



Innovation by Chemistry

TORAY IR Day

Medium-Term Management Program Project AP-G 2025

Electronic & Information Materials Business

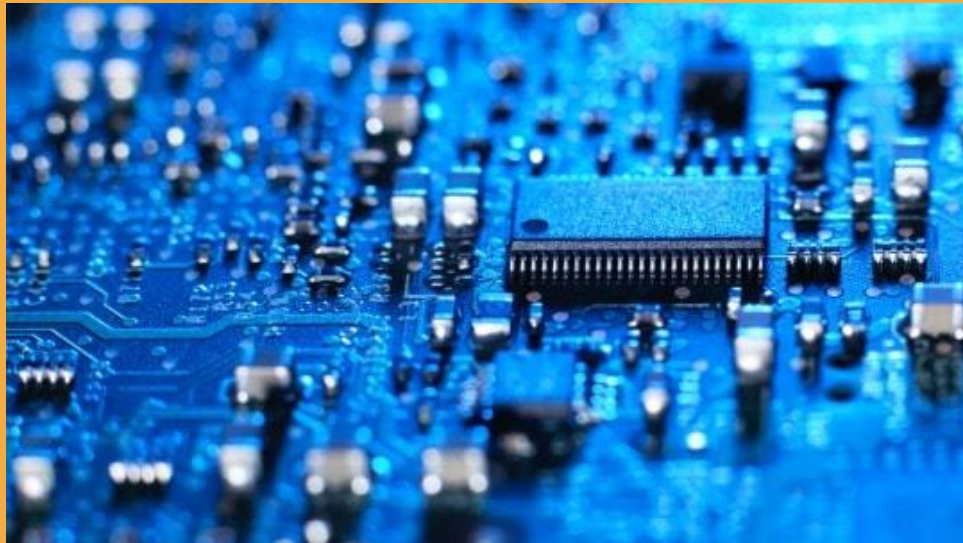
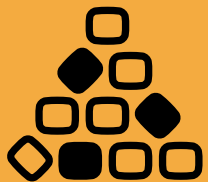
June 5, 2023

Hiroshi ENOMOTO

Senior Vice President

General Manager, Electronic & Information Materials Division

Toray Industries, Inc.



- I. Overview of Electronic & Information Materials Business**
- II. Reviewing the Medium-Term Management Program,
Project AP-G 2022**
- III. Medium-Term Management Program, Project AP-G 2025**

I

Overview of Electronic & Information Materials Business

Diverse Product Lineup

Semiconductor & JISSO



Photoneece™ Semicofine™
Polyimide Coating Material



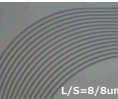
FALDA™
Photodefinable/Non-Photodefinable Adhesive Film



Flexible Printed Circuit Board
(Single-sided, Double-sided)



TORAYCERAM™
Fine Ceramics



RAYBRID™
Photodefinable Functional Paste

Printing



TORELIEF™
Photopolymer Letterpress Printing Plate



RESOLUCIA™
Photopolymer UV Flexo Printing Plate



IMPRIMA™
Environmentally Friendly Offset Printing Plate



PRIXIA™
High Resolution Dry Offset Printing Plate



Low Environmental Impact
Printing System

Main Applications



Display

Photoneece™
Photodefinable Polyimide Coating Material



Light-Emitting Material for OLED



LUMIRICA™
Organic Spectrum Conversion Sheet



RAYBRID™
Photodefinable Functional Paste



Photoblack™
High-performance Light-shielding Ink



Photoclear™
High-performance Coating Material



Medical & Industrial

RAYTELA™
Plastic Optical Fiber



X-ray Scintillator Panel



II

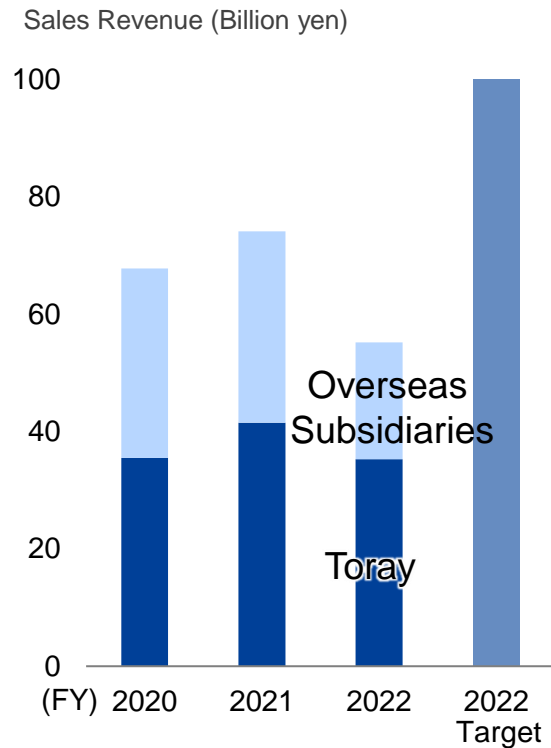
Reviewing the Medium-Term Management Program, Project AP-G 2022

