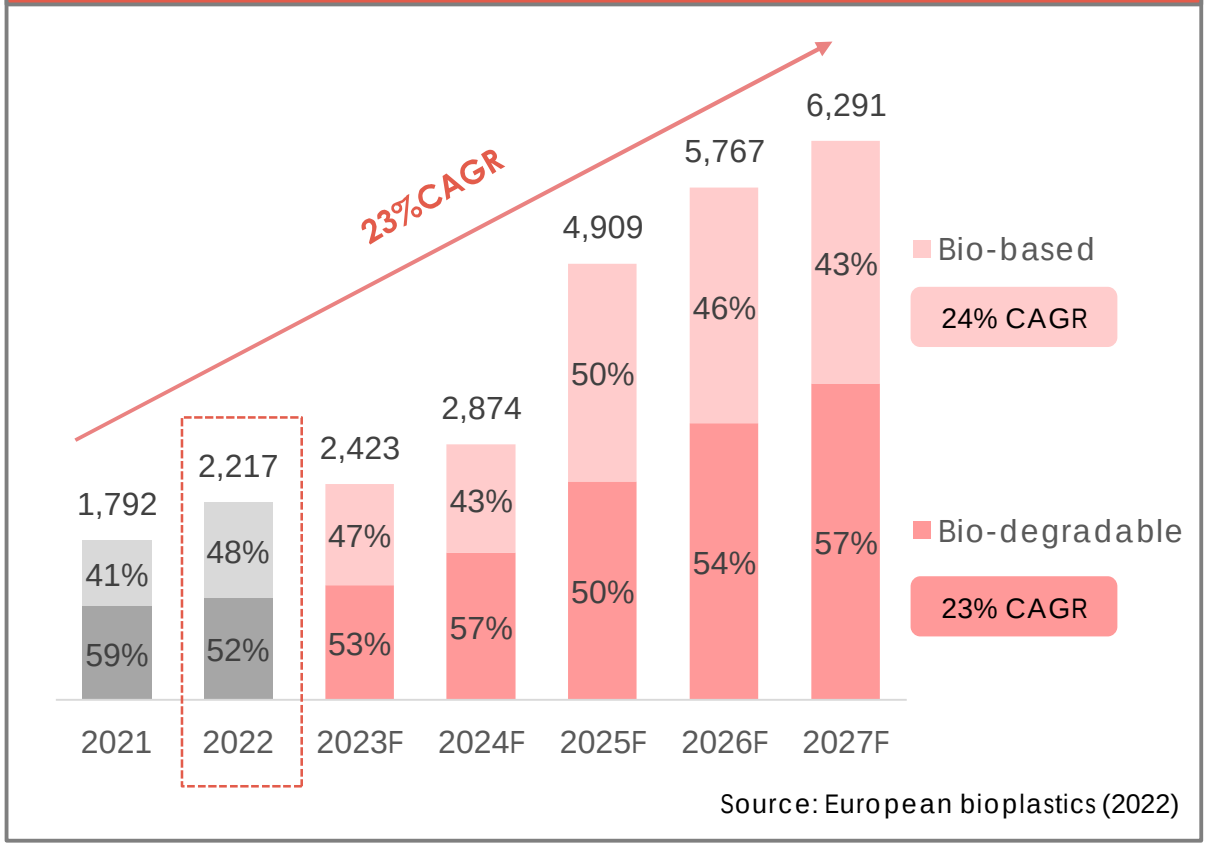
Bioplastics: Definition and Overview of the Global Production Capacity

- According to European bioplastics (2015), bioplastics refer to plastics having properties of being either bio-based, bio-degradable or both.

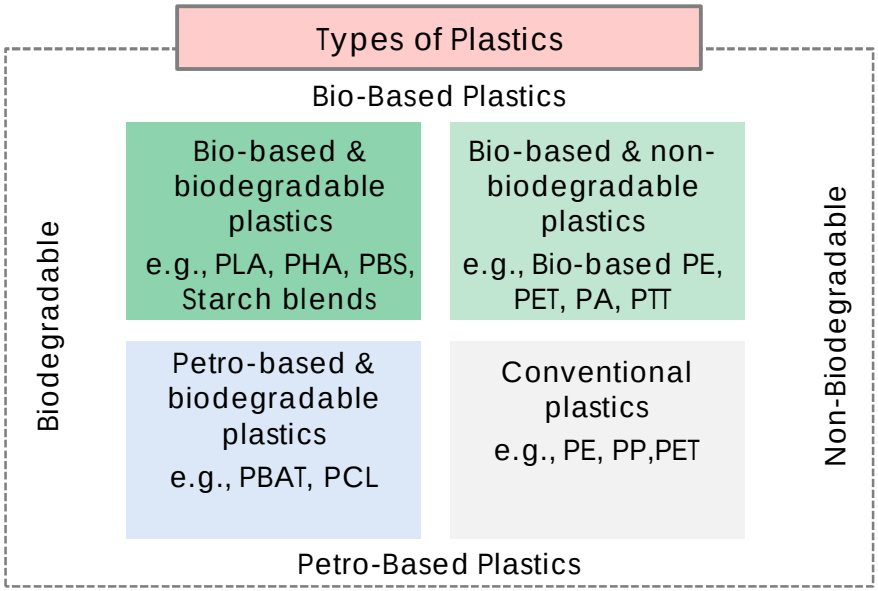
Bio-based plastics: this type is categorized based on material origin (at least partly) from biomass resources, such as cassava and sugarcane.

