

2022.9.29

# Business Presentation: Films Business

TOYOBO CO., LTD.

Representative Director & Co-COO & CTO

Head, Films and Functional Materials Solutions Division

Chikao Morishige

## I . Positioning of the Films Business

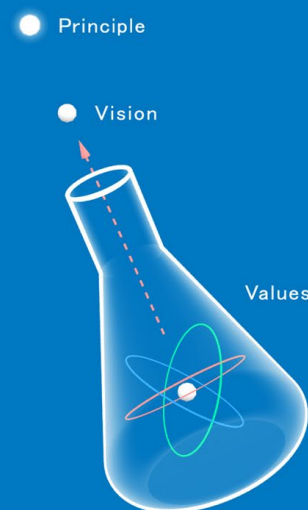
## II . Environmentally Conscious Films Business

## III . Films Business for the Digital Society

## IV . Future Development

## V . Appendix

### Corporate Philosophy System TOYOBO PVVs



#### Principle

“Jun-Ri-Soku-Yu”  
Adhering to reason leads to prosperity

#### Vision

We will continue to create the solutions needed by people and the earth with our materials and science.

#### Values

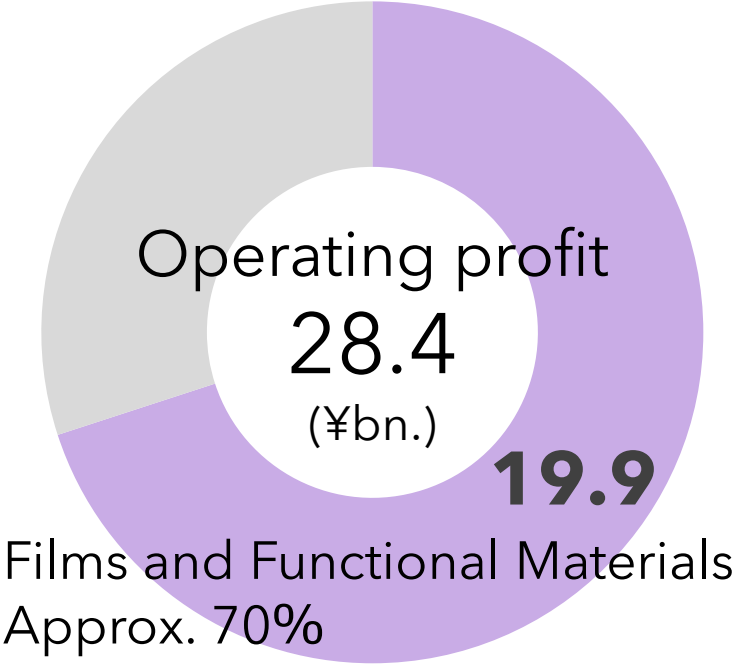
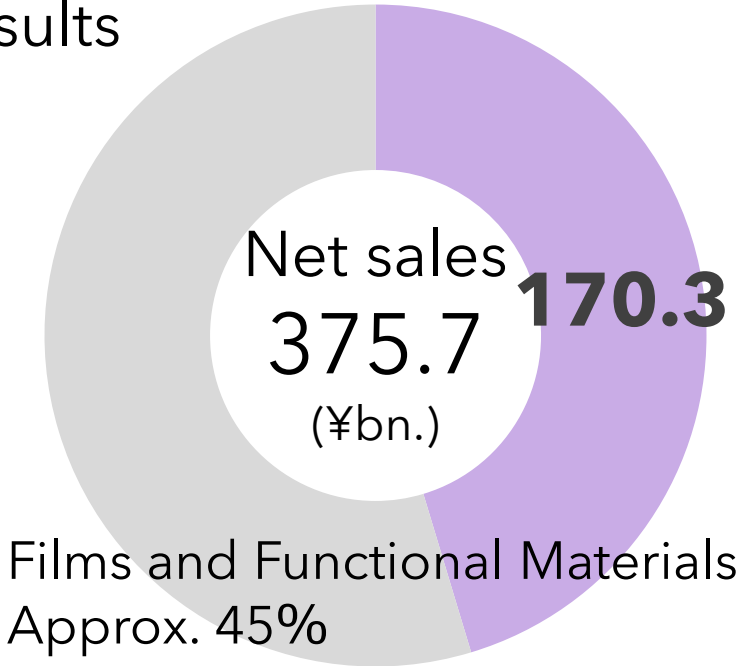
We welcome change, enjoy change, and create change.  
TOYOBO Spirit:  
Challenge, Reliability, Collaboration

# **I . Positioning of the Films Business**

# Positioning of the Films Business within the TOYOBO Group



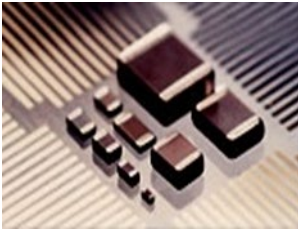
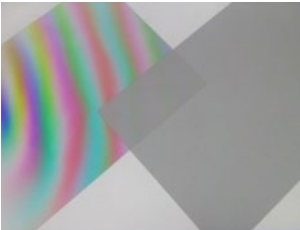
## FY 3/22 Results



