



# ***BIOFUEL AND BIOCHEMICAL***



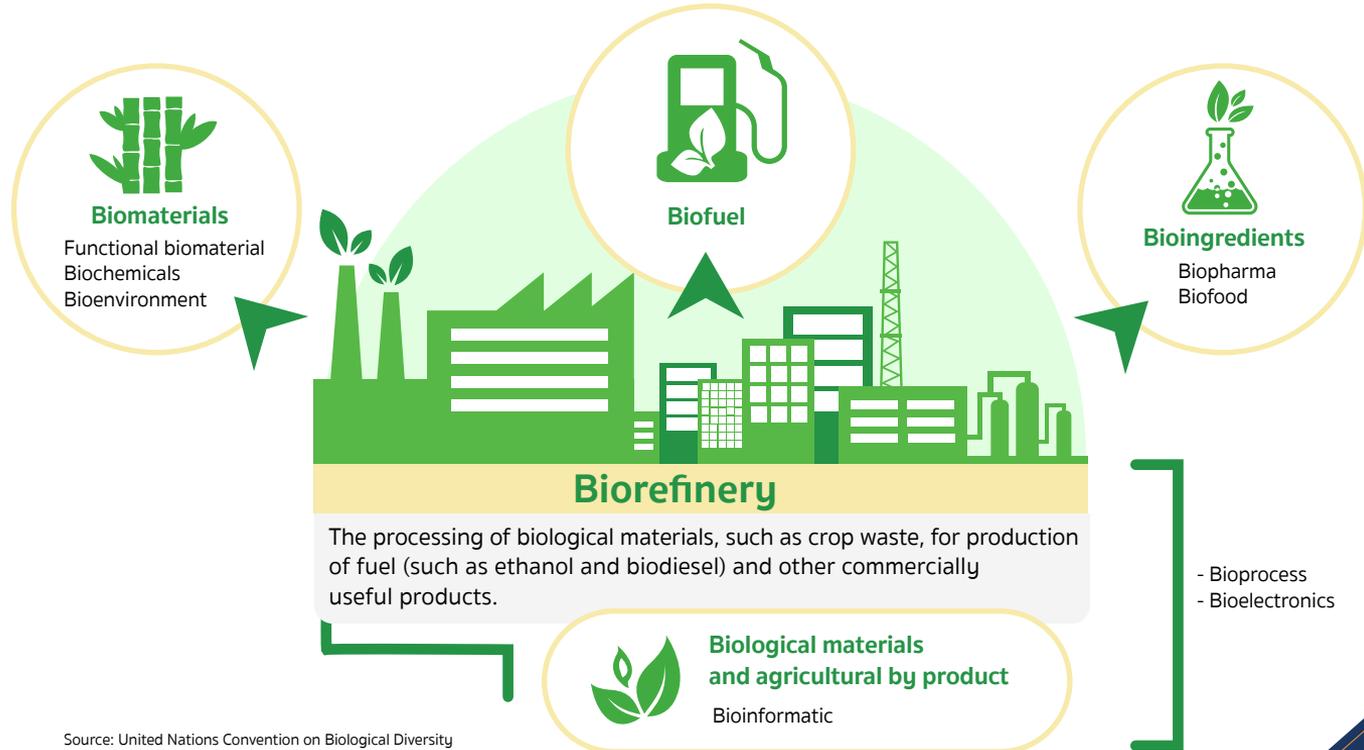
# BIOFUEL AND BIOCHEMICAL

## Understanding the Industry

The biofuel and biochemical industries can be allocated under the biotechnology activity umbrella.

- Biotechnology is defined as the use and exploitation of biological systems, living organisms or derivatives thereof, for product development and other industrial purposes.