Biodegradable plastics: the term biodegradable refers to materials that can biodegrade into natural elements with the help of micro-organisms.

Global Production Capacity of Bioplastics (2021-2027F)



Source: European bioplastics (2022)



Total global production capacity

- According to European bioplastics (2022), the global production capacity was 2,217,000 tons and was forecasted to increase to 6,291,000 tons in 2027 with a 23 percent CAGR between 2021-2027.

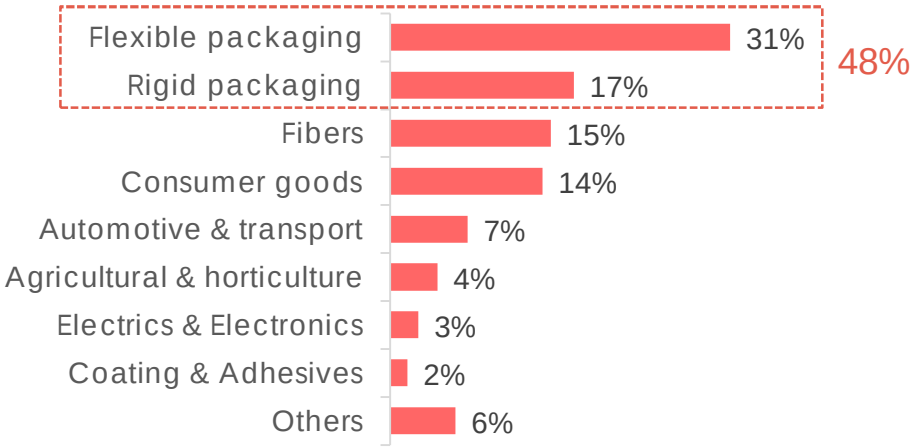
Global production capacity by type

- In terms of types of bioplastics, in 2022, major bioplastics was bio-degradable, accounting for 52 percent, followed by bio-based plastics.
- The forecasted percentage of bio-degradable plastics compared to the total capacity is expected to increase, from 52 percent in 2022 to 57 percent in 2027. In terms of volume, it is forecasted to grow with a 23 percent CAGR (2021-2027).
- For bio-based plastics, the percentage to total capacity is expected to decrease, from 48 percent in 2022 to 23 percent in 2027. However, in terms of volume, it will grow with a 24 percent CAGR (2022-2027).

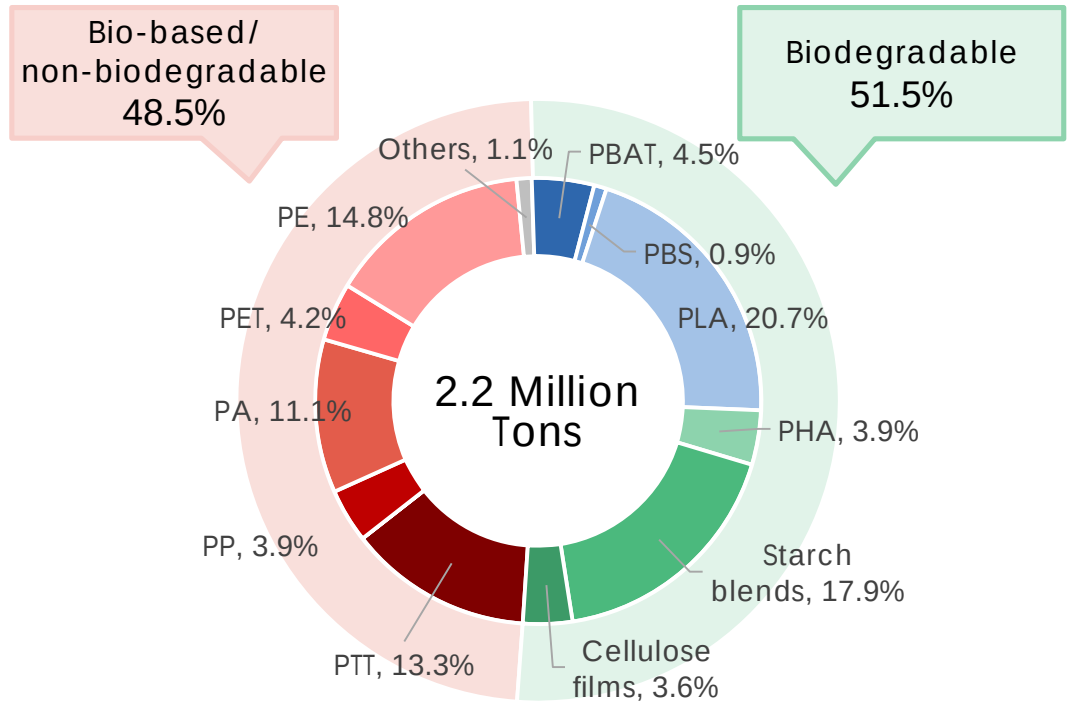
Global Production Capacity of Bioplastics by Materials, Regions & Applications