Review of Project AP-G 2022

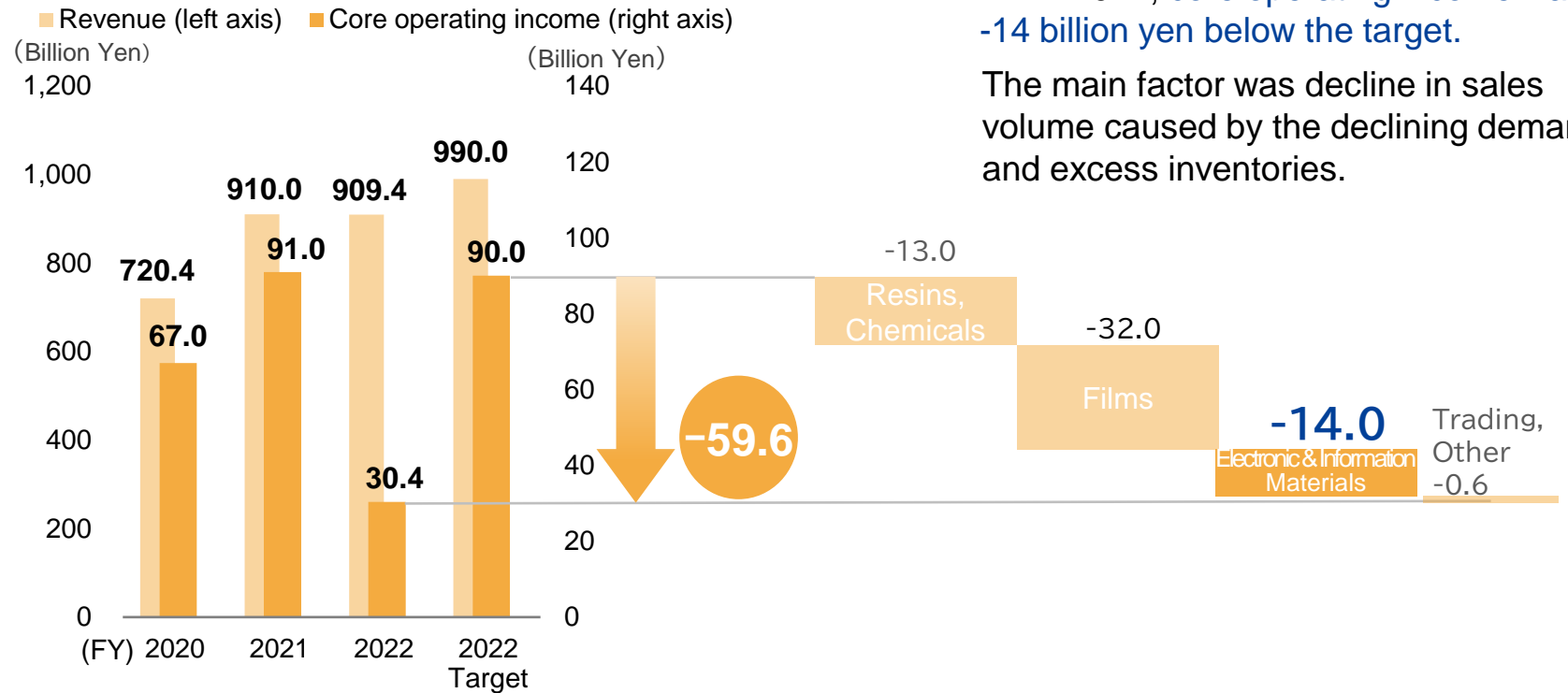
AP-G 2022 Basic Strategy

- Use advanced core technologies to create high value-added electronic materials that meet customer needs in a timely manner
- Earn customers' trust and continuously expand business by providing prompt solutions through advanced materials and processes

Electronic & Information Materials Trends in Revenue



The Performance Chemicals Segment Variance Analysis



In FY 2021, sales were strong due to the special demand for stay-at-home. In FY 2022, core operating income was -14 billion yen below the target.