- Global Market
- Industry in Thailand
- Investment Incentives in EEC
- Related Agencies



Source: United Nations Convention on Biological Diversity

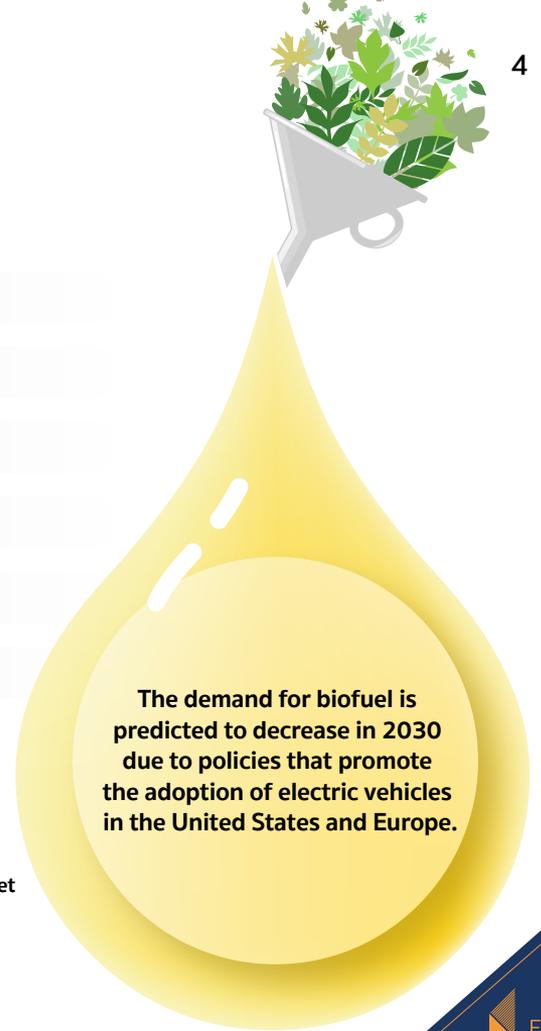
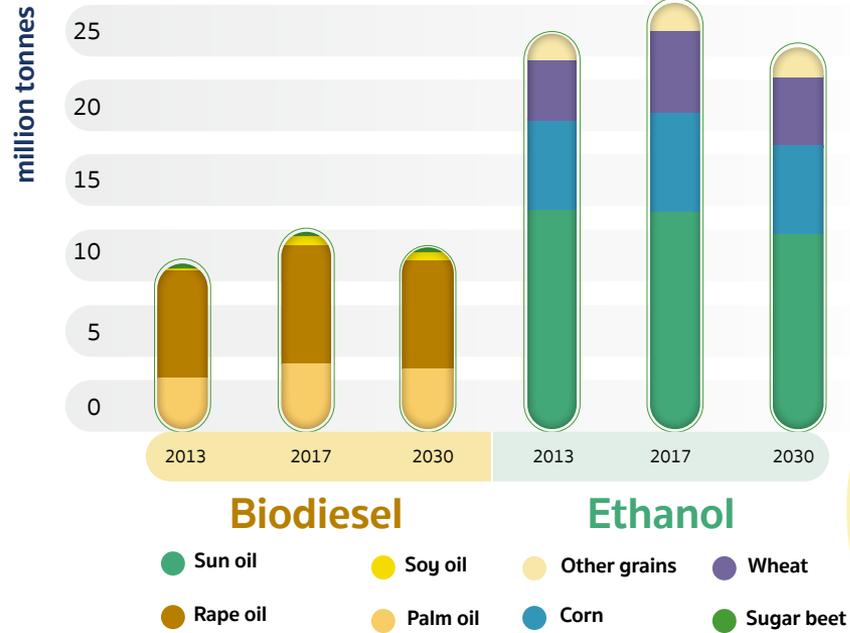
## Biofuel and Biochemical Products



Agriculture	Products	Industry	
		Types	Products
 <p><b>Sugar Cane</b></p>	Raw Sugar Refined Sugar Molasses Bagasse	Bio-fuels	Ethanol Biodiesel
		Bio-energy	Biogas Biomass Power
 <p><b>Tapioca</b></p>	Starch Tapioca Chips Modified Starch	Bio-chemicals	Lactic Acid Citric Acid Glycerine Sorbitol Lysine Olechemicals
			 <p><b>Palm Oil</b></p>