- Biodegradable materials dominated the global production of bioplastics products, accounting for 51.5 percent in 2022.
- In terms of global production capacity by region, Asia was the major player in this industry, having more than 40 percent of market share, followed by Europe and North America, respectively.
- For applications, most bioplastics are made for flexible and rigid packaging, of which the combined market share was almost half of the global production capacity in 2022.
- This huge amount of bioplastics production capacity for packaging implies that global companies and citizens have become more environmentally conscious.
- Also, the packaging industry has been transitioning towards more environmentally friendly products, both in the eyes of producers and consumers.

Global Production Capacity of Bioplastics by Application (2022)



Global Production Capacity of Bioplastics by Material Types & Regions (2022)



Regions	% of Global Production
Asia	41%
Europe	26%
North America	19%
South America	13%
Australia/Oceania	1%

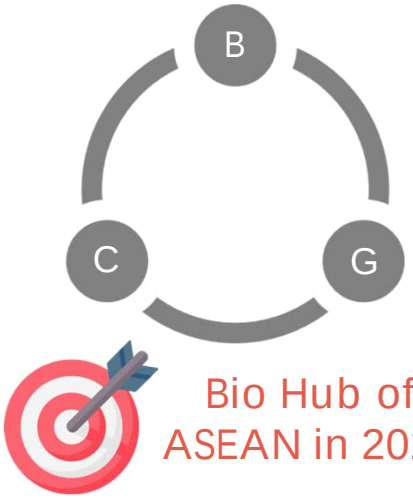
Bioplastic Materials	
PE: Polyethylene	PBAT: Polybutylene adipate terephthalate
PET: Polyethylene terephthalate	PBS: Polybutylene succinate
PA: Polyamide	PLA: Polylactic acid
PP: Polypropylene	PHA: Polyhydroxyal-kanoates
PTT: Polytrimethylene terephthalate	

Source: European bioplastics, Nova Institute (2022)

Bioplastics Industry in Thailand: At a Glance

- The Thai government has implemented the BCG economic model and its target industries. The bioplastics industry is one of the industries that has been attracting foreign investors due to Thailand competitiveness in terms of resources, governmental support and incentives.

Thai Government Strategy: Bio-Circular-Green (BCG) Economic Model



Bio Hub of ASEAN in 2027

Bio-Economy Target Industries

- ✓ Agriculture, food, medical industries
- ✓ Bioenergy, biomaterial industries
- ✓ Biochemical industry
- ✓ Bioplastics industry

Bioplastics Benefits

- ✓ Adding value to the Thai agricultural industry
- ✓ Increasing resource efficiency (agricultural feedstocks)
- ✓ Reducing carbon footprint and greenhouse gas emissions (GHG)
- ✓ Increasing brands' reputations regarding sustainability and environmental consciousness
- ✓ Being independent from fossil resources, which relies on imports

Thailand's Competitiveness in Bioplastics

Agricultural Resource Abundance

Ranked 2ND in global Cassava Production

Ranked 4TH in global Sugarcane production

Various Governmental Support & BOI Incentives

Bioplastics Investment Status (BOI)

24 Bioplastics Projects
37 Billion Baht Investment Value
(During 2018- Sep 2023)

Example of Players

Purac (Thailand) Ltd.	SCG Chemicals Pcl.
PTT MCC Biochem Co., Ltd	Total Energies Corbion Ltd.
Mitr Phol Sugar Corp., Ltd.	Thai Wah Pcl.

Bioplastics Supply Chain and Activities in Thailand

- Companies in Thailand have been operating all activities in the bioplastics supply chain, from upstream to downstream as follows:

Bioplastics Supply Chain

Agricultural Feedstocks

cassava Sugarcane
(Example)

- **34 MT** Cassava root production in 2022
- **1,205** Cassava processing facilities in 2022
- **96 MT** Sugarcane production in 2022/23
- **57** Sugar factories in 2022

Biochemical

E.g., Lactic acid produced by fermenting feedstocks

Key Player

Purac (Thailand), from Corbion Purac (global Lactic Acid producer)

- 145,000 tons annual production capacity
- Also, the new plant is expected to finish by 2023 with an annual capacity of 125,000 tons.

Bioplastics Resin/Polymer

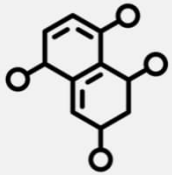
E.g., Polylactic acid (PLA)

Polybutylene Succinate (PBS)

Key Players

- Total Energies Corbion Ltd. (PLA)
  Annual production capacity: 75,000 tons
- PTT MCC Biochem Co., Ltd. (PBS)
  Annual production capacity: 20,000 tons

Bioplastics Conversion



As of 2022, there are more than 3,000 plastics converter companies in Thailand, which can expand their business to bioplastics as well.