### Packaging film



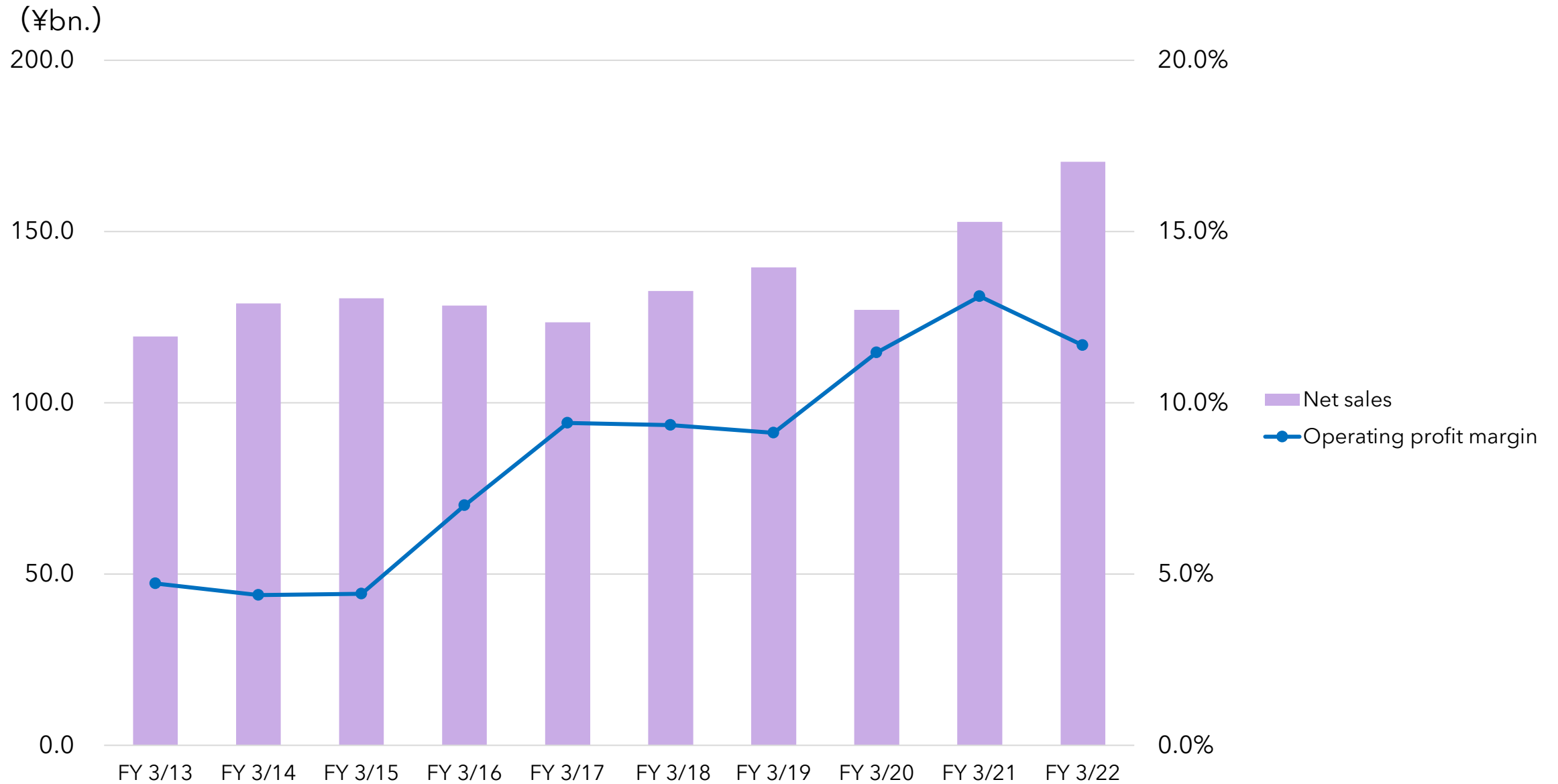
### Industrial film



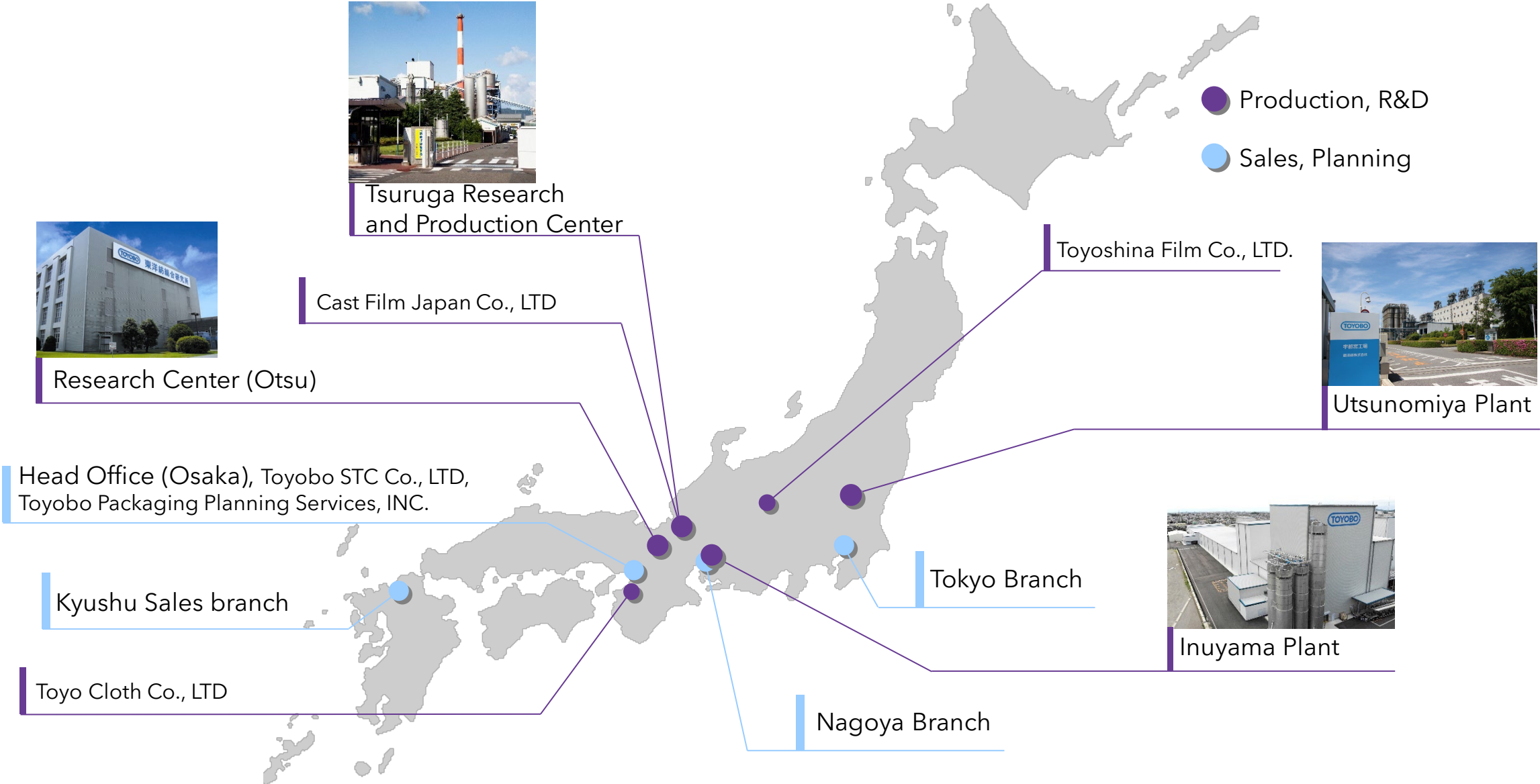
### Functional materials



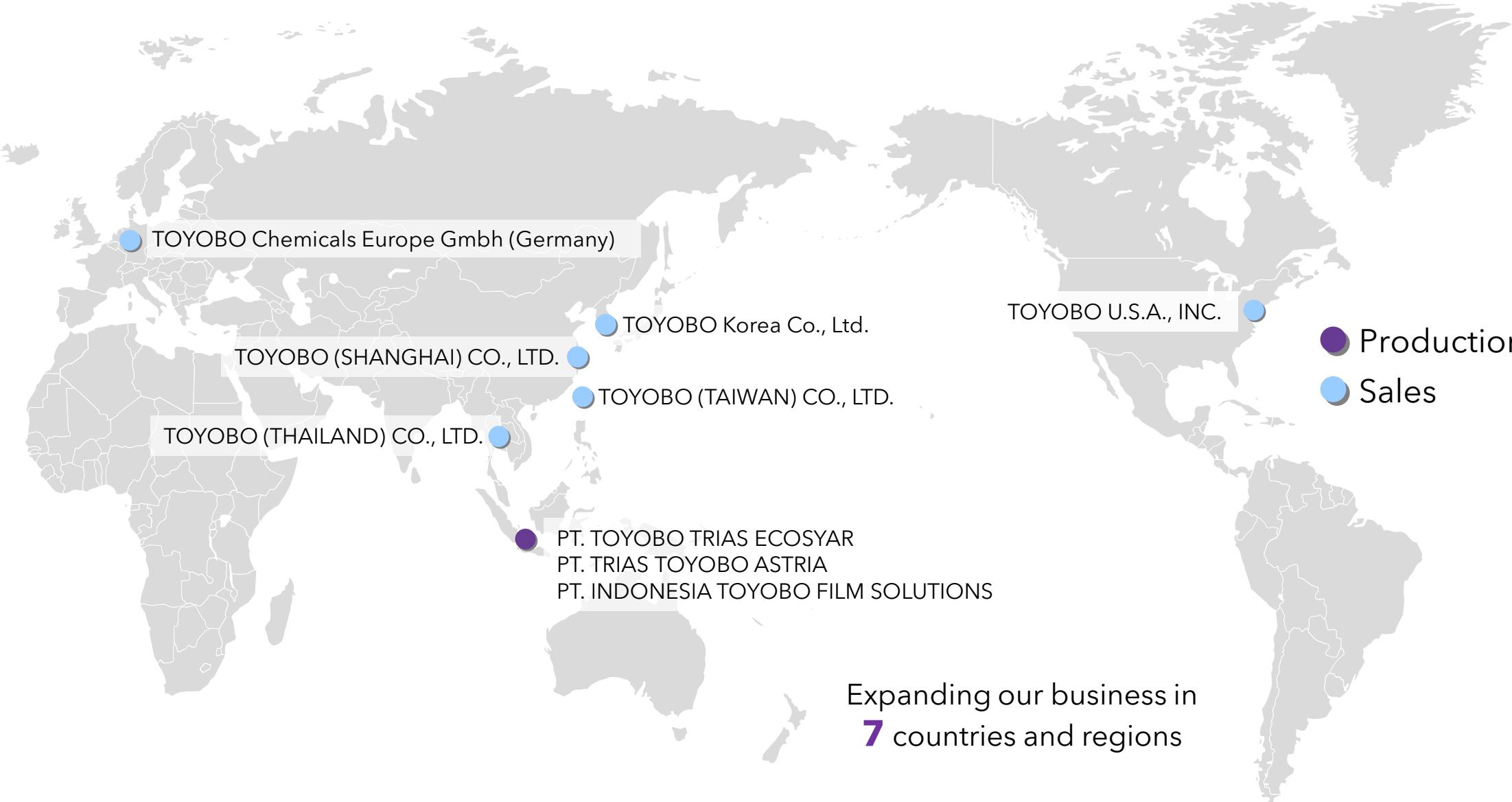
# Change in Net Sales and Operating Profit Margin of the Films and Functional Materials Business



# Films Business Bases in Japan



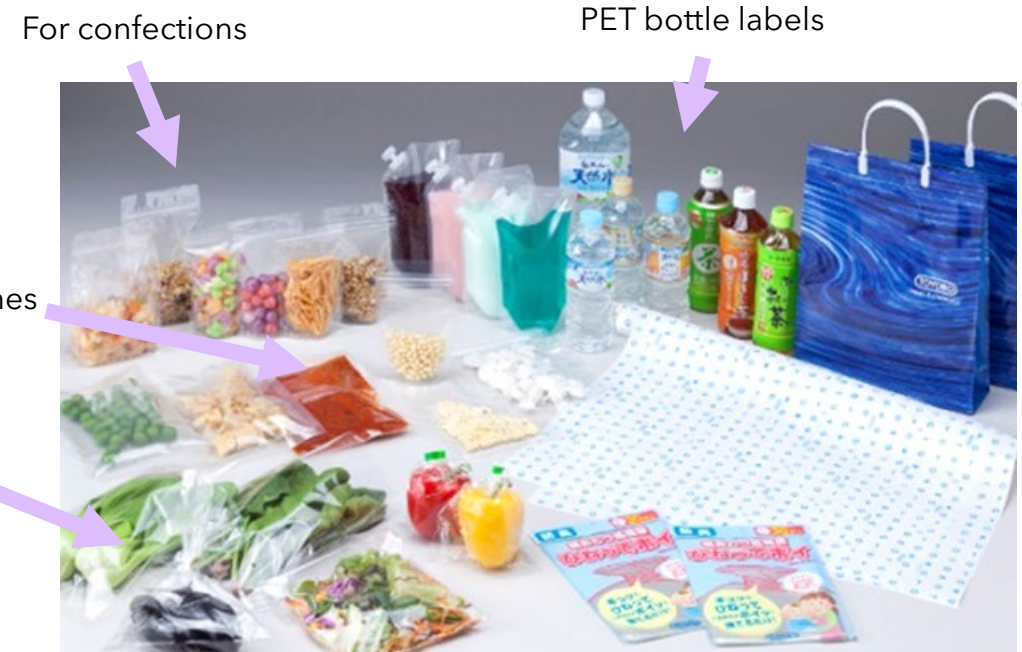
# Films Business Overseas Bases



Expanding our business in **7** countries and regions

## Packaging Film

- Possesses multiple materials, and achieves multiple functions
  - Polyester (Ease of cutting)
  - Nylon (Tear-resistant)
  - Polypropylene, Polyethylene (Sealing ability) etc.
- Applications: **Food** packaging films, laminating films for cans, etc.
- Share: **Top share overall in Japan** (TOYOBO's estimate)



## Industrial Film

- Materials: Polyester, etc.
- Applications: **Polarizer protective films for LCDs**, Bases film for displays, PET based synthetic paper, Label films, **Mold releasing film for MLCC**, etc.



Polarizer protective films for LCDs

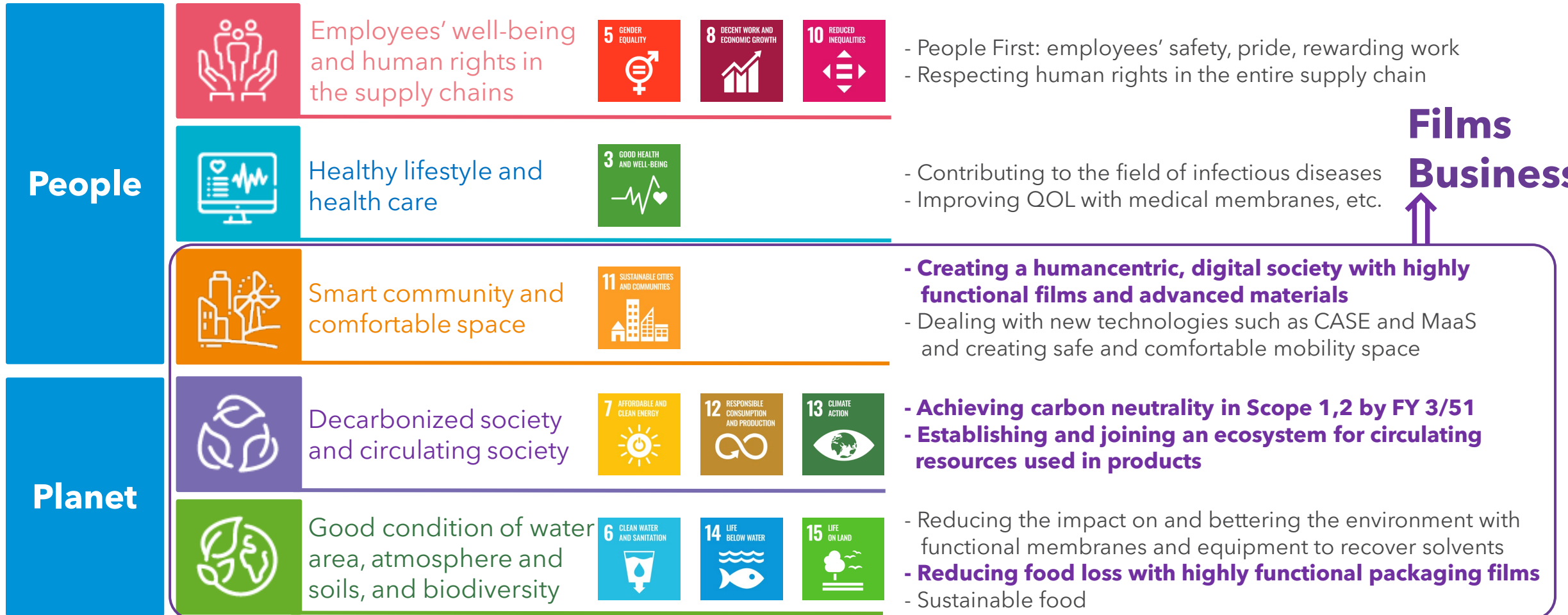


PET based synthetic paper



Vision : We will continue to create the solutions needed by people and the earth with our materials and science

## Relations between five social issues and SDGs



Films Business



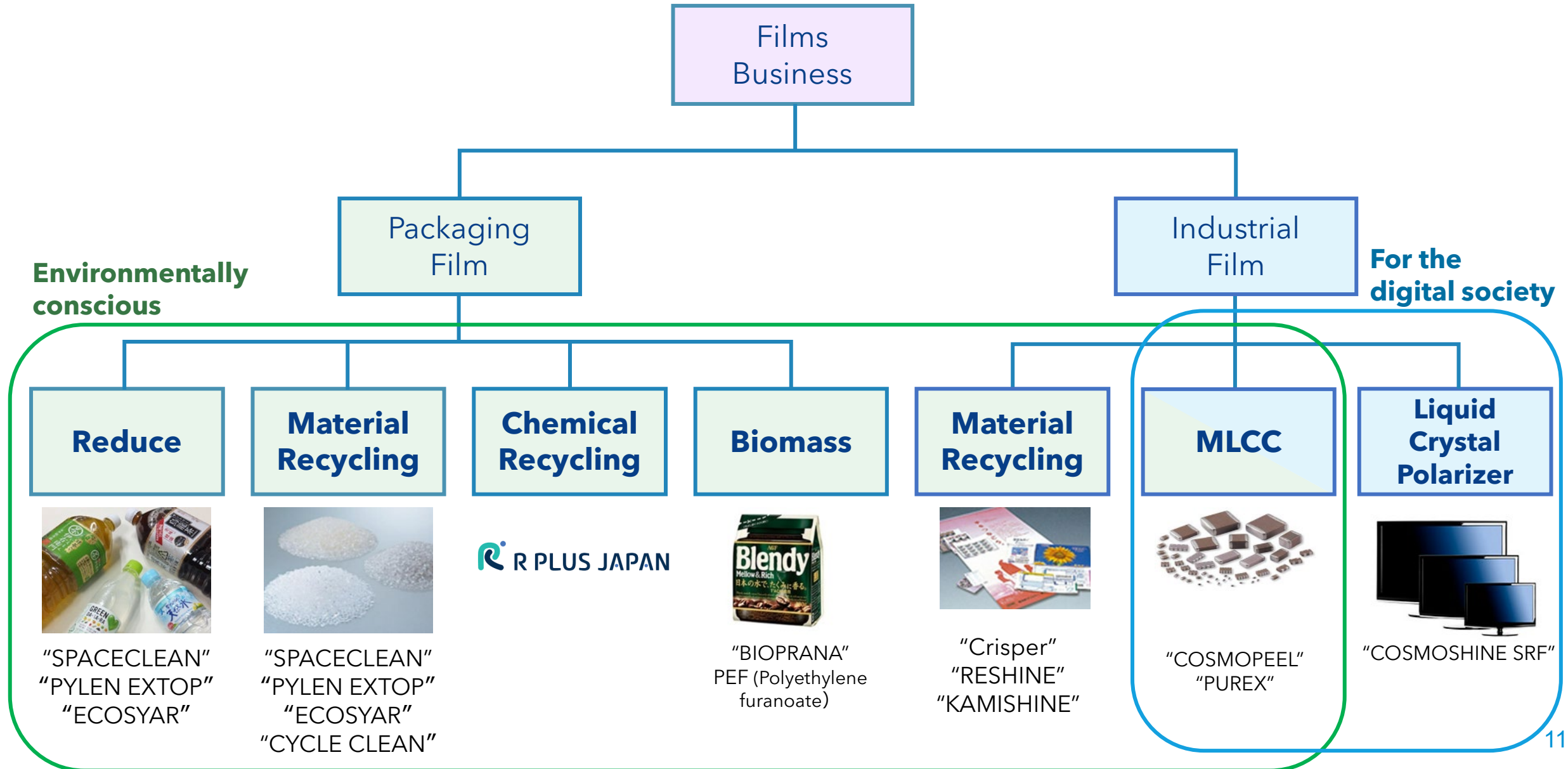
# Reorganization of the Business Portfolio

