THAILAND’S BIOPLASTICS INDUSTRY
INDUSTRY OVERVIEW

Worldwide consumption of bioplastics has increased more than 600% in the past decades and expected to reach 40% market share of global plastics market in 2030. This remarkable growth is resulted from the global trend of environmental awareness. That is why 66% of global respondents are willing to pay more for bio product.

Governments around the world also ramp up with this trend. Bangladesh is the first country in the world to ban the lightweight plastic bags in 2002. European Union also plans to ban plastic bags across the EU by 2020. This is a bright future of bioplastics investment that has been increased around the world in the past few years as well as in Thailand. The country’s largest energy company PTT just invested nearly 2 billion on the bioplastics and bio-based production in 2016. These gigantic movements have tremendous effect to world in order to become bio-based community.

With more sophisticated materials, applications, and products emerging, the global production capacity of bioplastics is forecasted to grow by 50 percent, from 4.2 million tons in 2016 to roughly 6.1 million tons in 2021.

Global Production Capacities of Bioplastics

<table>
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<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total:</td>
<td>3,952</td>
<td>4,156</td>
<td>4,392</td>
<td>4,728</td>
<td>4,865</td>
<td>5,964</td>
<td>6,111</td>
</tr>
</tbody>
</table>

Asia will continue as a major production hub. In 2021, it is expected that more than 45 percent of bioplastics will be produced in Asia, and a quarter of the global production capacity will be based in Europe.

Global Production of Bioplastics in 2016 (By region)

<table>
<thead>
<tr>
<th>Region</th>
<th>%</th>
<th>Total: 4.16 million tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asia</td>
<td>43.4</td>
<td></td>
</tr>
<tr>
<td>Europe</td>
<td>27.1</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>5.9</td>
<td></td>
</tr>
<tr>
<td>0.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source:
1 Ceresana Consulting; Worldwide consumption of biodegradable plastics from 2000-2008
2 Energy and Gold Ltd.
3 Green Peace
4 Marrickville Council
5 Deal Street Asia

Source: 1, 2 European Bioplastics, Nova Institute (2016)
THAILAND: THE HUB OF BIOPLASTICS

As a land of agriculture, Thailand enjoys competitive advantages in the bioplastics industry. The richness of biomass, materials supply, research driven resources, strong downstream industry demand, and supporting government policy have created significant bioplastic business opportunities in the country. Thailand is also ASEAN’s second largest exporter of plastic products after Singapore, and ranked 14th in the world in 2016.1

Thailand is one of the top agricultural countries in the world with main crops such as rice, rubber, sugar cane, cassava, palm oil etc. The export value of the agricultural raw material is approximately USD 20 billion.1

Moreover, Thailand has the necessary workforce and supporting organizations to encourage a vibrant agricultural products. Currently, Thailand has 1,440 plant breeders and seed technologist, and over 143 industry experts and researchers in agriculture industry.2

Thailand’s Bioplastics Value Chain

Agricultural Feedstock

Thailand is the world’s largest cassava exporter (60% market share), the world's second largest sugar exporter (51+ sugar factories).1

Biopolymers

Thailand is the world’s major lactic acid producer with capacity of 330,000 tons/year.2

Bioplastics Converters

Thailand has more than 3,000 local plastics converters which are ready to develop their machines or adjust their production processes to serve the bioplastics market.

Sugarcane & Cassava Domestic Production3

[In Million Tons]

Source:
1 Ministry of Commerce
2 The National Center for Genetic Engineering and Biotechnology (BIOTEC)
3 Office of Agricultural Economics
Note:
Exchange rate (BOT, May 1, 2017): USD 1 = THB 34.70

Source:
1 SCB Economic Intelligence Center
2 Petroleum Institute of Thailand
3 Plastics Institute of Thailand
Note:
* BDO = Bio-base 1,4-Butanediol; BSA = Bio Succinic Acid;
PBS = Polybutylene Succinate; PLA = Polyactic Acid;
Thailand is a top exporter of raw materials used to produce bioplastics goods. Therefore, producing bioplastic products in Thailand will provide strong advantages in reducing the conversion cost and ensure supply continuity.

**Biomonomers**

The number of biomonomer production plants in Thailand increases in the past few years resulted from a strong support and attractive incentives from the government. Thailand presents a unique combination of all the attributes necessary to be a successful site for biochemical and bioplastics production which together makes Thailand is the most attractive locations for the biomonomer hub.