Key Players

- PTT Global Chemical Pcl.
- Multibax Pcl.
- Prepack Thailand Co.,Ltd.
- Thantawan Industry Pcl.

Finished Products

Example of Bioplastics Products

- Flexible and rigid packaging
- Food packaging
- Cutlery
- Bioplastics bags
  e.g. shopping, zipper, garbage bags
- Paper coating

Source: European bioplastics, Krungsri research, BOI, Office of Industrial Economics, Office of Agricultural Economics, Thailand's Sugarcane Planters Federation, companies' websites, public news.

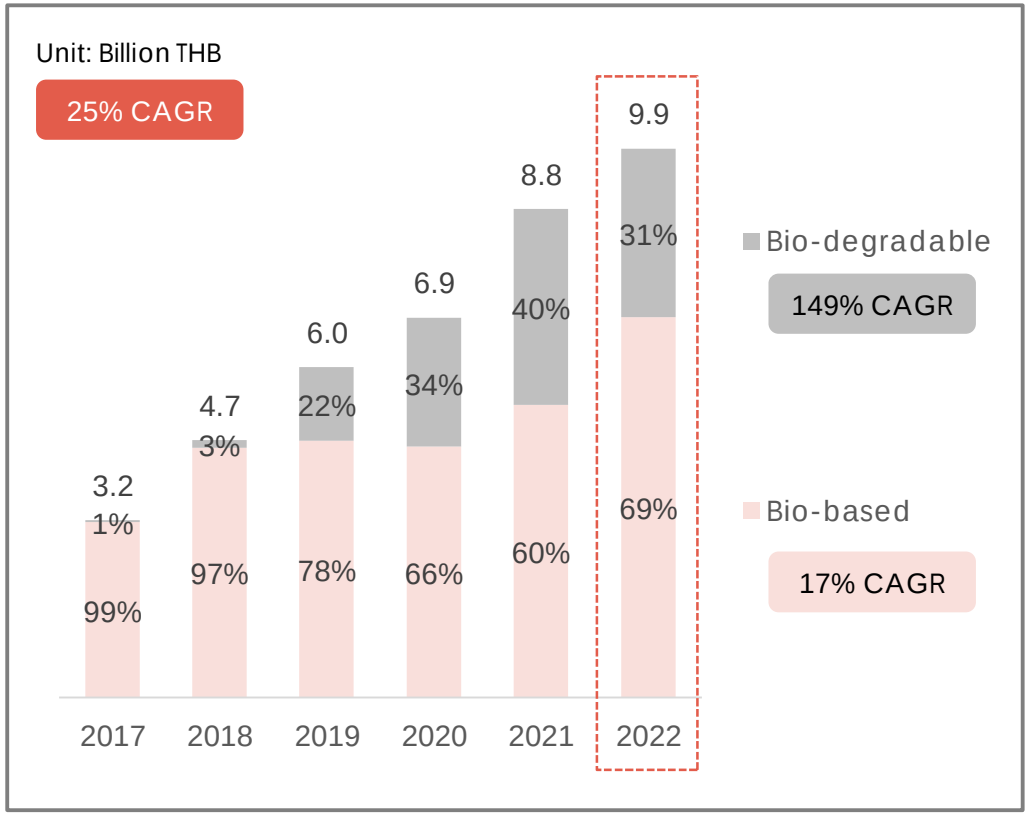
Pictures in this slide retrieved from URL: *https://www.pttmcc.com/paper-coating, https://www.scgchemicals.com/uploads/SCGC_Company_Profile_ENG.pdf*