(from 2025 Medium-Term Management Plan)

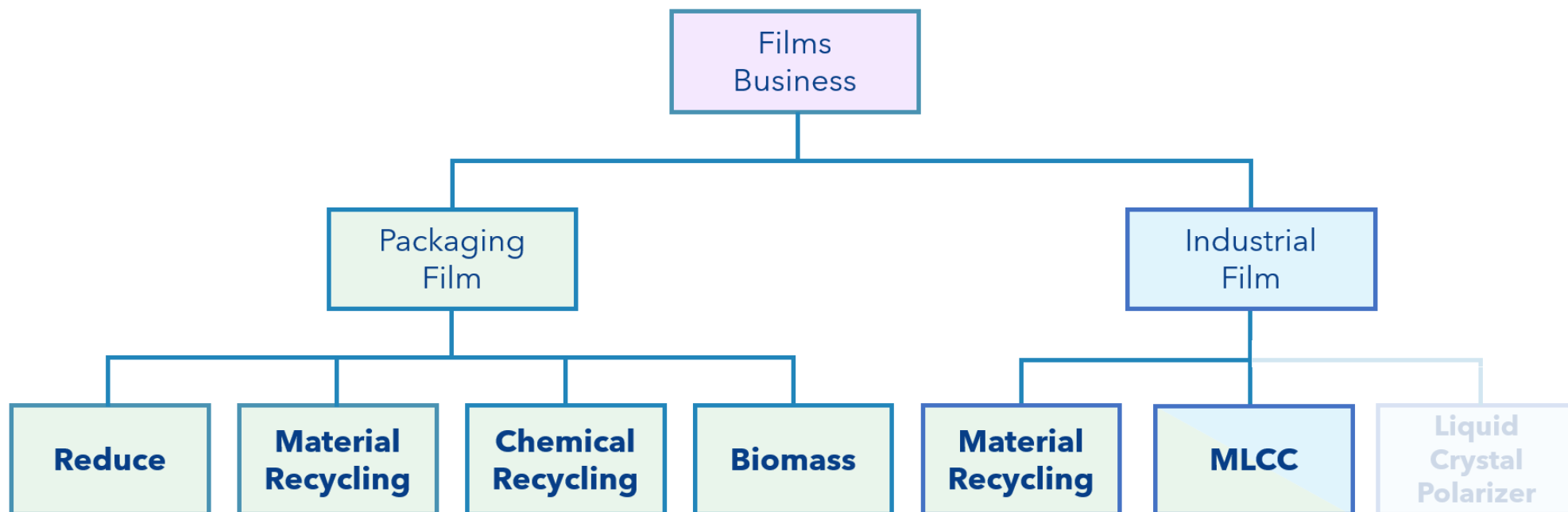
Assess and stratify each business into 4 quadrants with 2 axes: "Profitability" and "Growth potential"



# Key Products of the Films Business



## II . Environmentally Conscious Films Business



Market Summary  
CAGR 6 %



Source : Mordor Intelligence

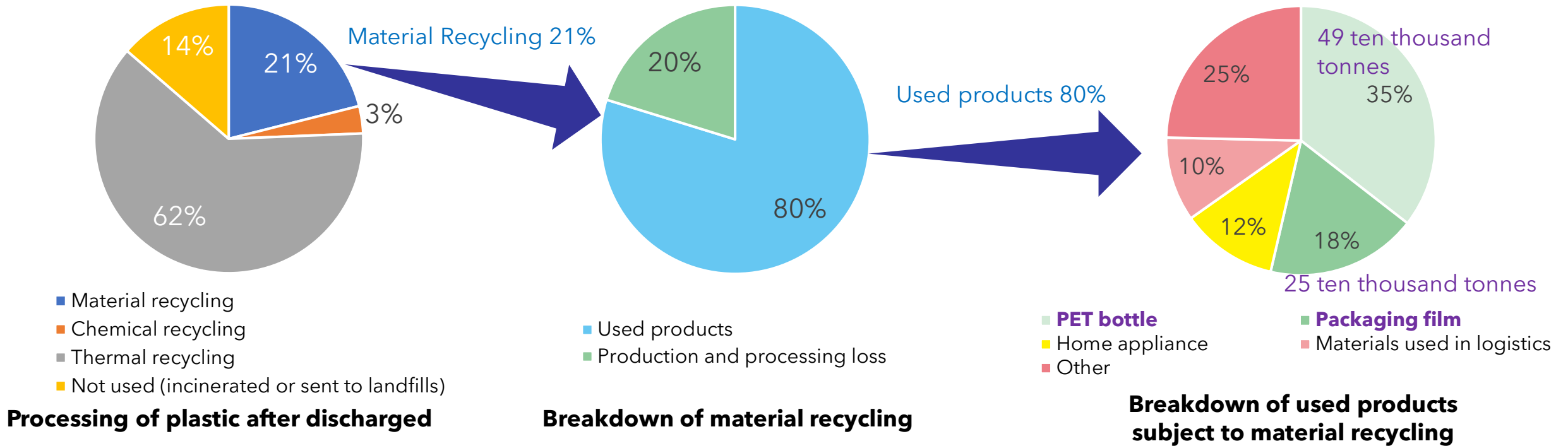


- Market: Expected **CAGR of 6% for the global packaging film market**
    - Demand for packaged food is increasing in China, India and other countries in the Asia-Pacific region
  - External environment:
    - ① **Global restrictions on resources and waste, and marine plastic issue**
      - Clean Ocean Material Alliance (CLOMA)  
Vision: Build a sustainable 3R system  
+ Manufacture, use and replace with plastic products that have a low environmental impact
    - ② **“Act on Promotion of Resource Circulation for Plastics”**  
was enforced from April 2022 (Ministry of Economy, Trade and Industry)
      - Act for promoting resource circulation by business operators and local governments in all processes from designing plastic products to manufacturing and reuse
- Concept of **a circular economy**:  
3Rs (reduce, reuse and recycle) + Renewable

# Current Situation regarding Plastic Recycling

- Amount of discharged plastic in Japan: 822 ten thousand tonnes (FY 3/21) From material the Plastic Waste Management Institute

**TOYOBO's film production ability: Approx. 25 ten thousand tonnes/year**



**Supply chains for packaging films**



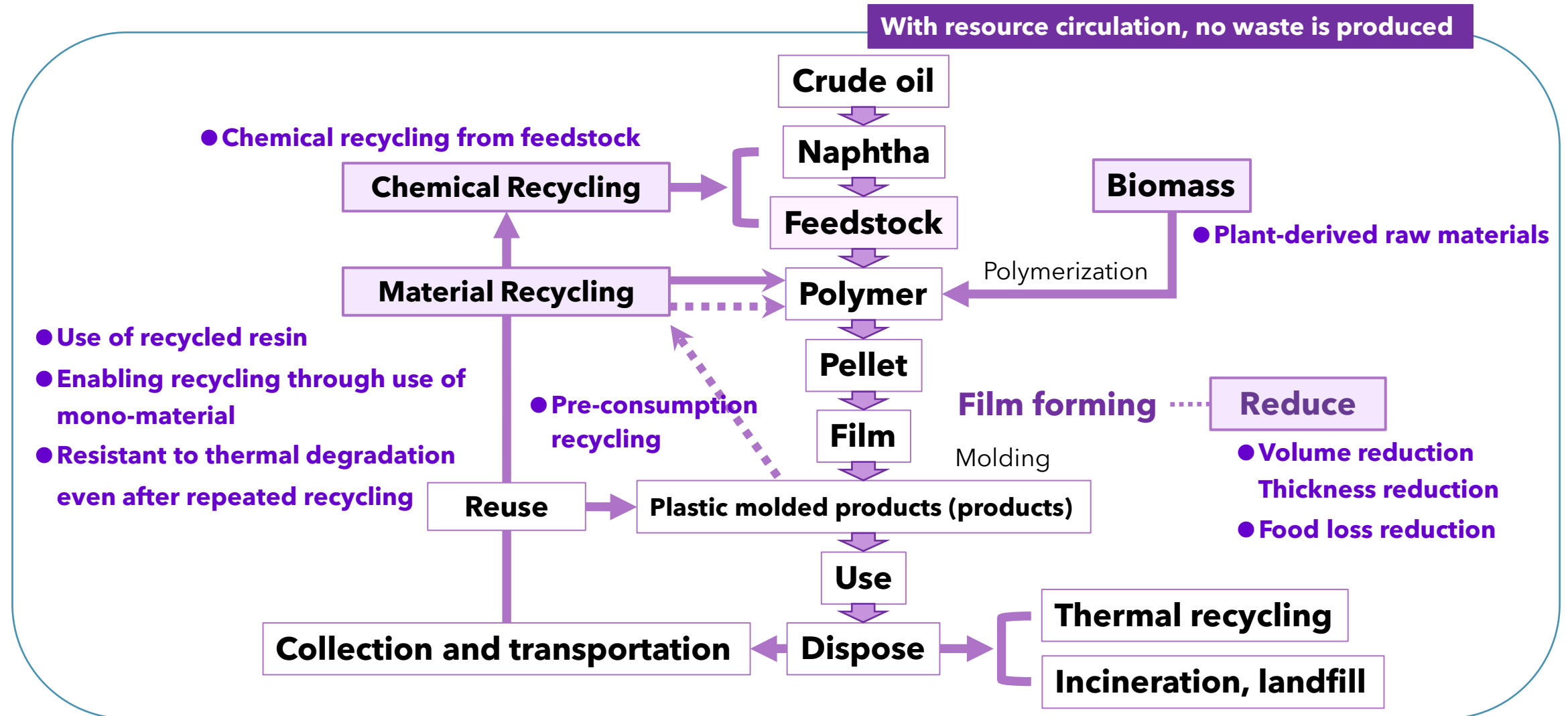
**Recycling initiatives throughout the entire supply chain**

# To Be the World's Leading Green Film Maker

The target greening rate of 60% in FY 3/31 and 100% in FY 3/51 (Biomass, Recycling, Volume reduction)

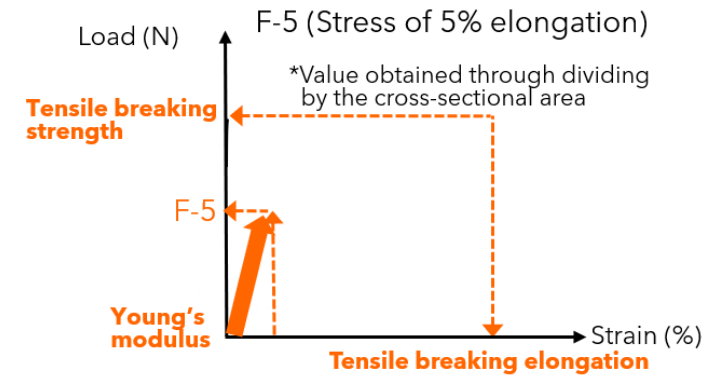
~ Aiming to realize "a symbiotic society with plastics," not a plastic-"free" society ~

With resource circulation, no waste is produced



## Ultra-highly rigid polypropylene film "PYLEN EXTOP"

- Rigidity approx. 1.7 times that of general biaxially oriented polypropylene films
    - ⇒ Possible 20% **thickness reduction**. Reduced waste due to **volume reduction**
    - ⇒ Possible to change to **mono-material**
  - Including lineup of high heat resistant type and defogging type
- **Start sales from fall 2022**



## High strength polyester thermal shrinking film "SPACECLEAN"

- Higher strength due to biaxial orientation
  - ⇒ Possible 20 $\mu$ m **thickness reduction** (approx. 40 $\mu$ m for typical products), and **volume reduction**
  - ⇒ Improved ease of cutting along perforated line due to unidirectional shrinkage
- Use of 25% recycled resin is possible



For customers' packaging materials that use our environmentally friendly films and are certified to **reduce the amount of plastic used by more than a certain amount compared to typical packaging**, we started a system for displaying our original "**Reduced Plastic**" mark to convey to consumers that the packaging was designed considering the environment.