# BIOFUEL AND BIOCHEMICAL

## Biofuel: Global Demand Prediction



Source: Strategie Grains, Oilworld, PRIOR, Rabobank 2017

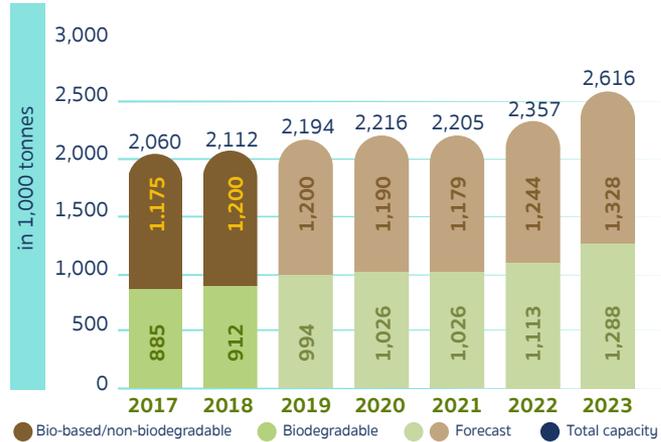
# BIOFUEL AND BIOCHEMICAL

## Biochemical: Global Bioplastic Production Prediction

The global capacity for bioplastics production is expected to expand from 2.11 million tons in 2018 to 2.61 million tons by 2023. Currently, over 50% of bioplastics production is taking place in Asia, making it a major production hub in the region.

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Global production capacities of bioplastics in 2018 (by region)



Total: 2.11 million tonnes



## Overview of the Thai Biodiesel Industry

Global Market

Industry in Thailand

Investment Incentives in EEC

Related Agencies



Crude palm oil producers in the global ranking

At present, the production of biodiesel in Thailand is mainly for domestic consumption, while the import of biodiesel remains under the control of the Department of Energy Business.



The commercial manufacture of biodiesel took off in Thailand in 2007. Since May 2017, the government has specified that B100 should be included in the diesel mix at a rate of 7%. The results was that biodiesel consumption has steadily expanded over time.

## Timeline Biodiesel Blend in Thailand



# BIOFUEL AND BIOCHEMICAL

## Biodiesel Production in Thailand



There are total 14 biodiesel production plants in Thailand

Feedstock	No. of Plant	Installed Capacity
CPO + Other Feedstock	4	2.11
Palm Stearin + Other Feedstock	7	2.93
RBDPO + Palm Stearin + PFAD	3	1.20

Unit: Million Liters / Day

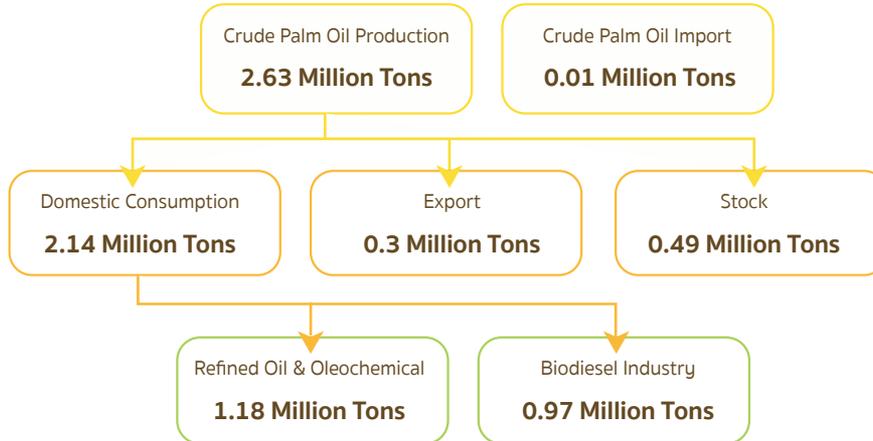
Global Market

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Related Agencies

### Thailand's Biodiesel Balance



- ★ CPO + Other Feedstock
- Palm Stearin + Other Feedstock
- RBDPO + Palm Stearin + PFAD

## Overview of Thailand's Biochemical Industry

Global Market

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Related Agencies



Cassava

**Export<sup>1</sup>**  
**Quantity** = 10 Million tons/Year  
**Value** = \$ 2.3 Million<sup>1</sup>  
 According to National Innovation Agency (NIA) research, using cassava starch as a feedstock for bioplastic products is 30% cheaper than using corn starch.