Bioplastics Products Export Situation from Thailand

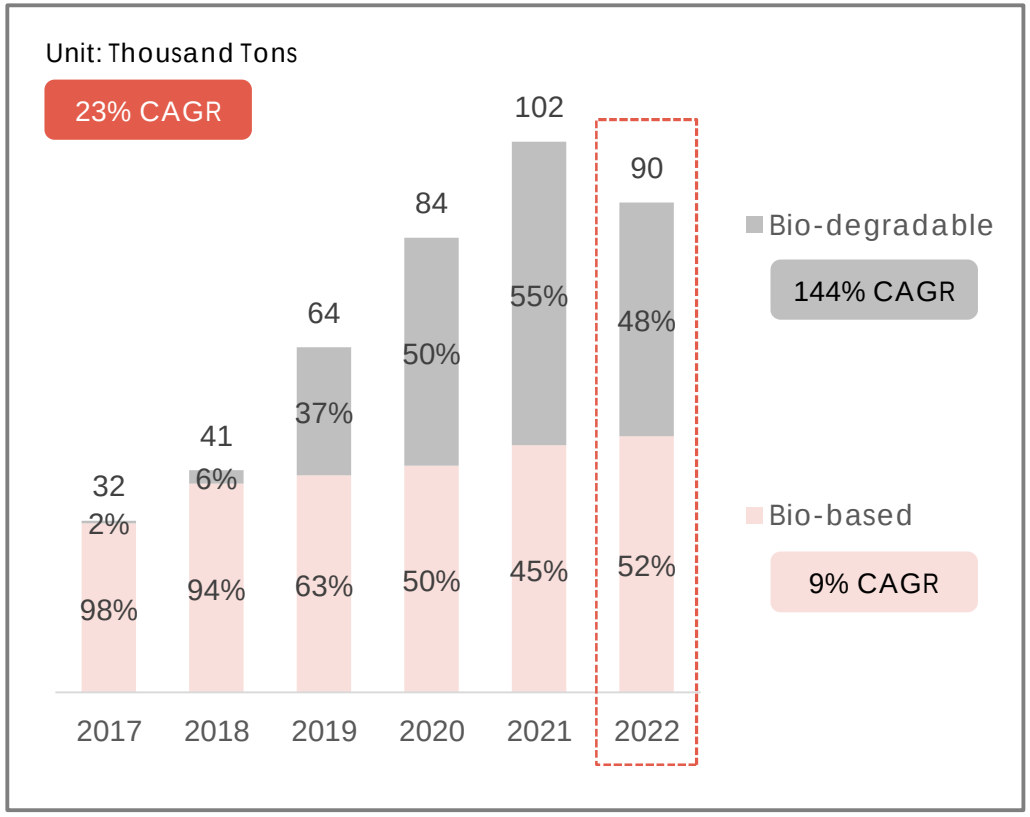
- According to Bangkok post (2023), Thailand is among the top 5 bioplastics manufacturing countries in the world, and a leader in ASEAN.
- More than 90 percent of the total bioplastics production is exported, with 25 percent CAGR in terms of value and 23 percent CAGR in terms of volume (2017-2022). As Thailand aims to be the bio hub of ASEAN in 2027, there has been various attractive incentives for investors, which increase production capacity in Thailand, as well as export volume in recent years.
- Especially biodegradable export volume, Total Energies Corbion Ltd., one of the largest PLA manufacturers, has been investing in Thailand since 2019, by investing in a production plant with an annual production capacity of 75,000 tons, resulting in a surge in export volume since 2019.

Bioplastics Products Export Situation (2017-2022)

Bioplastics Products Export Value (2017-2022)



Bioplastics Products Export Volume (2017-2022)



Source: The Office of Industrial Economics, Bangkok post, public news

Thailand Competitive Capabilities Towards the Bioplastics Industry: Resource Abundance

- Thailand is well-known for its abundance of natural resources, including needed feedstocks for bioplastics production, such as cassava and sugarcane. Thailand is considered the leading cassava and sugarcane producer in the world.
- Despite the rich resources, in 2020, less than 1 percent of cassava and sugarcane was used for bioplastics.

Cassava

- Cassava root production has been facing steady growth. In 2022, production was 34 million tons. However, it is forecasted to drop during 2023 to 2024 due to drought.

Thailand is ranked 2nd in global cassava production

Source: Worldatlas (the rankling information is as of May 2023)

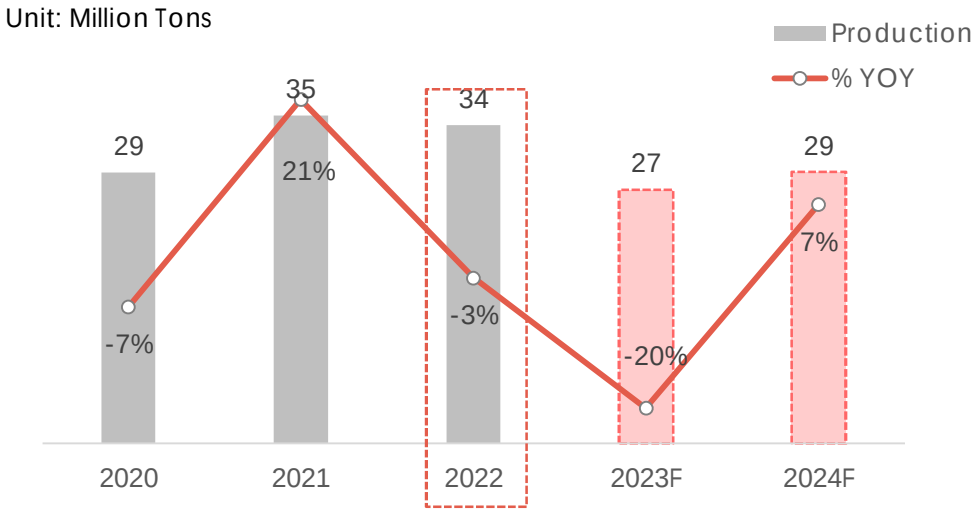
Sugarcane

- Sugarcane production was 94 million tons in 2022 and 2023. However, it is expected to decrease due to El Nino, which resulted in decreased rainfall for the year.