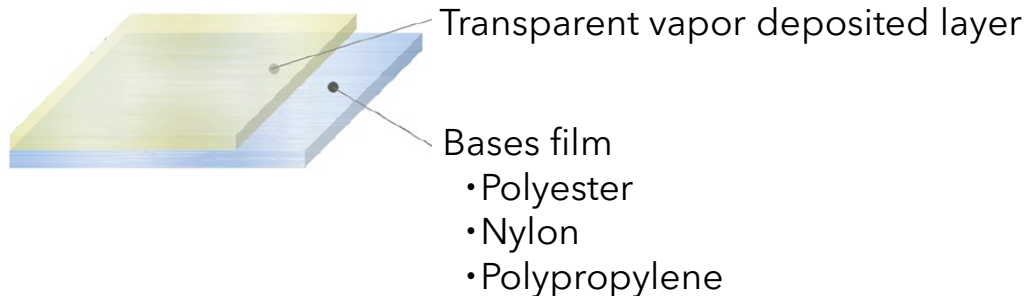
[Our strengths]  
Film forming technology  
High rigidity, high strength



## Transparent vapor-deposited film "ECOSYAR"

- Binary vapor deposition of alumina and silica.
- **Both flexibility and gas barrier property**
- **Extend food's best before date** with superior barrier properties.
- Transparent and microwave-safe.  
Possible for boil-in-bags and retort pouches.
- Does not contain chlorinated compounds and does not generate chlorine gas when incinerated
- Possible to change to **mono-material**

[Our strengths]  
Binary vapor deposition technology

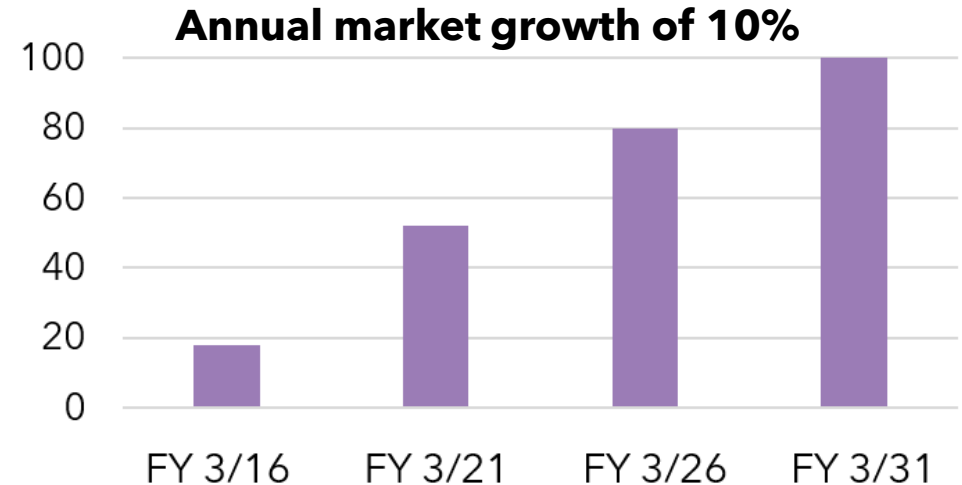


- **Polypropylene scheduled to go on sale in H1 FY 3/24**

## –ZERO HUNGER–



Demand is emerging for products that extend expiration dates and **reduce food loss** as countermeasures for food shortages. The barrier market is growing



Market of the Transparent vapor-deposited film  
(thousand tonnes / year)

Full-fledged operation of a plant in Indonesia, contributing to global demand

**Aiming for an increase in sales volumes in FY 3/31 of 4x compared to FY 3/21**

## Use recycled resin

### "CYCLE CLEAN"

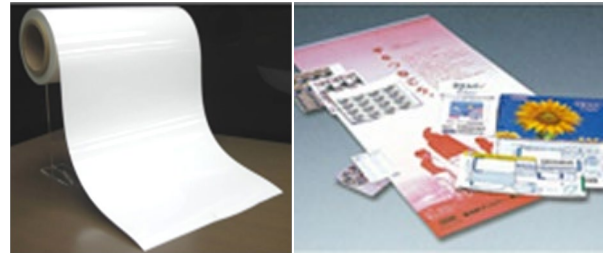
- Packaging film
  - Uses of 80% recycled resin
  - Same physical properties as regular polyester films
  - Reduces CO<sub>2</sub> emissions by approx. 24%
  - Also achieve a thickness reduction to a 12μm thickness



We are the only company in Japan producing and selling polyester films for food packaging applications domestically that contain recycled resin

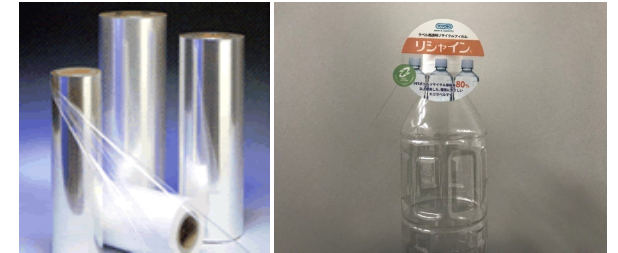
- Industrial film

- Uses of recycled resin from PET bottles
  - PET based synthetic paper ..... more than 25%
  - Transparent film for labels ..... over 50% - 80%
  - PET based synthetic paper for labels .... more than 25%



"Crisper"

Calendar  
Poster  
Cards etc.



"RESHINE"

### "Crisper"

### "RESHINE"

### "KAMISHINE"



"KAMISHINE"

Pop Labels  
Food Labels  
Frozen Food Labels etc.

## Uses plant-derived raw materials

“BIOPRANA”

- 20% are plant-derived polyester films
- Quality equivalent to general purpose polyester films
- Nylon and polypropylene also considered



[Our strengths]  
Film forming technology and  
polymerization technology

## Future Development

### 100% bio-based resin

PEF (Polyethylene furanoate)

- Polymerized bio-based ethylene glycol and **bio-based furandicarboxylic acid**  
(polyester is polymerized ethylene glycol and terephthalic acid. Furandicarboxylic acid has a similar structure to terephthalic acid)
- **Better barrier properties** than polyester films (10x vs. oxygen, 2x vs. water vapor, 4x vs. CO<sub>2</sub>)

Avantium Renewable Polymers: Plan to scale up furandicarboxylic acid monomers  
5,000 tonnes/year in 2024



### Polyester from 100% bio-based resin

- Paraxylene, the raw material for terephthalic acid, formed from non-edible woodchips
- PET bottles made from 100% plant-derived raw materials

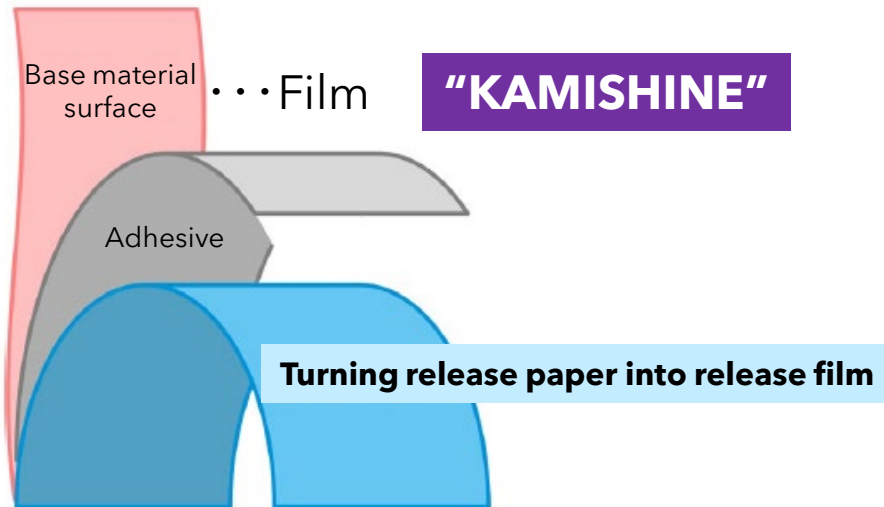
Helped the Suntory Group and Anellotech Inc. with their trialing and developing.



## Development of a film-type label release paper

**"KAMISHINE"  
mold releasing film**

[Our strengths]  
Coating Processing Technology



- Turning the release paper (label backing paper) into a film makes it recyclable

- Applications: Various labels

- Market: **The release paper market in Japan produces 116 million m<sup>2</sup> / month**

(approx. double the area of Tokyo's 23 Special Wards)

- Equivalent to approx. 7 ten thousand tonnes of "KAMISHINE" per year



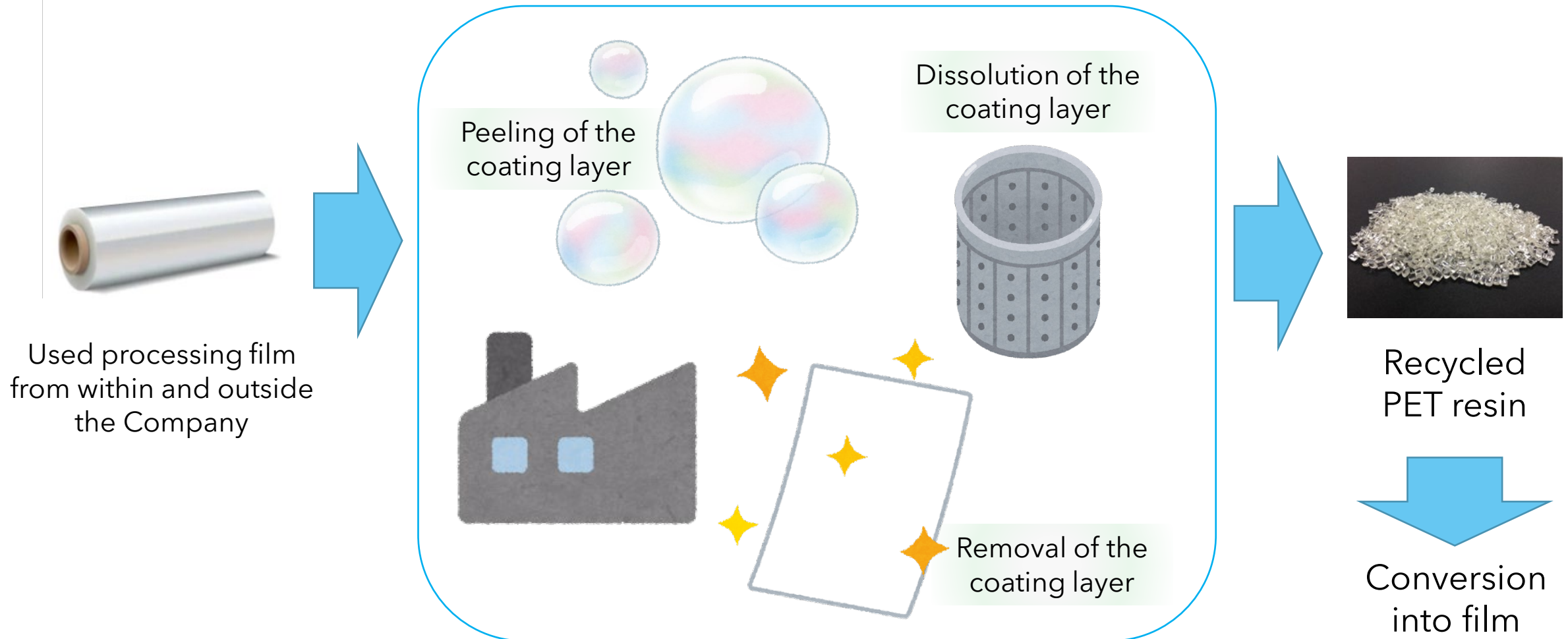
Cooperate with NEION Film Coatings Corp., TOPPAN INFOMEDIA CO., LTD., Shionogi Pharma Co., Ltd. and MITSUI BUSSAN CHEMICALS CO., LTD.