Cassava Pellets  
 Chip Native Starch  
 Sago Modified Starch



Sugarcane

**Export<sup>2</sup>**  
**Quantity** = 6 Million tons/Year  
**Value** = \$ 2.3 Million  
 Bioplastic production processes consumes only 54,000 tons of sugar per year which is less than 1% of the total export. Moreover, the processing of sugarcane to produce bioplastics creates almost 10-times value added benefits.<sup>3</sup>

Raw Sugar  
 White Sugar

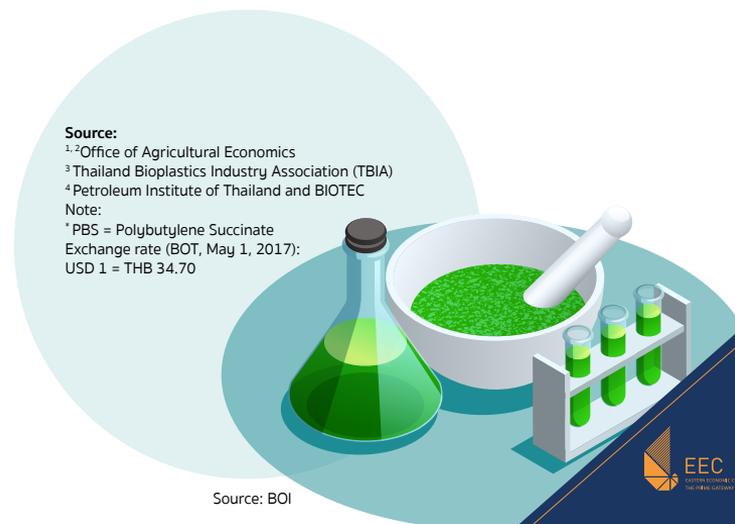
6X -15X  
 Value Added

Ethanol	Biogas	Biomass	Lactic Acid
1,058 million liter/years <sup>4</sup>	1,523 million liter/years <sup>4</sup>	2,321 MW <sup>4</sup>	330,000 tons/year <sup>4</sup>
Citric Acid	Sorbitol	Lysine	PBS*
15,000 tons/years <sup>4</sup>	43,000 tons/years <sup>4</sup>	47,000 tons/years <sup>4</sup>	20,000 tons/years <sup>4</sup>

The biochemical industry contributes significantly to the Thai economy as it is able to add substantial value to raw agriculture products.

For instance, the conversion of sugarcane into polylactide (PLA) can increase its value at least sevenfold, and the conversion of sugarcane and cassava to bioplastic can triple or quadruple their values.

**Source:**  
<sup>1,2</sup>Office of Agricultural Economics  
<sup>3</sup>Thailand Bioplastics Industry Association (TBIA)  
<sup>4</sup>Petroleum Institute of Thailand and BIOTEC  
 Note:  
 \* PBS = Polybutylene Succinate  
 Exchange rate (BOT, May 1, 2017):  
 USD 1 = THB 34.70