**Proposed Biochemical: Production Capacity in 2016**

<table>
<thead>
<tr>
<th>Biomonomers</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bio-BDO*</td>
<td>45,000 tons/year</td>
</tr>
<tr>
<td>BSA**</td>
<td>34,000 tons/year</td>
</tr>
<tr>
<td>Lactic Acid</td>
<td>330,000 tons/year</td>
</tr>
</tbody>
</table>

**Examples of Biomonomer producers in Thailand**

- **CASSAVA**
  - Cassava Pellets
  - Chip Native Starch
  - Sago Modified Starch

- **SUGARCANE**
  - Raw Sugar
  - White Sugar

<table>
<thead>
<tr>
<th>Biomonomers</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethanol</td>
<td>1,058 million liter/years</td>
</tr>
<tr>
<td>Biogas</td>
<td>1,523 million liter/years</td>
</tr>
<tr>
<td>Biomass</td>
<td>2,321 MW</td>
</tr>
<tr>
<td>Lactic Acid</td>
<td>330,000 tons/year</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Biomonomers</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citric Acid</td>
<td>15,000 tons/years</td>
</tr>
<tr>
<td>Sorbitol</td>
<td>43,000 tons/years</td>
</tr>
<tr>
<td>Lysine</td>
<td>47,000 tons/years</td>
</tr>
<tr>
<td>PBS*</td>
<td>20,000 tons/years</td>
</tr>
</tbody>
</table>

Source:

1. Office of Agricultural Economics
2. Thailand Bioplastics Industry Association (TBIA)
3. Petroleum Institute of Thailand and BIOTEC
4. Mitr Phol Group

Note:

* PBS = Polybutylene Succinate

Exchange rate (BOT, May 1, 2017): USD 1 = THB 34.70
Bioplastics Converters

With world-class standards, Thailand is ASEAN’s second largest exporter of plastic products after Singapore, and ranked 14th in the world in 2016.¹ With over 3,000 plastics converters, Thailand is also very well-established in the downstream industries with the capability to produce a wide range of products, as those converters can adjust production processes to make goods from bio-plastics, for example, bioplastics bag, biodegradable box, etc.

Thailand is the best production hub with world-class quality product and standard serving domestic, regional and global demands. The country’s top destination of bioplastics products export are including the European Union, the United States, and Japan.

Thailand’s Biopolymer Industry Ranking¹

<table>
<thead>
<tr>
<th>Rank</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>The first PBS bioplastic plant in the world</td>
</tr>
<tr>
<td>2nd</td>
<td>PLA Producer in the world*</td>
</tr>
</tbody>
</table>

The Global Leading Biopolymer Manufacturers in Thailand

Total and Corbion are joining forces to produce and market polyactic (PLA) polymers. The two partners plan to modify the existing plant in Rayong to build a world-class PLA polymerization plant with a capacity of 75,000 tons per year. This development plant will be operating in 2018. Total-Corbion investment is approximately USD 100 million.

PTTMCC is a strategic joint venture between PTT Public Company Limited (PTT) and Mitsubishi Chemical Corporation (MCC). The joint venture produces and sells Polybutylene Succinate (PBS) with a total production capacity of 20,000 tons per year. The plant started commercial operations in 2017.

Examples of Bioplastics Converters in Thailand

- BAG
- Multibax
- M.D. Synergy
- PolyOne
- REANGWA STANDARD
- THANAWAN INDUSTRY PLC.
- Tobi
- Wandee Panich Industry

Source:
¹ International Trade Center

Note:
* The plant is expected to commercial operation in 2018
WHY INVEST IN THAILAND?

Security of Supply

Thailand’s rich natural resources have solidified the country’s reputation as the leading global supplier of agriculture products such as cassava, sugarcane and palm oil. These commodities, as well as their waste byproducts, can be utilized as biomass which is a critical source for bioplastic products.

1st  Cassava Products Exporter in the world

2nd  Sugar Exporter in the world

Strategic Location

Situated at the best location in Asia, Thailand has the perfect location connected to 3 billion people in Southeast Asia, China and India with world-class infrastructure provided. Suvarnabhumi Airport will accommodate 60 millions passengers while Laem Cha-bang deep sea port will reach 18 TEUs capacity annually when finish their third phase expansion.

Skilled and Ready Workforce

Thailand is equipped with quality researchers and experts covering every process of bioplastics production. More than 1,500 biotechnology experts and researchers work actively on the R&D in the industrial sector. With more than 3,000 plastic converters, Thailand has over 360,000 workers to serve the bioplastics industry.