The main factor was decline in sales volume caused by the declining demand and excess inventories.

Laying Groundwork for AP-G 2025

Semiconductor & JISSO Market

- In response to spread of xEV and renewable energy infrastructures, we concentrated our efforts on developing materials for power-semiconductor applications. Increase of market share in China from track record for qualification in Japan.
- Newly developed NMP-free polyimide has been qualified by one of the top power semiconductor manufacturer in the world. This material may become the next standardized material in the semiconductor industry.
- Active collaborative work with numerous industrial, academic, and governmental societies (e.g. LSTC and IME) to develop materials for the next generation of semiconductors.

Display Market

- Partnering-up with promising OLED display manufacturers with technological advantages of high brightness, efficient dimensional designs and low power dissipation, a business success is strongly sealed.
- For the next generation of displays, development for the micro LED materials has accelerated.
- Shift of Sales and R&D resources toward OLED and micro LED to enable quick response to customers.

Printing Market

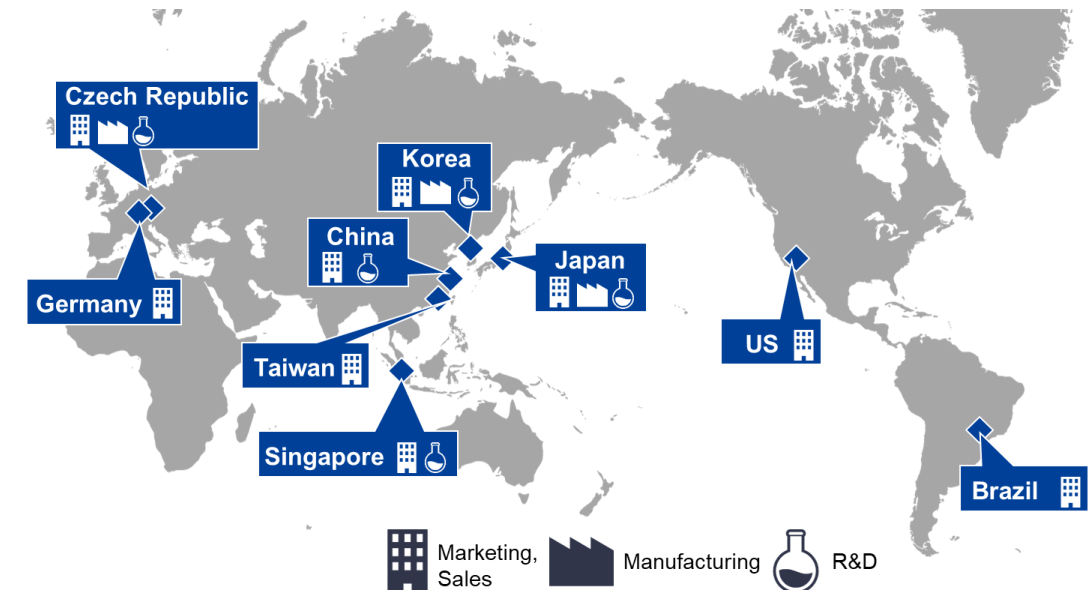
- Succeeding in mass production of printing plates for environmentally friendly VOC-free printing systems to dramatically improve working conditions at printing process.
- Focusing on developing and marketing of label and package printing applications to appeal high added value.

New Growth Market

- Developed multi-core technology for plastic fiber using Toray's unique NANODESIGN™ technology. Evaluation is progressing in optical communication.
- Developed a high photodefinable material that can form high-aspect bulkhead and a higher definition scintillator panel for non-destructive testing.

Reinforcement of Global Network

- Strengthened the global network to accommodate customer needs with speed and localized sales & technical support around the globe.