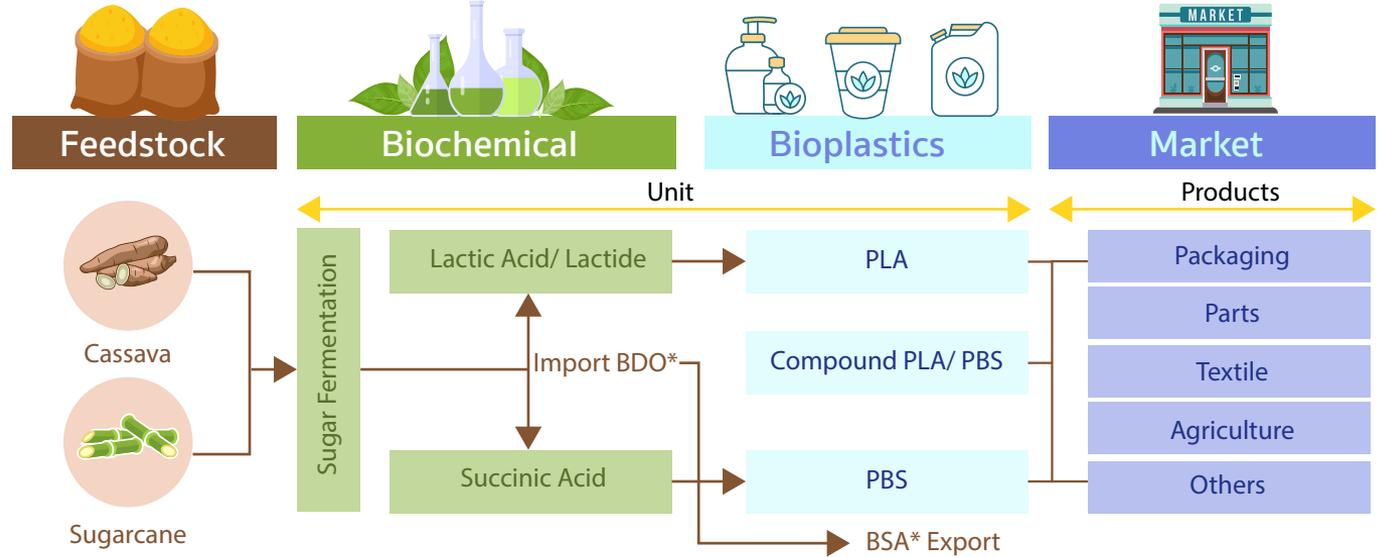


Source: BOI

# BIOFUEL AND BIOCHEMICAL

## The Process of Bioplastics Production in Thailand

- Global Market
- Industry in Thailand
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### Other by-products from Production Processes



Note: BDO = Bio-base 1,4-Butanediol; BSA = Succinic Acid Source: Petroleum Institute of Thailand and BIOTEC

# BIOFUEL AND BIOCHEMICAL

## Strong Supply Chain of Bioplastics Production

Global Market

Industry in Thailand

Investment Incentives in EEC

Related Agencies



- The first PBS Bioplastic plant in the world
- 2<sup>nd</sup> PLA Producer in the world
- 2<sup>nd</sup> largest exporter of plastic in ASEAN
- 14<sup>th</sup> largest exporter of plastic in the world

### Biomonomers

ptt GLOBAL CHEMICAL

Corbion purac

MTR PHOL GROUP

### Biopolymers

TOTAL

Corbion purac

### Bioplastic Converters

Ingredion.

NatureWorks

BAG  
BAGS AND GLOVES CO., LTD.

HMC Polymers  
A Hesse Admitted Company  
an associate of PTSC, a subsidiary

POLYPLEX

UNI  
Polimer  
CERAMISERIN POLYMER  
IND. TECHNOLOGY CORP.