Thailand is ranked 4th in global sugarcane production

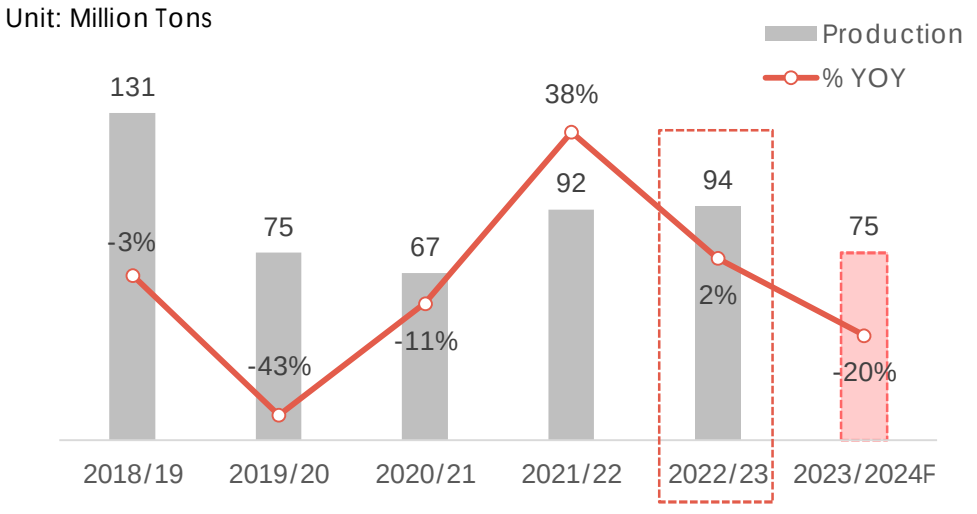
Source: Worldatlas (the rankling information is as of May 2023)

Cassava Root Production in Thailand (2020-2024F)



Source: Department of Internal Trade, Office of Agricultural Economics

Sugarcane Production in Thailand (2018/19-2023/24F)



Source: Office of The Cane and Sugar Board, Thailand's Sugarcane Planters Federation

Thailand Competitive Capabilities Towards the Bioplastics Industry: Government Policies (1/2)

Government Strategy: Bio-Circular-Green (BCG) Economic Model

- The Bio-Circular-Green Economic Model was conceptualized by the Thai government as a strategy directed towards economic and social recovery after the COVID-19 pandemic.
- The BCG model was also created to enhance Thailand's commitment to the United Nations Sustainable Development Goals (SDGs).

Definition

Bio Economy

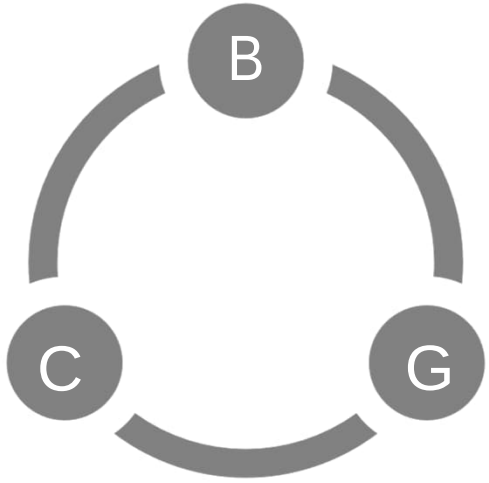
- The creation of growth by relying on the nation's biological resource base and biodiversity, including health, environment, or even tourism, and conversion into value added products and services.

Circular Economy

- Effort to maximize the lifespan of available resources, such as reuse, recycle, upcycle, or sharing.

Green Economy

- Development where the balance between economic, industrial activities, agriculture, production or service is environmentally friendly.



2022
- Bio industry's growth rate increases by 3%
- Investment value = 3 billion baht

2024
- Bio industry's growth rate increases by 6%
- Investment value = 10 billion baht

2027
Bio Hub of ASEAN in 2027
- Bio industry's growth rate increases by 10%
- Investment value = 19 billion baht

Bio-Economy Target Industries

- ✓ Agriculture, food, medical industries
- ✓ Bioenergy, biomaterial industries
- ✓ Biochemical industry
- ✓ Bioplastics industry

Source: The National Science and Technology Development Agency (NSTDA)

Thailand Competitive Capabilities Towards the Bioplastics Industry: Government Policies (2/2)

- The Thai government aims are to make Thailand into the Bio Hub of ASEAN in 2027, so they have been supporting bioplastics manufacturing and adoption in business sectors and end customers.

Thailand's Bio Industry Development Plan (2018-2027)

- Eliminating investment obstacles by revising related regulations to ease investments in bio industry
- Launching supporting regulations and facilities

- Stimulating demand by launching fiscal and monetary policies to support bio-industry
- Supporting adoption of bioplastic products in business sectors

- Accelerating domestic investment by supporting bio-industry pilot projects in various locations across Thailand, such as EEC (Rayong), Khon Kaen, etc.

- Forming a Center of bio-excellence (CoBE), operated by the Plastic Institute of Thailand, in order to effectively research and develop bio products.

Bio Hub of ASEAN in 2027

Example of monetary policies launched to encourage businesses to use more biodegradable plastic products

Corporate income tax reduction program by the industry and finance ministries

- According to the Ministry of Industry, companies buying biodegradable plastic products can record these expenses at 125 percent of actual costs before corporate income tax calculations, resulting in actual tax reductions between 2022 and 2024.
- Biodegradable plastic products must be purchased from manufacturers certified by the Office of Industrial Economics.