III

Medium-Term Management Program, Project AP-G 2025 1. Basic Strategies

Basic Strategies of Project AP-G 2025

Achieving maximum profit by expanding sales in growing markets and regions, strengthening the management foundation, and creating new big business

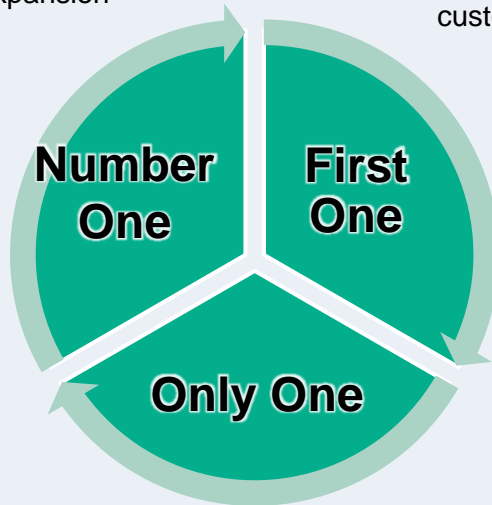
“The One” Strategy

De facto standardization

By global expansion

Early acquisition of future needs

Tracking of customer trend and market trend



Early adoption of our products through rapid development

using advanced and extensive fundamental technologies, process technologies, and evaluation capabilities

High barrier-to-entry

IP network, Production performance (high quality, stable supply, competitive cost), customer support

Expansion of Core Businesses

Expanding the strategic products sales in growing markets and regions

Polyimide Material

High-performance Coating

Functional Paste

Letterpress/Offset Plate

New Business Creation

Creating and promoting new business that fits “The One” strategy.