kuraray

Source: Petroleum Institute of Thailand

# BIOFUEL AND BIOCHEMICAL

## Cooperative Funding to Bioplastics Research and Development

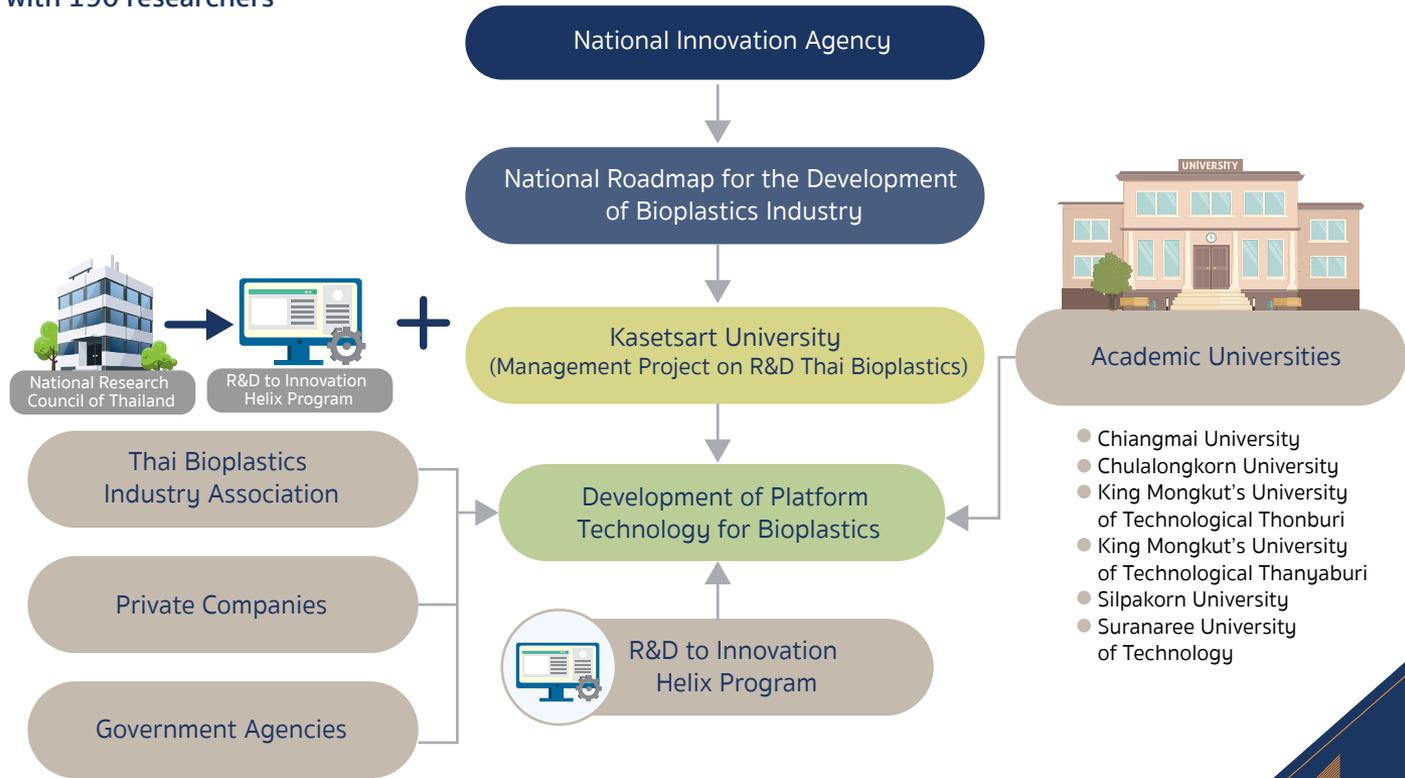
Building strong technology capability as R&D cluster of 2 research institutes and 15 universities with 190 researchers

Global Market

Industry in Thailand

Investment Incentives in EEC

Related Agencies



## Investment incentive package for investment projects in the Eastern Economic Corridor (2020-2021)

Global Market

Industry in Thailand

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Related Agencies

Key features	Investment Incentives	Targeted activities			
		Section 8	A1	A2	A3
1. Standard tax package	Tax holidays	10 Years (no cap)	8 Years (no cap)	8 Years	5 Years

### Human resource development programs (additional tax incentives)

2. Investment projects which are engaged in human resource development programs	Tax holidays	2 Years (no cap)	-	-	-	
	50% reduction of CIT	-	3 Years	3 Years	3 Years	

### Projects located in the four promoted zones for specific industries (EECi, EECd, EECA and EECmd) OR industrial estates and promoted industrial parks

3. Investments located in EECi, EECd, EECA and EECmd	Tax holidays	1 year (no cap)	-	-	-	
	50% reduction of CIT	-	2 Years	2 Years	2 Years	

### OR

3. Investments located in industrial estates and promoted industrial parks.	Tax holidays	1 year (no cap)	-	-	1 Year	
	50% reduction of CIT	-	-	-	-	

### Remarks:

- A1 : Knowledge-based activities focusing on R&D and design to enhance the country's competitiveness.
- A2 : Infrastructure activities for the country's development, activities using advanced technology to create value-added, with no or very few existing investments in Thailand.
- A3 : High technology activities which are important to the development of the country, with a few investments already existing in Thailand.
- Section 8 : Technology and Innovation Development includes targeted core technology development such as development of biotechnology, nanotechnology, advanced materials technology and digital technology.