➤ Aiming to start sales in FY3/24

Part of the efforts by the Japan Partnership for Circular Economy (J4CE) jointly established by the Ministry of the Environment, Ministry of Economy, Trade and Industry, and Japan Business Federation (Keidanren)

## Recycling of mold releasing film for MLCC

- Recovery of used film from within the Company and from the market and recycling into new film
- Currently partially underway

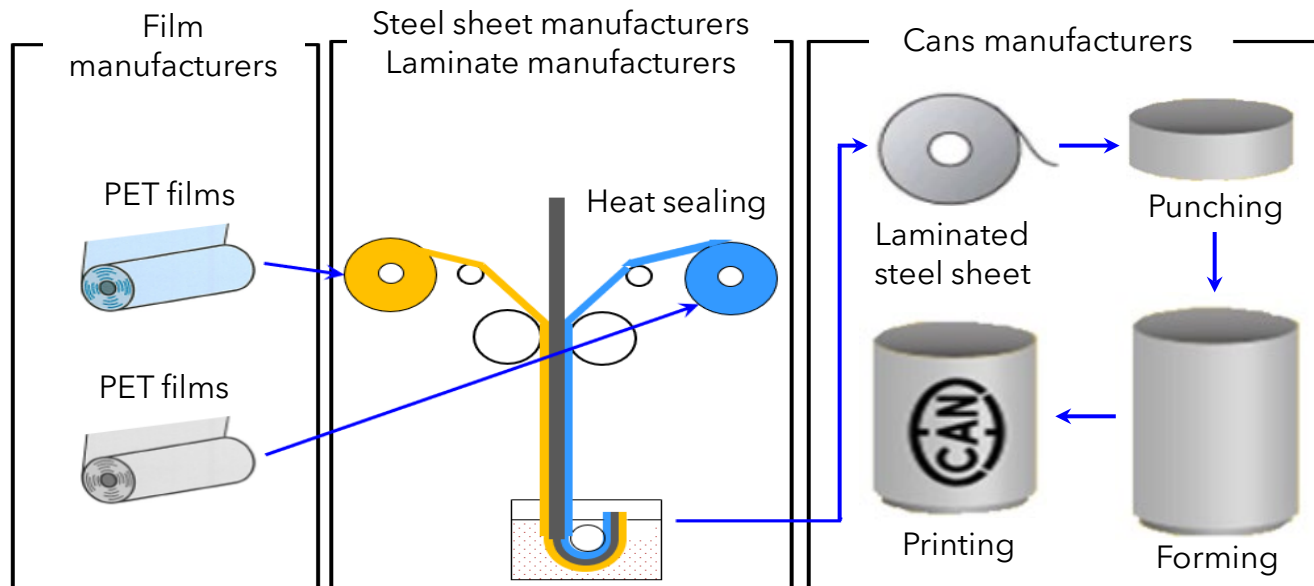


## Laminating Films for Cans

- Film lamination for both inside and outside of metal cans Polyester film
- **Uses film as substitute for paint. Environment friendly**, as this doesn't involve coating with paint
- Combines both laminability (adhesiveness) and formability towards steel sheets
- Market: **At least 95% of cans** in the food, beverage and aerosol (spray) can metal container market **use paint**  
Painting market has reached maturity  
Replace market of nearly 50 ten thousand tonnes / year with film, and promote **global expansion**

[Our strengths]  
Polymerization technology + Film forming technology

### ● Manufacturing processes



Aerosol cans

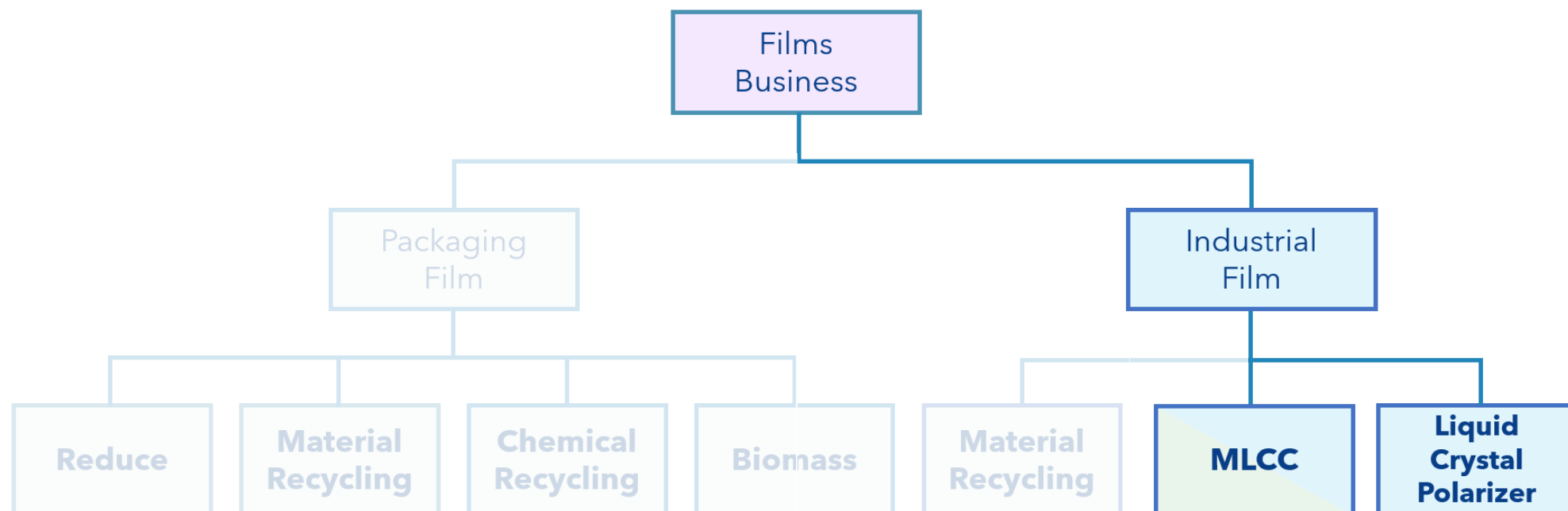


Food cans



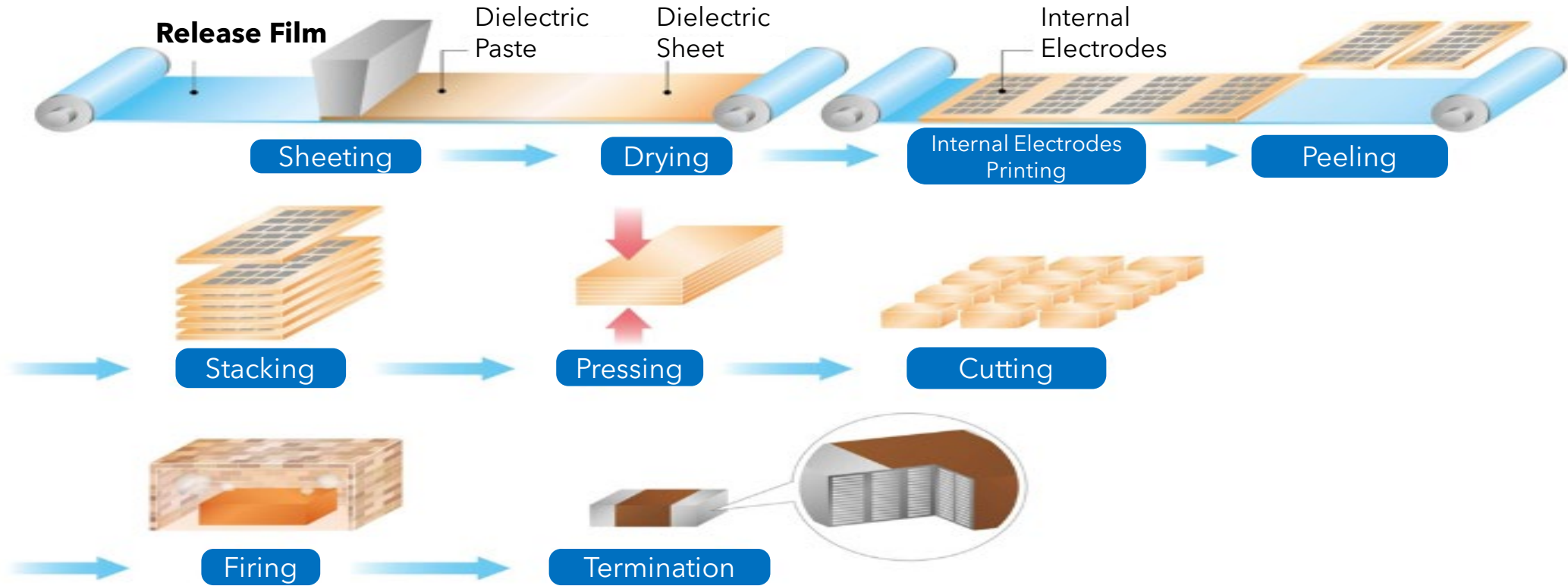
TULC cans

### III. Films Business for the Digital Society



- Polyester based releasing films used in MLCC manufacturing processes

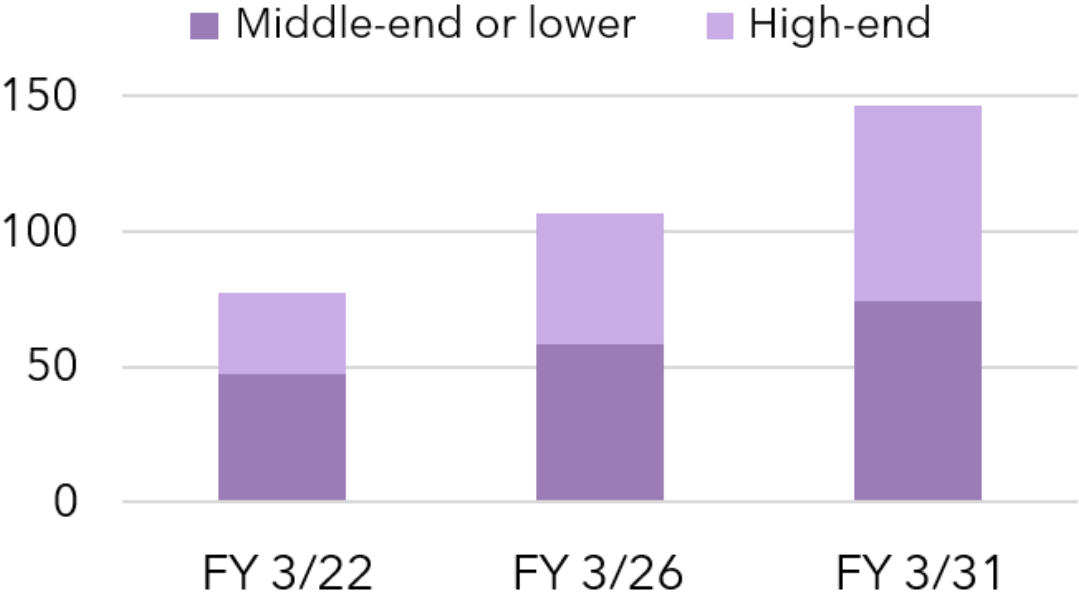
**"COSMOPEEL"** **"PUREX"**



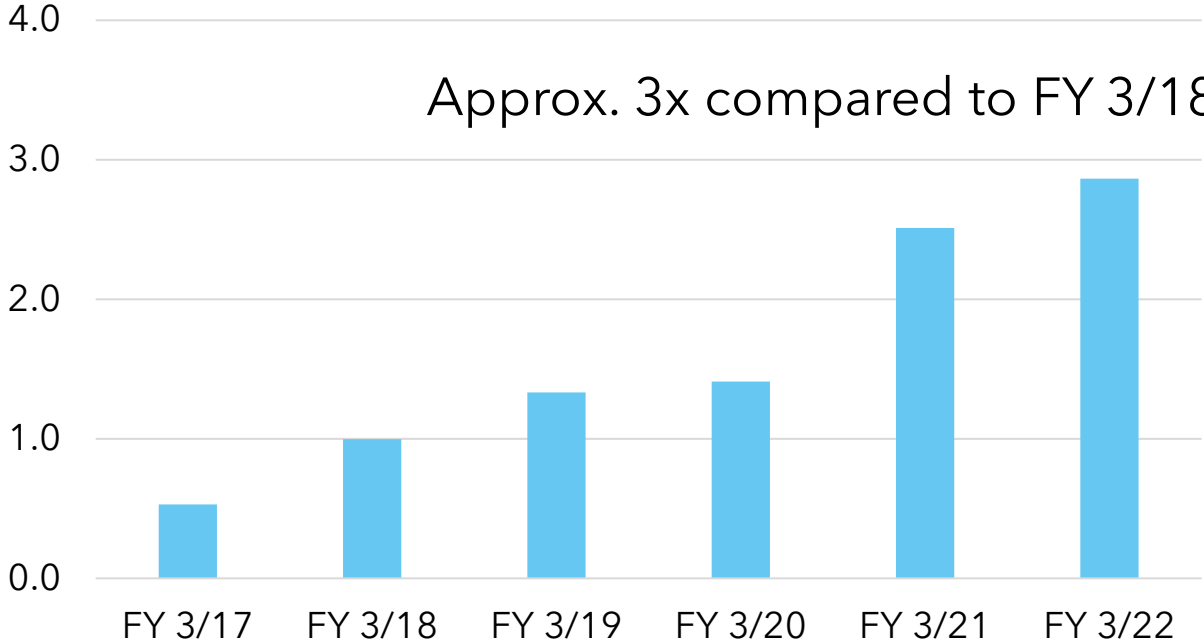
- Commercial distribution







Forecast for market of the mold releasing film for MLCC (thousand tonnes / year)



Approx. 3x compared to FY 3/18

Net sales of the TOYOBO products (times)  
(FY 3/18 as 1)

FY 3/21 onward includes the integration of Teijin Film companies as subsidiaries

# Mold Releasing Film for MLCC | Features

[Strengths] The only manufacturer that can manufacture high-end products through an integrated process spanning from base film manufacturing to release processing