Expanding adoption of environmentally friendly materials

Power Semiconductors



Energy Saving

xEV

Optical Cable Optoelectronic Fusion Technology

Communication



Environmentally Friendly Technology



Wearable Devices



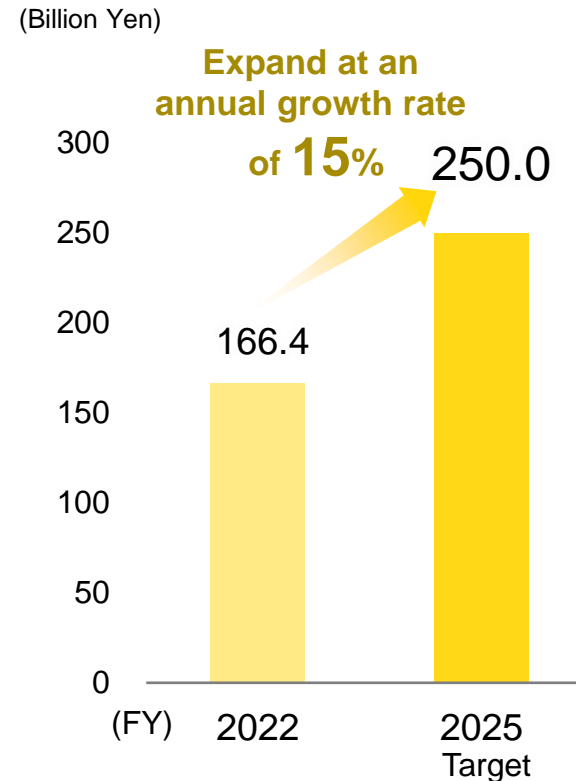
Labels & Packaging

Our Position in the Toray Group Growth Business Fields

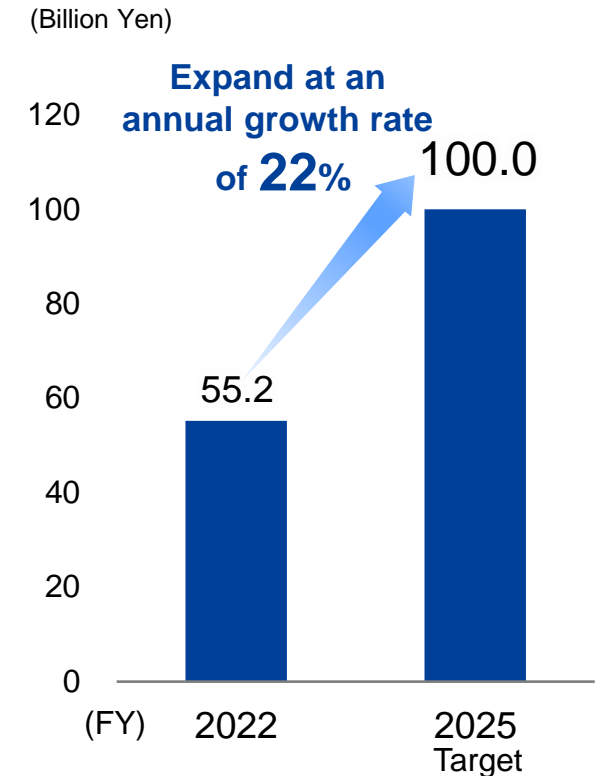
Growth Business Fields under AP-G 2025



TORAY Group Revenue from DI Business



Revenue of Electronic & Information Materials Business



III

Medium-Term Management Program, Project AP-G 2025

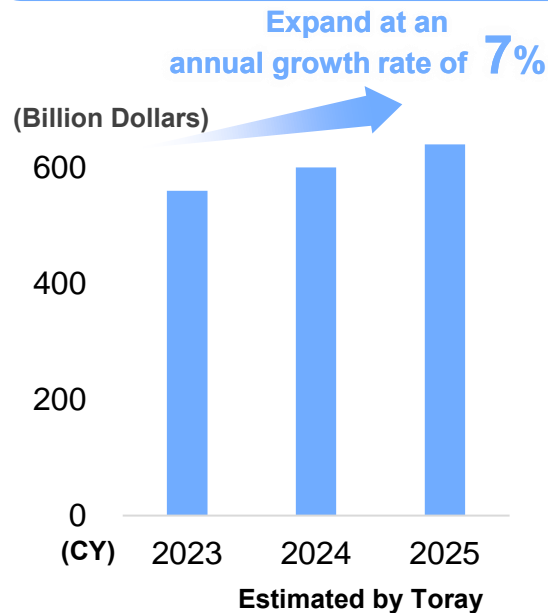
2. Semiconductor & JISSO Market

Semiconductor & JISSO Market

Achieving our business growth by focusing on the materials used for semiconductor memories and power semiconductors

- **Japan:** In order to accelerate our material development for the next-generation of semiconductors, actively collaborating with numerous industrial, academic and governmental organizations.
- **China:** Expanding sales by localizing customer support for faster and efficient services.
- **EU/USA:** Expanding sales by introducing environmentally friendly materials to the major power semiconductor manufacturers.
- In order to accommodate sales expansion for semiconductors related products, investments will be made to increase the mass production capacity.

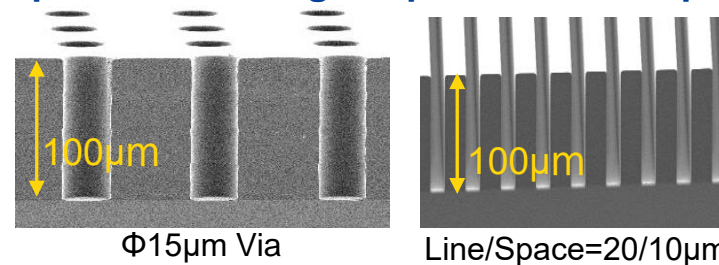
Market Size of Semiconductors



Products for Semiconductor & JISSO Market



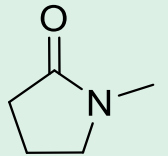
Super thick and high-aspect-ratio examples



NMP-Free Polyimide that Lowers Potential Environmental Impacts

NMP (N-methylpyrrolidone)

Used in polyimide polymerization solvents, but regulations are spreading due to concerns about reproductive toxicity.

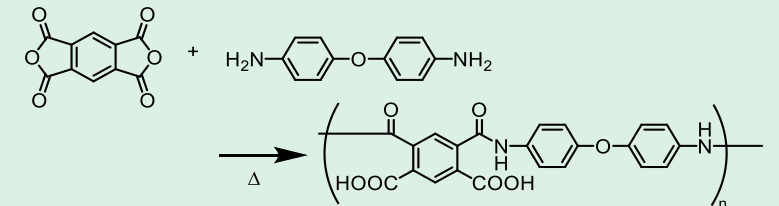


REACH control



EPA (Ministry of the Environment) regulations

NMP-Free Polyimide With Non-NMP Solvent



*Differs from the actual structure

Products for Power Semiconductors

Expanding sales in power semiconductor applications with polyimide coating materials and adhesive films

- The power semiconductor market is expanding with the spread of electric vehicles and renewable energy infrastructures
- Proposing heat resistance and high reliability buffer coating materials and thermal conductive insulation films

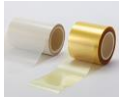
Power Semiconductor

Toray Group

Materials



Toray Singapore Research Center (TSRC) established (June 2022)