Strong Government Support

Thailand is making a tremendous effort to be the “Bio Hub” of Southeast Asia. To achieve the plan The government’s Action Plan for Technology Solutions for Climate Change: the Adaptation of the Agricultural Sector (2015-2024) which is the first important step to help sustain country’s agricultural industry and lift up the quality of raw material as well as farmer’s life quality which will continuously impact the whole agricultural and bioplastics value chain. The first investment phase puts $1.44 billion in Rayong area which later will expand to Khon Kaen.

Note:
* Compound Annual Growth Rate (2011-2015)

Source:
Ministry of Commerce

1 Office of Higher Education Commission
2 Plastics Institute of Thailand
SUPPORTING FACILITIES

To provide continuous support in improving the investment environment for bioplastics investors, the government, in collaboration with educational institutions, research centers, and the private sector is offering various resources for research and development, human resource training as well as dedicated bioplastics related faculties in over 20 leading academic institutions.

Associations and Institutions

<table>
<thead>
<tr>
<th>Institution</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plastics Institute of Thailand</td>
<td>Promotes and enhances the Thai plastics industry’s competencies through R&amp;D and product testing services.</td>
</tr>
<tr>
<td>National Science and Technology Development Agency</td>
<td>Supports R&amp;D in 5 target areas, including agriculture and food, energy and environment, health and medicine, bioresources and community, and manufacturing and service industries.</td>
</tr>
<tr>
<td>National Metal and Materials Technology Center (MTEC)</td>
<td>Creates and enhances capabilities in materials technology of both governmental and private sectors through R&amp;D.</td>
</tr>
<tr>
<td>Thai Bioplastics Industry Association</td>
<td>Assists in the development of the Thai Bioplastics industry to reach international standards and promotes networking within the Bioplastics community.</td>
</tr>
<tr>
<td>National Innovation Agency</td>
<td>Supports R&amp;D of innovative products and embeds the innovative strategic direction of firms.</td>
</tr>
<tr>
<td>Biodiversity-Based Economy Development Office (Public Organization): BEDO</td>
<td>Supports and promotes the bio-based economy and enhances value-added bio product of the country.</td>
</tr>
<tr>
<td>National Center for Genetic Engineering and Biotechnology</td>
<td>Supports R&amp;D, policy research, and international relations in agricultural, biomedical and environmental sciences.</td>
</tr>
<tr>
<td>Thailand Institute of Scientific and Technological Research</td>
<td>Promotes and enhances innovations in science and technology R&amp;D capabilities for commercialization and social benefits.</td>
</tr>
</tbody>
</table>

Research Centers

<table>
<thead>
<tr>
<th>Center</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Center of Excellence on Petrochemical and Materials Technology</td>
<td>Chulalongkorn University</td>
</tr>
<tr>
<td>Bioplastics Research Unit</td>
<td>Prince of Songkla University</td>
</tr>
<tr>
<td>Cassava and Starch Technology Research Laboratory</td>
<td>Kasetsart University</td>
</tr>
<tr>
<td>Department of Biotechnology</td>
<td>Faculty of Science, Mahidol University</td>
</tr>
<tr>
<td>Faculty of Science</td>
<td>Burapha University</td>
</tr>
</tbody>
</table>
INVESTMENT INCENTIVES

BOI Incentives

BOI recognizes the importance and value of the bioplastics industry, and offers a wide range of tax and non-tax incentives for projects that meet national development objectives.

Non-Tax Incentives

These activities also receive the following non-tax incentives:

| Permit to bring in expatriates | Permit to own land | No restriction on foreign currency |

| Tax Incentives

Bioplastics

<table>
<thead>
<tr>
<th>GROUP</th>
<th>ELIGIBLE ACTIVITIES</th>
<th>INCENTIVES</th>
</tr>
</thead>
<tbody>
<tr>
<td>A2</td>
<td>Manufacture of eco-friendly chemicals or polymers or manufacture of products from eco-friendly chemicals or polymers that is incorporated within the same project as the manufacture of eco-friendly chemicals or polymers</td>
<td>8 years</td>
</tr>
<tr>
<td>A3</td>
<td>Manufacture of products from eco-friendly polymers</td>
<td>5 years</td>
</tr>
<tr>
<td>A4</td>
<td>Manufacture of paper container coated with bio-plastics</td>
<td>3 years</td>
</tr>
</tbody>
</table>

Note:
* Exemption of import duty on machinery and raw or essential materials used in manufacturing export products
OFFICE OF THE BOARD OF INVESTMENT
555 Vibhavadi-Rangsit Road, Chatuchak, Bangkok 10900
Tel: +66 (0) 2553-8111
Fax: +66 (0) 2553-8315
Website: www.boi.go.th