### New investment promotion measure in EEC

- Starting January 2, 2020

According to the announcement of the Board of Investment No.2/2563, announced on January 15th, 2020,

- Applications must be submitted by the last working day of 2021.

- Projects located in the four promoted zones for specific industries (EECi, EECd, EECA and EECmd) are eligible for the incentives without application deadline.

# BIOFUEL AND BIOCHEMICAL

Global Market

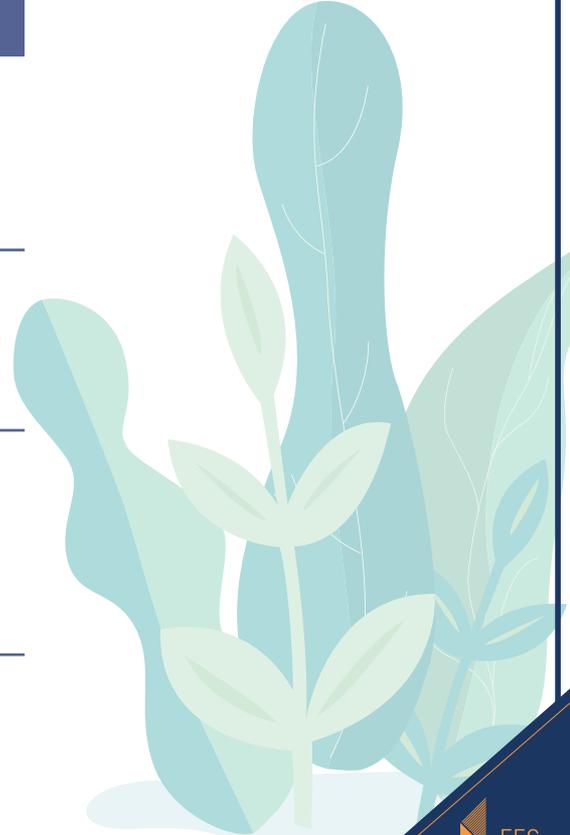
Industry in Thailand

Investment Incentives in EEC

Related Agencies

Industry Types	Producers
Bio-fuels	    
Bio-energy	    
Bio-chemicals	    
Bio-plastics	

Source: Petroleum Institute of Thailand



Global Market

Industry in Thailand

Investment Incentives in EEC

Related Agencies

## Examples of Bioplastic Producers



Product : Bio Degradable Bag



Product : Shopping Bags, Plastic Packaging, Plastic Bottles and Utensils



Product : Housewares, Furniture, Film, and Rigid Packaging



Product : Nonwovens, Food Packaging, Durables, Apparel and Films



Product : Resin, Films, Fibers, and Dental Material



Product : Bottle, Films, Sheets and Extrusion Coating



Product : Hot Stamping Foil, Flexible Air Conditioning Ducts, and Book Lamination

## Associations and Institutions



Global Market

Industry in Thailand

Investment Incentives in EEC

Related Agencies

## Research Centers



Center of Excellence on Petrochemical and Materials Technology, Chulalongkorn University



Bioplastics Research Unit, Prince of Songkla University



Cassava and Starch Technology Research Laboratory, Kasetsart University



Department of Biotechnology, Faculty of Science, Mahidol University



Faculty of Science, Burapha University



Faculty of Engineering and Industrial Technology, Silpakorn University



Faculty of Science, King Mongkut's Institute of Technology Ladkrabang



Faculty of Science and Technology, Thammasart University