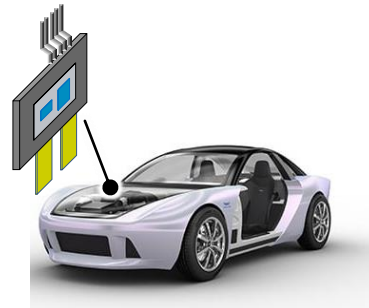
Manufacturing and inspection equipment



New company (TRENGEU) established in Germany (April 2023)

Customers

Power Module



Performance improvement
Increased productivity

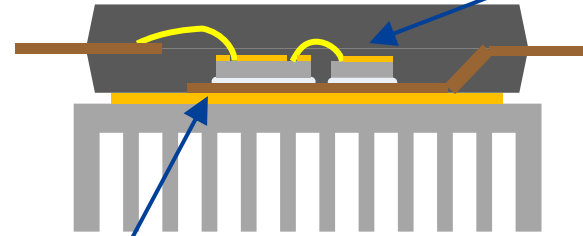
Polyimide Coating Materials For Buffer Coating



Track record of over 40 years as buffer coating materials for power semiconductor ICs

Semicofine
Photoneece

- High reliability
- High sensitivity



Thermal Conductive Insulation Films

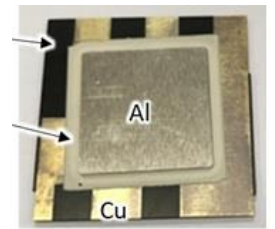


FALDA

Direct adhesion to heat sink without grease

Shortened the heat dissipation path by lowering the total thermal resistance of the module

EMS
Toray's Adhesive Films



SiC Power Module
Joint research with IME

III

Medium-Term Management Program, Project AP-G 2025 3. Display Market

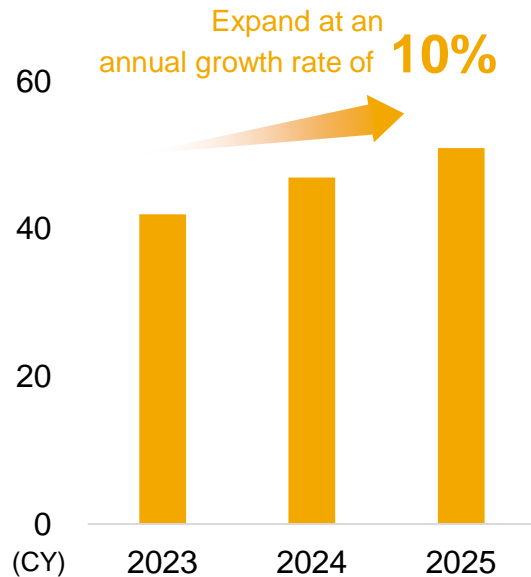
Display Market

Maintaining de facto standard position and expanding business in the OLED display market

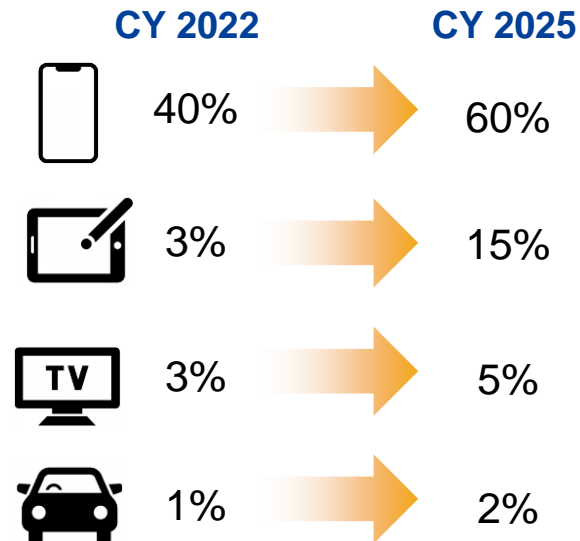
- The OLED display market will continue to expand with technological advantages of high brightness, efficient dimensional designs and low power dissipation
- Expect increase in market share for OLED display applications, such as mid-size TVs and smartphones. Also expect new adoption in applications such as tablets and automotive displays
- In order to accommodate sales expansion for OLED display related products, investments will be made to increase the mass production capacity

Market Size of OLED Displays

(Billion Dollars)