ONE START ONE STOP INVESTMENT CENTER (OSOS)
18th Floor, Chamchuri Square Building, 319 Phayathai Road, Pathumwan, Bangkok 10330
Tel: +66 (0) 2209-1100
Fax: +66 (0) 2209-1199
Website: osos.boi.go.th
Email: osos@boi.go.th

REGIONAL INVESTMENT AND ECONOMIC CENTER 1
CHIANG MAI OFFICE
Airport Business Park, 108-110, 90 Mahidol Road, Amphur Muang, Chiang Mai 50100
Tel: +66 (0) 5329 4100
Fax: +66 (0) 5329 4199
Email: cmmai@boi.go.th

REGIONAL INVESTMENT AND ECONOMIC CENTER 2
MAKINON RATCHASIMA
241/22 Mitraphap Road, Amphur Muang, Makinon Ratchasima 20000
Tel: +66 (0) 4348 4200
Fax: +66 (0) 4348 4299
Email: kmrai@boi.go.th

REGIONAL INVESTMENT AND ECONOMIC CENTER 3
KHON KAEN
Taksin MCB 17, Mitraphap Road, Amphur Muang, Khon Kaen 40000
Tel: +66 (0) 4327 1100-2
Fax: +66 (0) 4327 1103
Email: knkk@boi.go.th

REGIONAL INVESTMENT AND ECONOMIC CENTER 4
CHONBURI
36 Moo 12, East Chabang Industrial Estate, Sukhumvit Road, Toongwarkul, Sriracha, Chonburi 20230
Tel: +66 (0) 3840 4990
Fax: +66 (0) 3840 4997
Email: chonburi@boi.go.th

OVERSEAS OFFICES
SHANGHAI
Thailand Board of Investment, Shanghai Office
Royal Thai Consulate General, No.18, Wanshan Road, Changning District, Shanghai 200040, P.R. China
Tel: +86-21-3560-8876, +86-21-3560-8877
Fax: +86-21-3560-8873
Email: shanghai@boi.go.th

BEIJING
Thailand Board of Investment, Beijing Office
Royal Thai Embassy, No.21 Guanghua Road, Chaoyang District, Beijing, 100600, P.R. China
Tel: +86-10-8531-8755 to 8757, +86-10-8531-8753
Fax: +86-10-8531-8752
Email: beijing@boi.go.th

GUANGZHOU
Thailand Board of Investment, Guangzhou Office
Royal Thai Consulate General, No.36 Youhe Road, Royal Thai Embassy, 8th Floor, Fukuda Building West, 1-9-16 Kyutaro-Machi, Chuo-Ku, Osaka 541-0056, Japan
Tel: +81 (0) 6-6721-1384
Fax: +81 (0) 6-6721-1383
Email: tyo@boi.go.th

TAIPEI
Thailand Board of Investment, Taipei Office
Taipei World Trade Center, 2nd Floor, Room 3E 39-40, 18th Floor, Chamchuri Square Building, 319 Phayathai Road, Pathumwan, Bangkok 10330
Tel: +86-22-2204-1589-90
Fax: +86-22-2204-1525
Email: taipei@boi.go.th

MUMBAI
Thailand Board of Investment, Mumbai Office
Express Tower, 12th Floor, Barrister Ranil Patel Marg, Nariman Point, Mumbai, Maharashtra 400001, P.O. Box 120, Mumbai 400001
Tel: +91-22-2204-1589-90
Fax: +91-22-2204-1525
Email: mumbai@boi.go.th

NEW YORK
Thailand Board of Investment, New York Office
7 World Trade Center, 24th Floor, Suite F, 250 Greenwich Street, New York, New York 10007, U.S.A.
Tel: +1 (0) 212 422 9009
Fax: +1 (0) 212 422 9115
Email: newyork@boi.go.th

STOCKHOLM
Thai Board of Investment, Stockholm Office
Stureplan 4C, 4th Floor, 114 35 Stockholm, Sweden
Tel: +46 (0) 8463 1158, +46 (0) 8463 1174-75
Fax: +46 (0) 8463 1160
Email: stockholm@boi.go.th

SYDNEY
Thailand Board of Investment, Sydney Office
Suite 1010 The Centre, 650 George Street, Sydney, New South Wales 2000, Australia
Tel: +61-2-9252-4882
Fax: +61-2-9252-4882
Email: sydney@boi.go.th

Head Office
555 Vibhavadi-Rangsit Road, Chatuchak, Bangkok 10900
Tel: +66 (0) 2553-8111
Fax: +66 (0) 2553-8315
Website: www.boi.go.th

CONTACT US