125 %

Source: Thailand Bio Industry Development Plan (2018-2027) by Office of Industrial Economics, Ministry of Industry, public news

Thailand Competitive Capabilities Towards the Bioplastics Industry: BOI Incentives

- As one of the target industries, there are various incentives, both tax and non-tax, as follows:

Eligible Activities	Eligible Activities' Subcategories	Conditions	CIT Exemption
Manufacture of bioplastics or products from bioplastics 	Manufacture of bioplastics or products from bioplastics derived from the continual process within the same project	Projects must have certified by biobased content certificate, such as TISI 2734, ISO 16620 or an equivalent international standard. The certification must be completed before the full operation deadline.	8 years
	Manufacture of products from bioplastics	▪ Projects must have certified by biobased certificate, such as TISI 2734, ISO 16620 or an equivalent international standard. The certification must be completed before the full operation deadline. ▪ Project must have plastic forming process from bioplastics.	5 years
Manufacture of biochemicals 	-	▪ Products must use raw materials from agricultural products, processed agricultural products, biomass or scrap or waste from agricultural processing industries at least 51 percent by weight. ▪ Projects with only mixing or dilution processes shall not be promoted. ▪ Projects must have certified or qualified by ready biodegradability international standard, such as OECD Guidelines for the Testing of Chemical, Test No. 301: Ready Biodegradability. The certification or qualification must be completed before the full operation deadline.	8 years

- Investors investing in eligible activities mentioned above will also obtain tax incentives, including exemption of import duties on machinery, raw materials used in R&D, and raw materials used in production for export.
- In addition, investors will obtain non-tax incentives, including permit to own land, permit to bring into the Kingdom skilled workers and experts to work in investment promoted activities, permit for foreign nationals to enter the Kingdom for the purpose of studying investment opportunities, permit to take out or remit money abroad in foreign currency.

Source: BOI (2023)

Bioplastics Investment Situation in Thailand and Examples of Key Players

- According to the BOI (as of September 2023), the BOI has promoted 24 investment projects in bioplastics, which accounted for more than 37 billion baht over the past 5 years. There are several players, both Thai and foreign, in related fields who have been investing in the bioplastics sector in Thailand, from upstream to midstream stages. Also, there are many packaging companies who also expanded their businesses to bioplastics packaging.

Example of Companies Investing in the Bioplastics Sector in Thailand

Company Name	Nature of Business	Type of Business		Example of Bioplastics Activities
		Chemical	Agricultural Feedstock	
PTT MCC Biochem Co., Ltd. Joint venture between ▪ PTT Global Chemical Pcl. ▪ Mitsubishi Chemical Corporation	▪ Production and distribution of bio-PBS (Polybutylene succinate)	✓		▪ The company produces and distributes Bio-PBS (biodegradable and compostable), which can be used in various applications, such as paper coating, flexible packaging.
Total Energies Corbion Ltd. Joint venture between ▪ Total Energies Group ▪ Corbion Group	▪ Production of Poly Lactic Acid (PLA) and lactide monomers	✓		▪ The company produces Lactic Acid (PLA) and lactide monomers (biobased, recyclable, and biodegradable polymer), which can be used for rigid and flexible packaging, food service ware and durable goods.
SCG Chemicals Pcl. Majority shares held by: ▪ The Siam Cement Pcl.	▪ The production of plastic resins or polymers ▪ SCGC floating solar solutions, clean energy solutions etc.	✓		▪ The company has developed bio-compostable compound resins to produce bio-compostable bags. ▪ The company has partnered with Braskem to produce bio-ethylene (Green-Ethylene) from agriculturally based ethanol.
Mitr Phol Sugar Corp., Ltd. Majority shares held by: ▪ Mid Siam Sugar Co., Ltd.	▪ Fully integrated-sugarcane company ▪ Sugar producer and bio-based leader		✓	A subsidiary under the Mitr Phol group produces: ▪ PlaneX brand: biodegradable plastic pellets) ▪ CaneX brand: Biodegradable food packaging made from cassava starch and sugarcane bagasse
Thai Wah Pcl. Majority shares held by: ▪ Chang Fung Co., Ltd. ▪ Laguna Resorts and Hotels Pcl.	▪ Tapioca starch and starch-related products ▪ Food products		✓	▪ Tapioca based biodegradable products for local and international distribution

Source: BOI, companies' websites, public news

Thai Wah Group: The 1st Pioneer in Asia for Tapioca Based Bioplastics on a Commercial Scale