Forecast of OLED Display Percentage Change

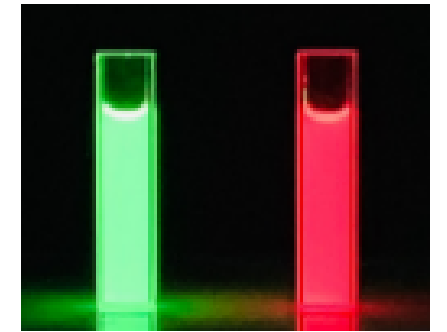


Estimated by Toray

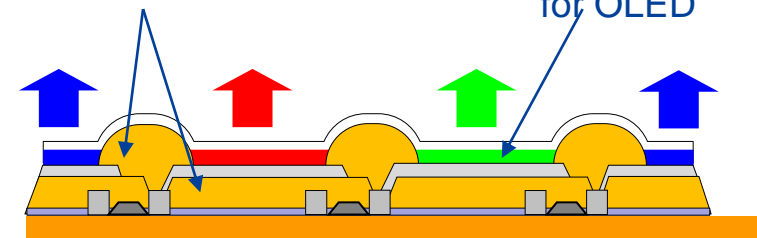
Products for OLED Displays



Polyimide Materials



Light-Emitting Materials for OLED



Products for Micro LED Displays

Promoting a wide range of advanced materials for micro LED displays regarded as next-generation display technology

- Many materials are under evaluation for displays for wearable devices and VR goggles.