- **Film forming technology that realizes superior smoothness**

- ⇒ Can reduce the defect rates of MLCC production

- ⇒ Thick coating not necessary

- Lineup from general-purpose items to high-end products

- Final products: Developed for automotive and consumer equipment applications
- Production facilities: Processing equipment Unit 1 (FY 3/21), Unit 2 (FY 3/23)
- Customers: MLCC manufacturers in Japan
- Sales: On sale from FY 3/17 (high-end)

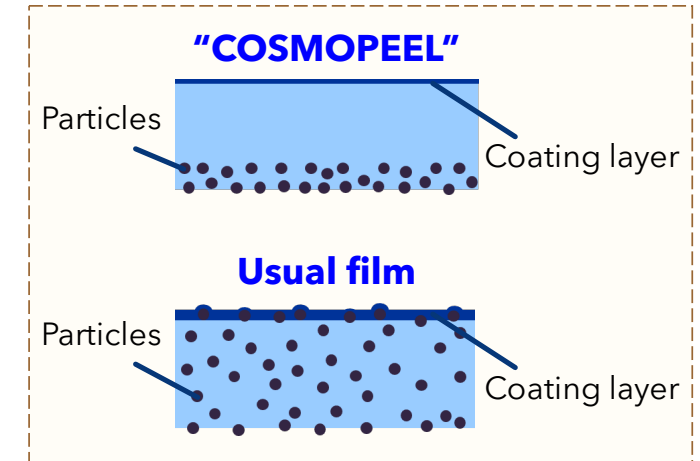
Grow sales more than 2x compared to FY 3/18

- Share: **Approx. 25 %** (TOYOBO's estimate), **a world-leading share**

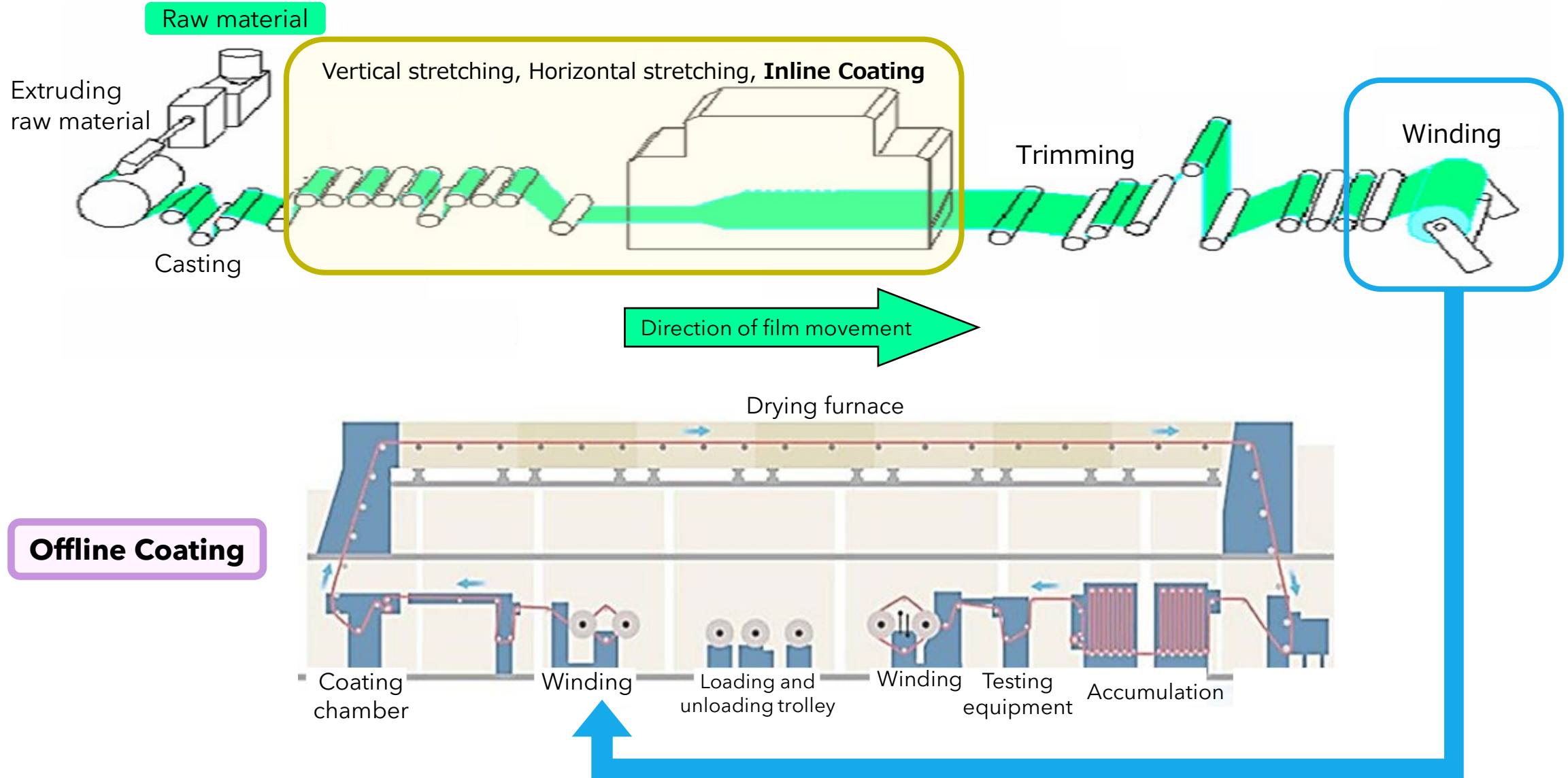
## Future Development

- **Introduce inline coating equipment** (at Utsunomiya Plant in FY 3/25)

[Our strengths] Film forming technology + Processing technology  
Manufacturing of near-high-end products through inline coating  
Synergies with Teijin Film subsidiaries



New manufacturing equipment to be built at the Utsunomiya Plant (image)

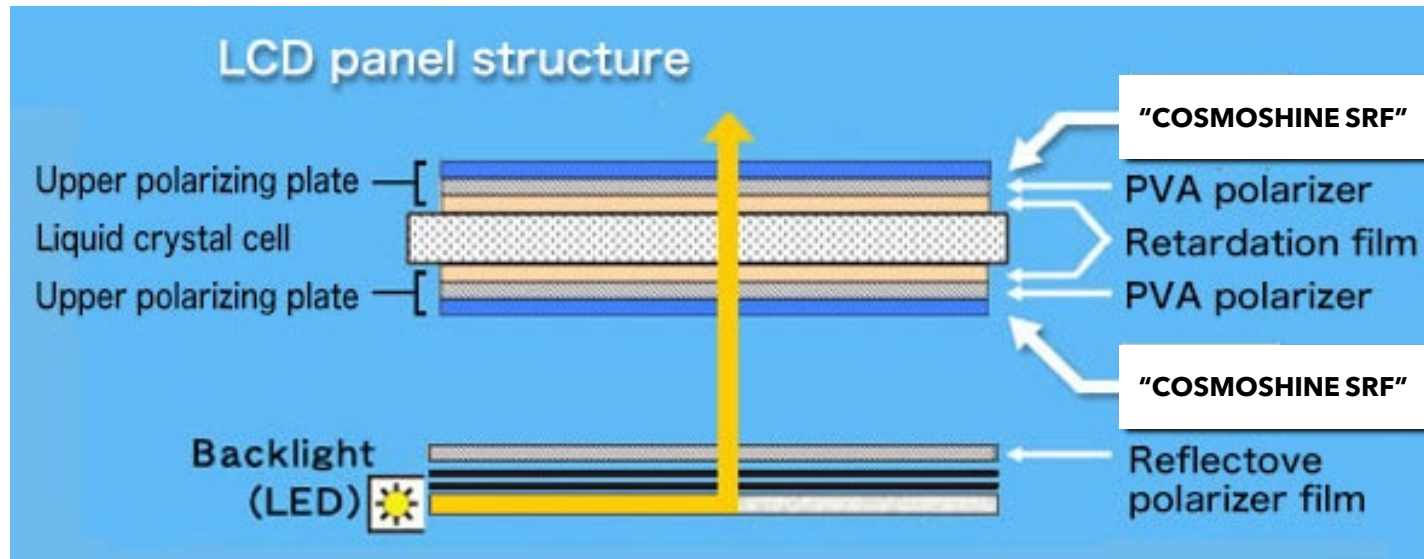
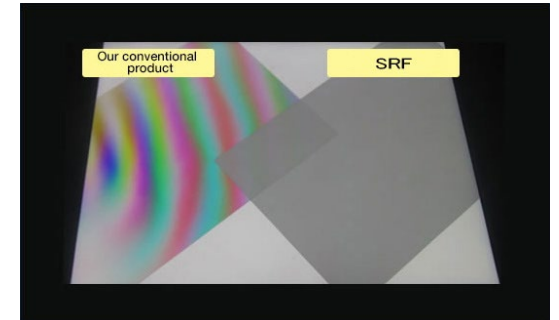


• Inline coating has cost advantage over offline coating

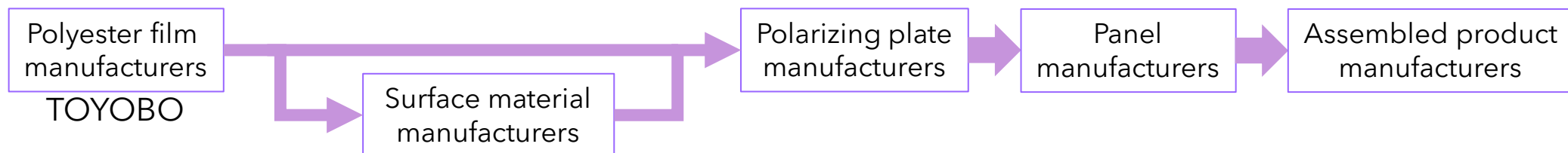
## ● Main application: Polarizer protective films for LCD TVs

**"COSMOSHINE SRF"**

- Polyester-based super retarder film.
- Elimination of coloration (rainbow pattern) caused by birefringence while being a stretched film.
- Placed on the exterior side of polarizing plates. Two sheets are used for one LCD TV.



## ● Commercial distribution



# Polarizer Protective Films for LCDs | Features

[Our strengths] • **Superior handling ability (superior dimensional stability, low degree of warping) due to low moisture absorbency**

⇒ Display strengths in increasing size, shifting to no bezel and shifting to open cell panels for LCD TVs

- Price competitive as they are polyester and melt-formed film

- Competitive materials: TAC, Acrylic (PMMA)

**\* Only TOYOBO uses Polyester**

- Customers: Polarizing plate manufacturers, surface material manufacturers

- Sales: Sales began from FY 3/14

Net sales in FY 3/22 grew approx. threefold compared to FY 3/18

- Increased production response: Unit 2 (FY 3/18), Unit 3 (FY 3/21)