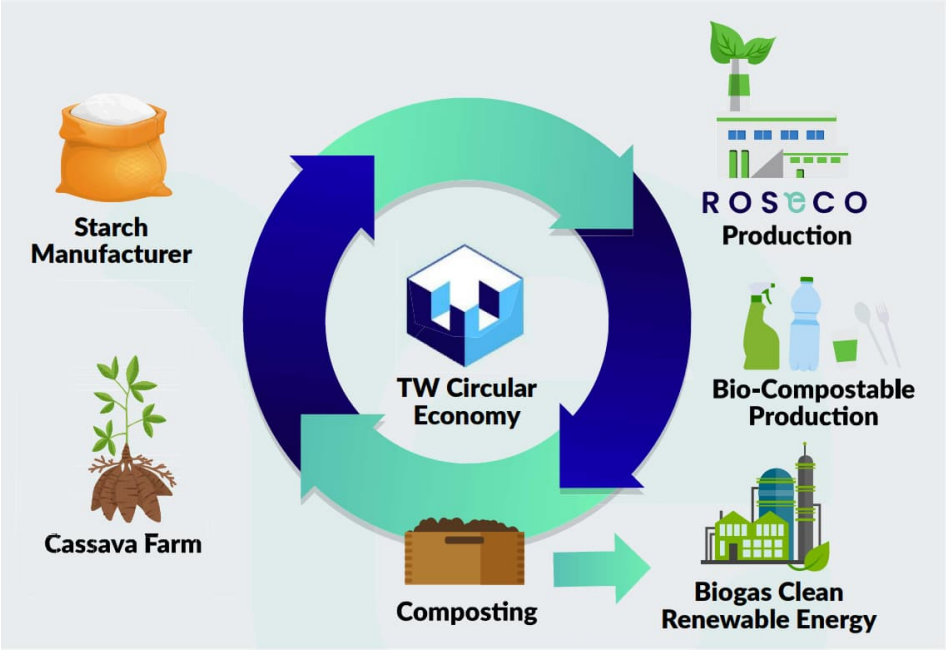
Thai Wah Group's Nature of Business

- The group's core businesses are categorized into 3 groups:

1) Manufacturing starch and starch related products (e.g., tapioca starch, glucose syrup, rice flour)
2) Food products (e.g., vermicelli, rice noodles, rice vermicelli, mung bean starch noodles)
3) Biodegradable products for local and international distribution

Tapioca-starch based Bioplastics by ROSECO

- As Thai Wah Group is a leading manufacturer of starch and starch related products, the company group has potential to expand its business to bioplastics as well.
- The main raw material for starch is cassava sourced from the farmers, which is also the raw material for bioplastics.
- In 2022, ROSECO, bioplastics products brand under Thai Wah group was established, aiming to add value to agricultural products.
- According to Thai Wah group's annual report in 2022, the group claims to be "*the first pioneer in Asia for Tapioca based bioplastics on a commercial scale*".
- "ROSECO" bioplastics plant is located in Rayong province, and in 2022 the bioplastics production was planned to be 3,000 tons.



- ROSECO Series has been innovated by Thai Wah group, consisting of tapioca-based thermoplastic starch resin, which can be used in various applications such as:
  - Organic waste bags
  - Shopping bags
  - Thermoform tray
  - Cutlery, Agricultural mulch film
  - Consumer goods etc.

Source: Thai Wah Group annual report (2022)
Pictures in this slide are retrieved from URL: *https://www.thaiwah.com/storage/downloads/products/biodegradable-products/20220314-twpc-roseco-ebook.pdf*

Future Trends, Challenges and Opportunities in the Bioplastics Industry in Thailand

Future Trends

Trends by Application

- The major application of bioplastics will be packaging, so the demand for bioplastics will grow continuously.
- There are more than 10,000 food & beverage processing companies in Thailand, which could drive the demand of food packaging and other related products in the food industry.

Potential Export Destinations

- European countries and the US are among those who are conscious about climate change and BCG.
- According to the Eurobarometer survey (2023), more than 90 percent of European citizens are "consciously making sustainable choices in their daily lives".
- Enormous brands in various industries in the EU have been introducing their bioplastics solutions. However, there is still a gap that companies in Thailand can attract similar brands and supply bioplastics components and solutions.

Challenges

Threat of Substitute due to the Price of Bioplastics

- The price of bioplastics is relatively higher than conventional plastics, so the adoption of bioplastics has been restrained by cheap petroleum-based alternatives.

New Entrants' Barrier due to Technological-Intensiveness

- To penetrate this market, investors need to heavily invest in research and development for bioplastics products in order to gain competitive advantage among the players in the market.

Risks of Feedstock Supply and Cost Fluctuations due to Climate Change

- As mentioned in earlier slide, the main raw materials for bioplastics production in Thailand are agricultural feedstocks, including cassava and sugarcane, where production heavily relies on the weather and climate.
- Insufficient raw materials supply might occur due to drought and El Nino, which results in increasing costs.

Opportunities

- As the bioplastics industry is one of the government and BOI's target industries, Thailand offers various incentives and benefits, both tax and non-tax, to investors . Thus, investors can penetrate this market with lower initial investment costs.
- Potential new entrants can be various industry players along the supply chain, from agricultural feedstock producers to those manufacturing plastic components and products. For companies already operating in the plastic industry, it is considered easier for them to expand business into bioplastics, as they have already invested in the necessary equipment and know-how, which can be applied to bioplastics components and products
- For foreign investors, partnering with Thais having local known-how is easier to establish this business in Thailand, as well as to implement suitable strategies.