Partially produced by OEM

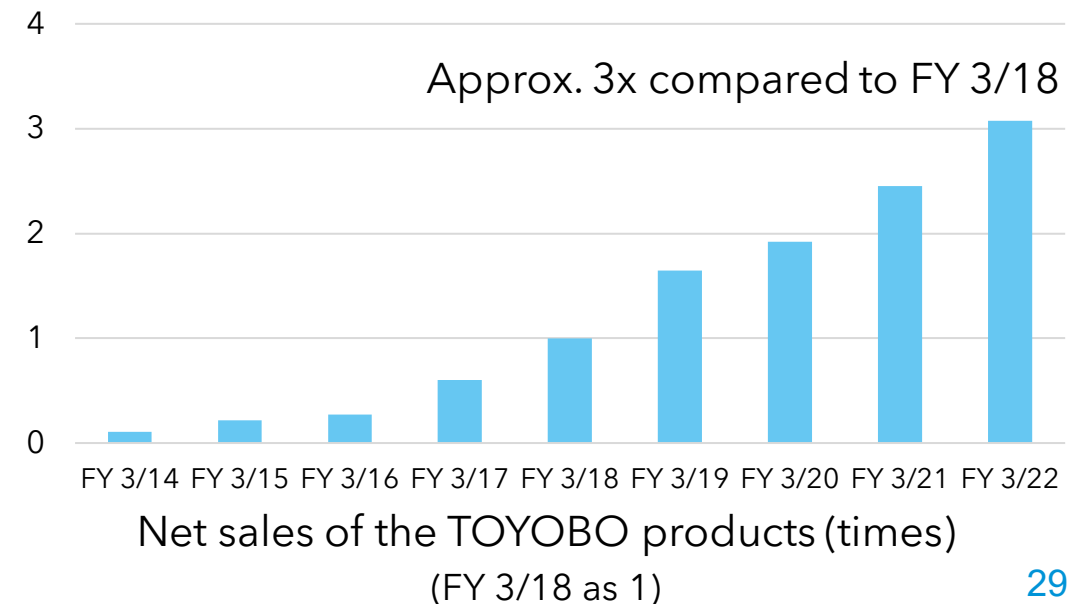
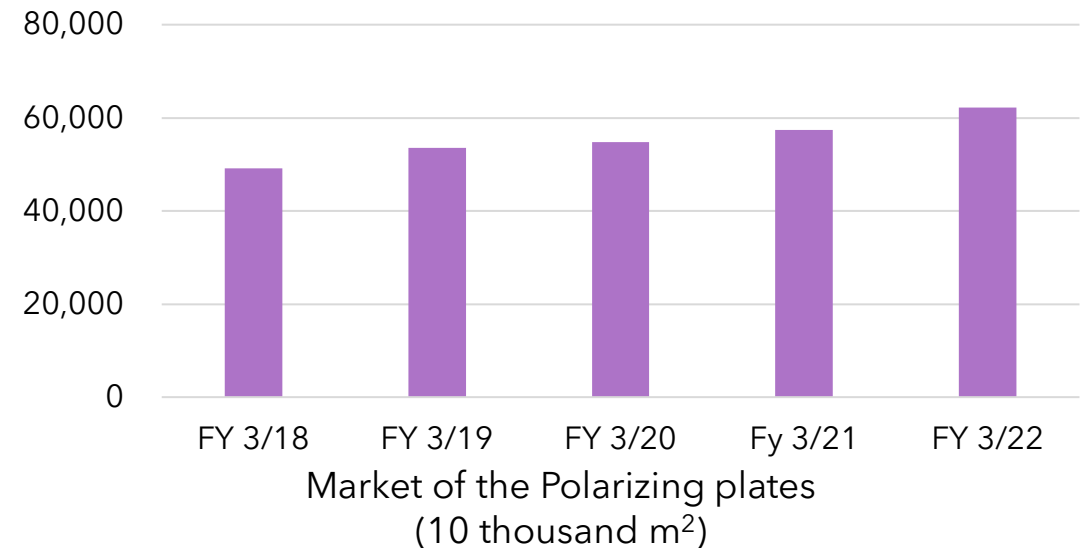
- Thickness: 60 μm under development. Possible to increase production by 20% compared to the current 80 μm.

- LCD TV share: **Approx. 50%** (Our estimate)

[Our strengths]  
Film forming technology

## Future Development

➤ Pursue thickness reduction



## Heat-resistant polyimide film "XENOMAX"

- High temperature resistance compatible with TFT (thin-film transistor) processes (400-500°C)
- Dimensional stability rivaling glass (low thermal expansion) World class among polymer films
- **Combines film qualities (light, thin, flexible, difficult-to-break)**

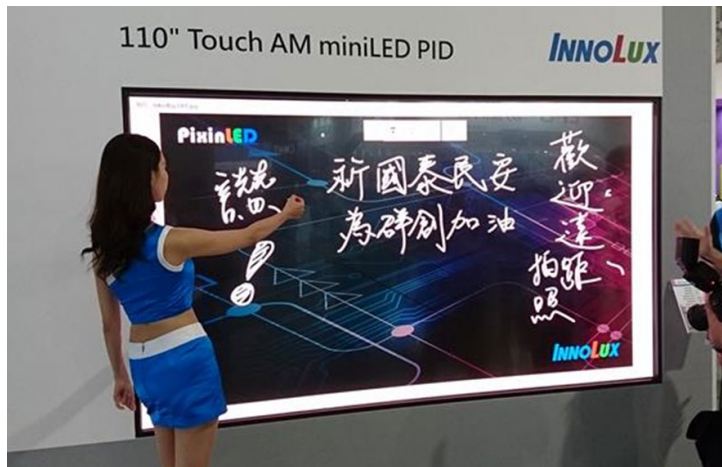


Electronic paper

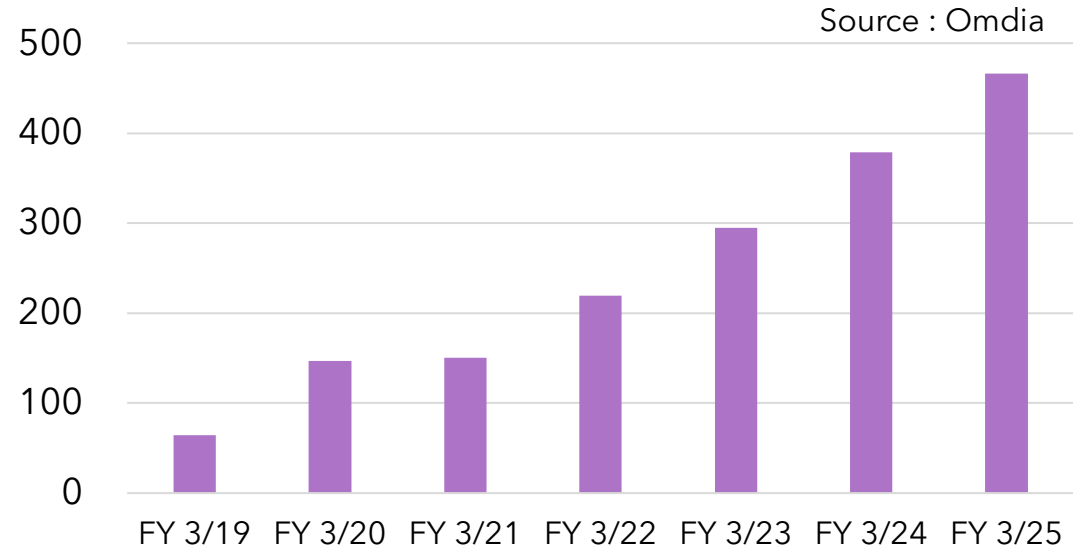
**with Glass qualities (heat resistant, dimensional stability)**

- Uses: Mini-LED, digital notebooks, electronic shelf labels, X-ray sensors, COF (Chip on Film), OLED, etc.

Mini-LED: Display covered by thousands of LEDs with a diameter of Approx. 100µm to 200µm



Enter market of mini-LEDs for digital signages  
Aim for high-resolution with a LED pitch of < 1.6mm



Market of the Mini-LEDs (thousand units)  
(LED pitch 2mm or less)

## PEN (polyethylene naphthalate) film **“TEONEX”**

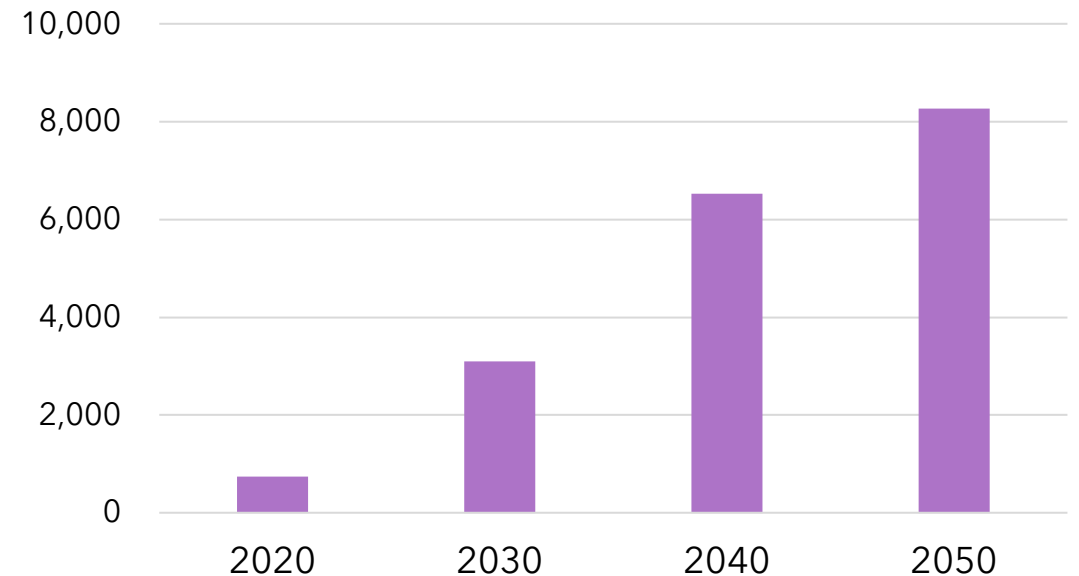
- Advantages compared to polyester:
  - high rigidity, dimensional stability (low thermal expansion), electric insulation, hydrolysis-resistance, solvent-resistance
- Applications: Car motors, isolation transformers (for wind power generation), FPC base materials (LIB peripherals), sealers for fuel battery cells, high capacity magnetic tapes, etc.



The new Toyota MIRAI



New MIRAI fuel cell unit



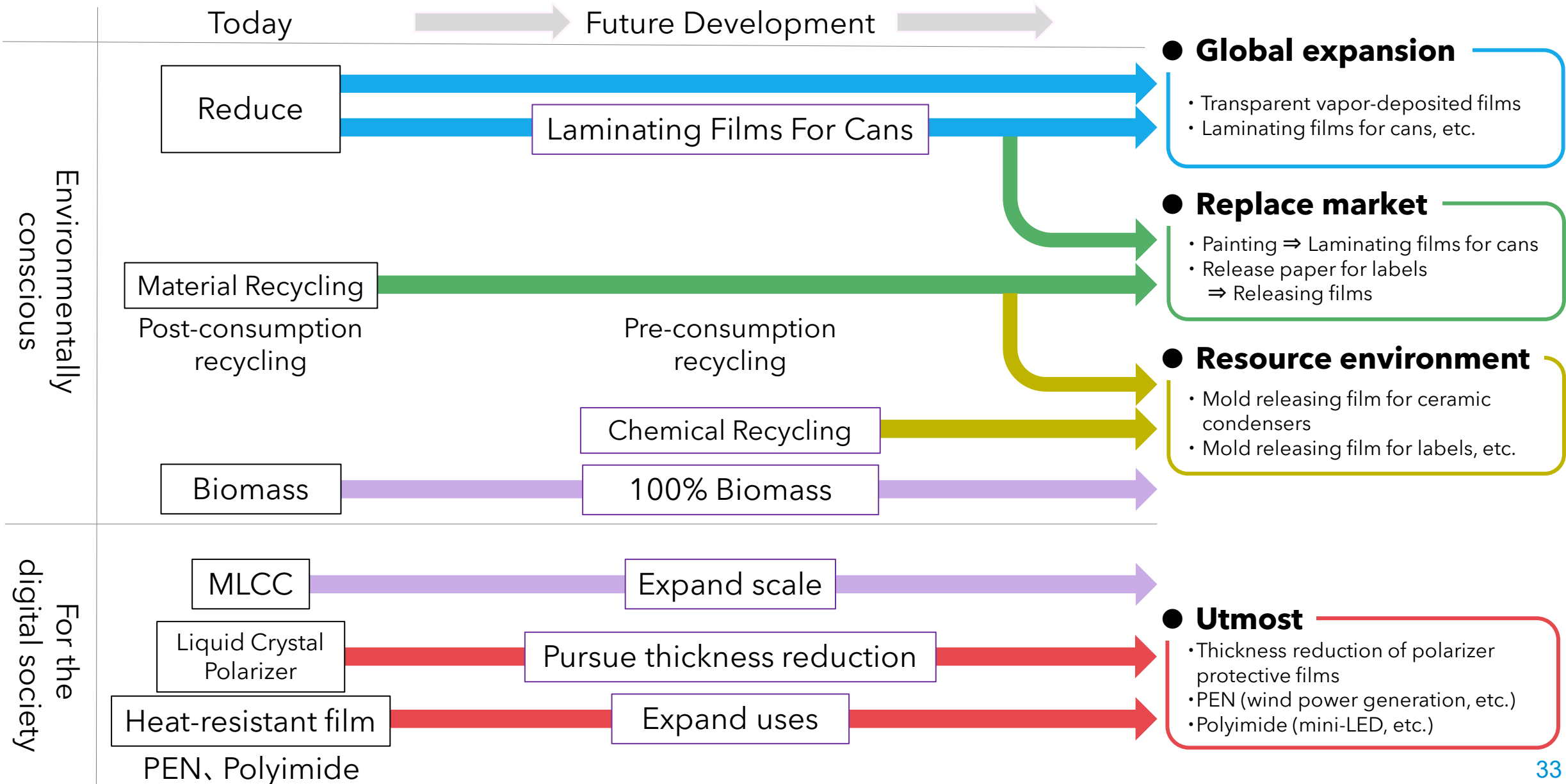
Wind turbine generator system capacity (GW)

In case of the 2050 net zero scenario  
Source : IEAEA, "World Energy Outlook 2021"

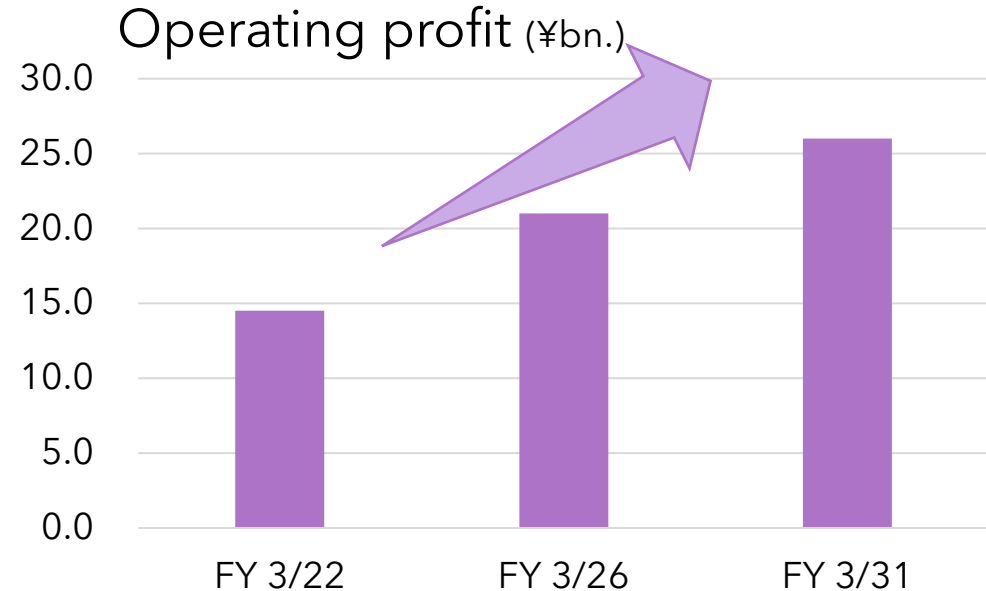
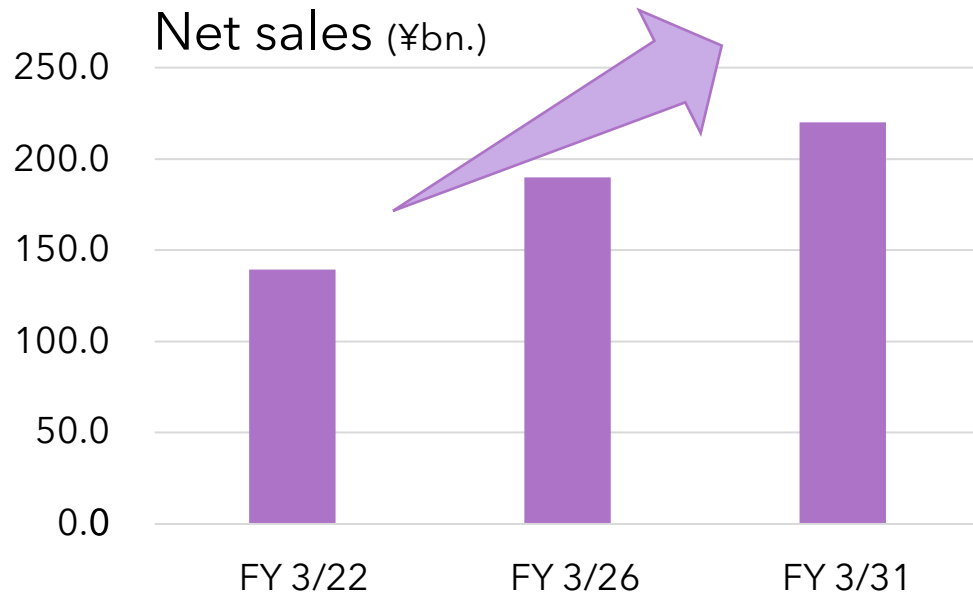
## **IV. Future Development**



# Films Business Today ~ Future Development



## ~ To be the world's leading green film maker ~



### CAPEX approx. ¥88bn. in 4 years

- New equipment for mold releasing film for MLCC ¥20.0 billion (2024)
- Expansion of TTA manufacturing equipment (Indonesia) ¥10.0 billion (2025)

(2025 Medium-Term Management Plan)



Panoramic view of TTA (TRIAS site)

# V. Appendix

- 1963 Entered the films business (started production of **unoriented polypropylene films**) (Tsuruga)
- 1964 Started production of **biaxially oriented polypropylene films** (Tsuruga)
- 1968 Inuyama Plant withdraws from the pulp business and changes to the films business
- 1971 Started production of biaxially oriented **polyester films** (Inuyama)
- 1976 Started production of biaxially oriented **nylon films** (Inuyama)
- 1982 **Started production of industrial films** (Inuyama)
- 2014 Establishment of CAST FILM JAPAN CO., LTD. jointly with DIC Corporation
- 2016 Tsuruga Films Plant decided to increase production capacity for ultra-birefringence films "COSMOSHINE SRF"
- 2017 Establishment of JV company with PT. Trias Sentosa, Tbk in Indonesia to produce packaging film
- 2017 Announcement of new facility plan of mold releasing film for MLCC in Tsuruga plant
- 2018 Founded Xenomax - Japan Co., Ltd. to produce and sell heat-resistant polyimide film "XENOMAX"
- 2019 Decided to set up Unit 2, mold releasing film processing equipment for ceramic condensers at the Tsuruga Research and Production Center
- 2019 Stock acquisitions of Teijin Film Solutions Limited (TFS) and P.T. Indonesia Teijin Film Solutions (ITFS)
- 2019 Joins European consortium CEFLEX to help develop a circular economy for flexible packaging
- 2020 Toyobo and 11 other companies jointly launch R Plus Japan, Ltd. to recycle used plastics
- 2020 Commercial production of "COSMOSHINE SRF" begins at the new facilities in Inuyama Plant
- 2021 The absorption-type merger of Toyobo Film Solutions Limited and inauguration of Utsunomiya Plant

**Co-funding R Plus Japan, Ltd.** (since its establishment in 2020)

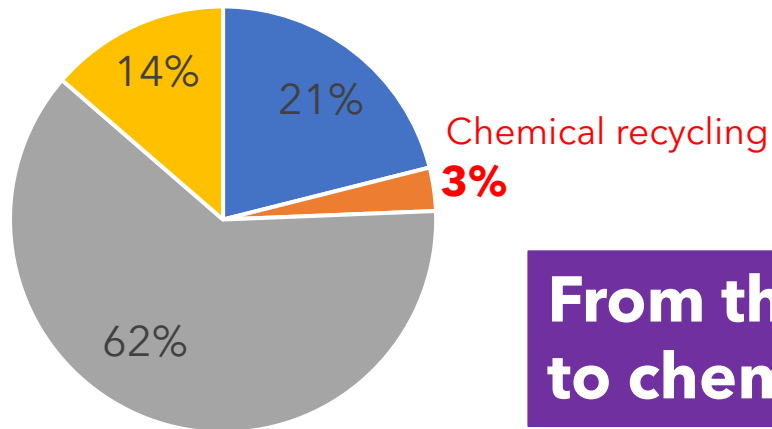
40 companies participating as of May 2022

Supporting the development of chemical recycling technology by Anellotech Inc. (U.S.)

A U.S.-based biochemical venture company (established in 2008)

➤ **Technologies for refining feedstocks from used plastic without using liquefaction**

Feedstocks: Ethylene, propylene, benzene, toluene, xylene



- Material recycling
- Chemical recycling
- Thermal recycling
- Not used (incinerated or sent to landfills)

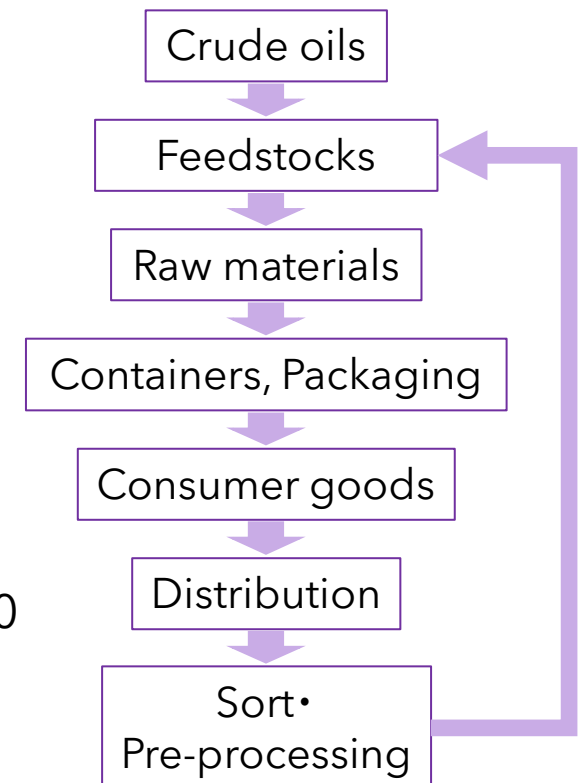
Plastic Waste Management Institute (2020)

**From thermal recycling to chemical recycling**

● Aiming for practical application in 2030



Anellotech



# Participating Companies in R Plus Japan, Ltd.

As of May 2022

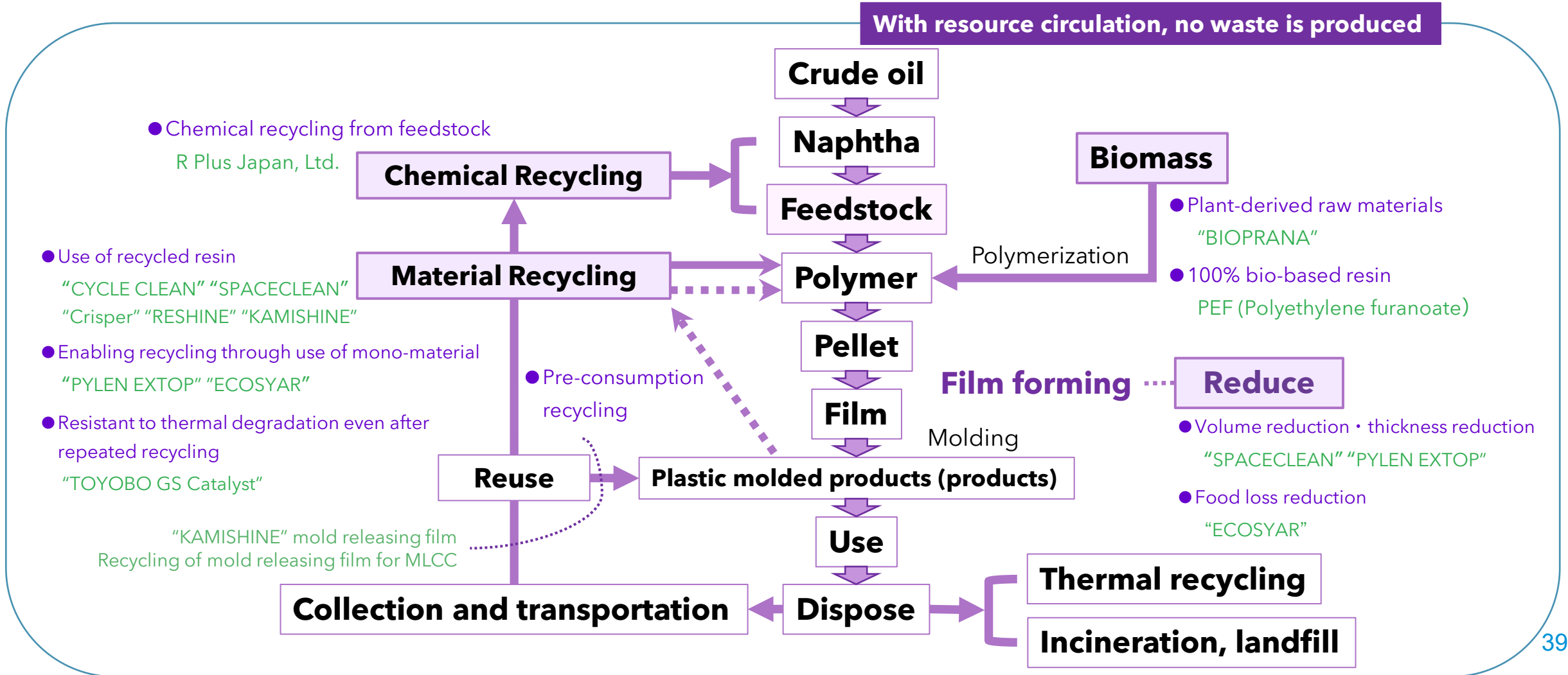


# Ideals Films Business Seek to Realize

## To be the world's leading green film maker

The target greening rate of 60% in FY 3/31 and 100% in FY 3/51 (Biomass, Recycling, Volume reduction)

~ Aiming to realize "a symbiotic society with plastics," not a plastic-"free" society ~



The business performance forecasts and targets included in the business plans contained in this presentation are based on information known to the Company's management as of the day of presentation. Please be aware that the content of the future forecasts may differ significantly from actual results, due to a number of unforeseeable factors.

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**TOYOBO**  
Beyond Horizons