Micro LED Displays

Toray Group

Materials



Manufacturing and Inspection Equipment

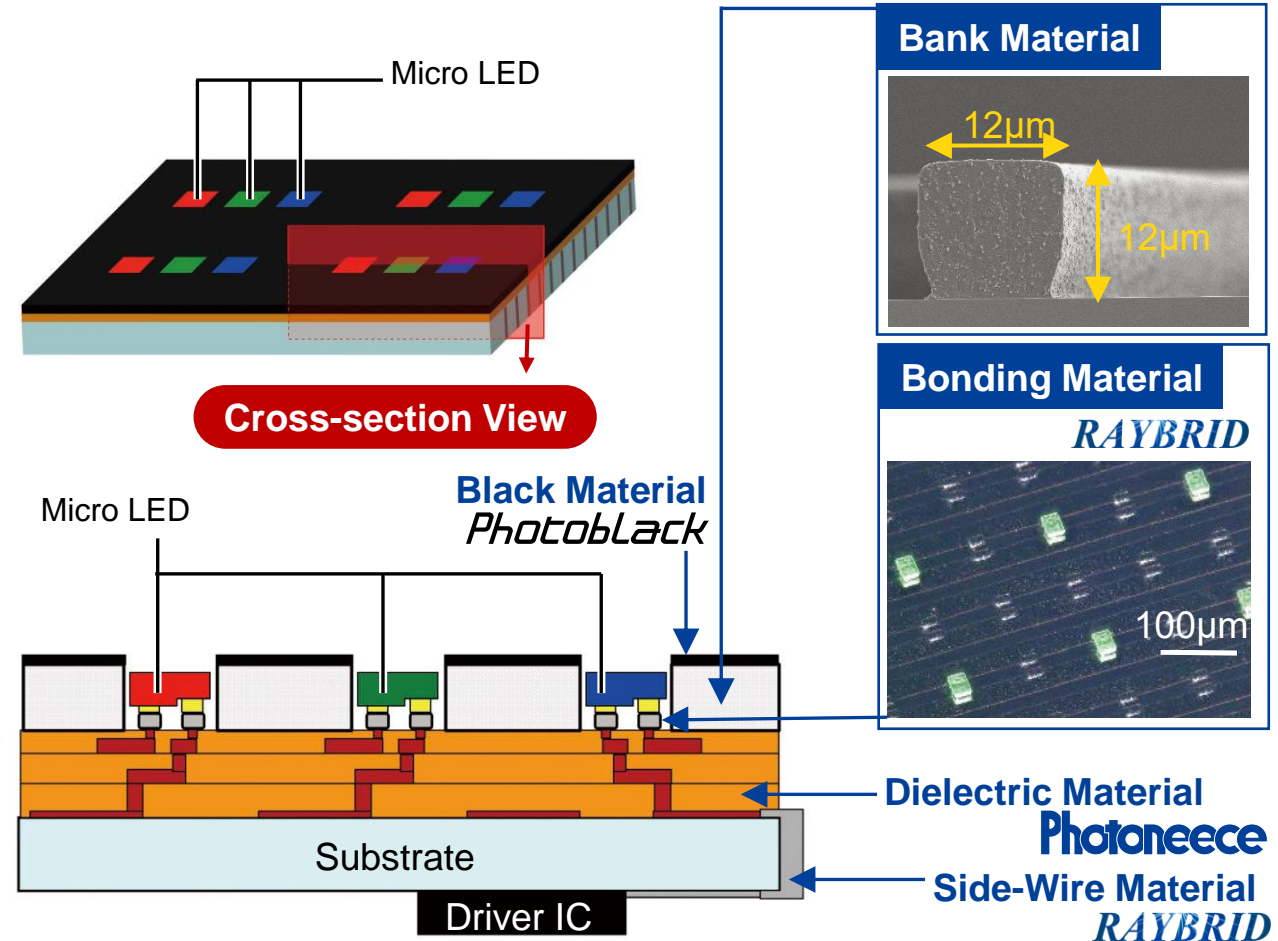


Customers

Micro LED Displays



Quality improvement
Increased productivity



III

**Medium-Term Management Program,
Project AP-G 2025
4. Printing Market**

Printing System for “Zero Environmental Impact”




Promoting the environmentally friendly printing system as a global standard to improve the working environment and protect the global environment

- Conventional printing process uses many organic solvent in inks, cleaning agents, etc., and improving the work environment and protecting the environment are serious issues
- “Completely ZERO VOC printing system” was achieved by the environmentally friendly offset printing plate IMPRIMA™ and water soluble EB curable ink

Environmentally Friendly
Offset Plate IMPRIMA™



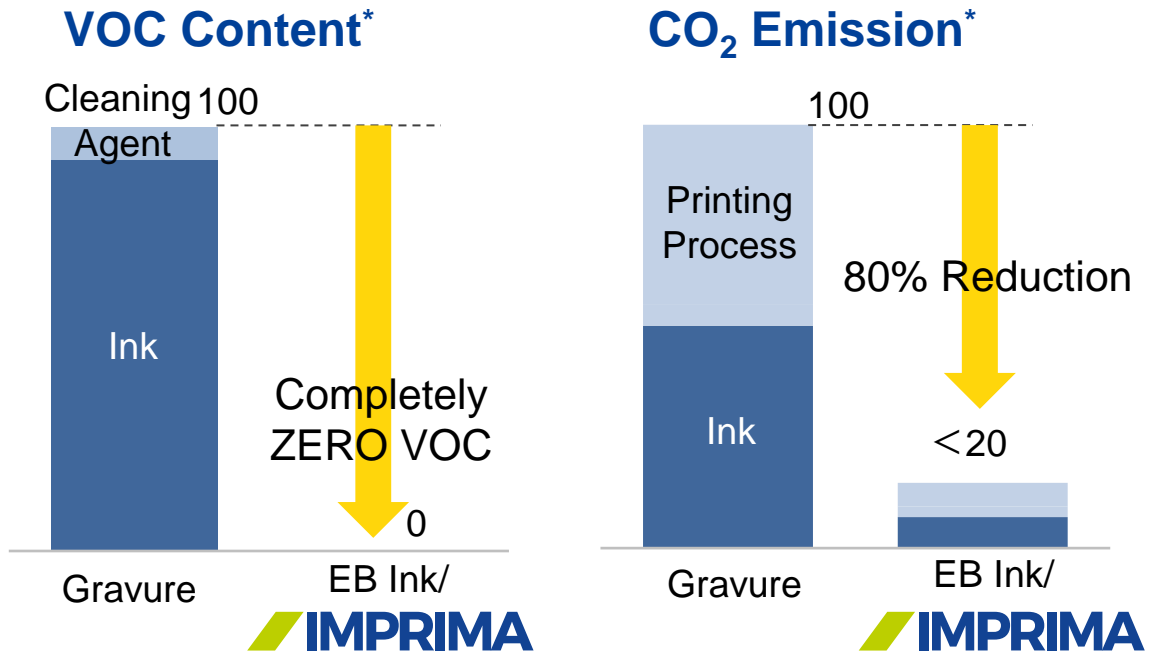
Water Soluble Electron Beam (EB) Curable Ink



Ink Ingredients

Ink

Achieved “Completely ZERO VOC Printing System”



* Estimated by Toray with solvent gravure printing emissions as 100

The Sustainable Solution for The Future of Flexible Packaging

Developing the ultimate environmentally friendly materials for flexible packaging to target various applications including food packaging

- Low environmental impact flexible packaging using recyclable materials and IMPRIMA™ EB offset printing system were developed with partners.

Partners

TORAY

Printing Plates, Ink Ingredients, Film



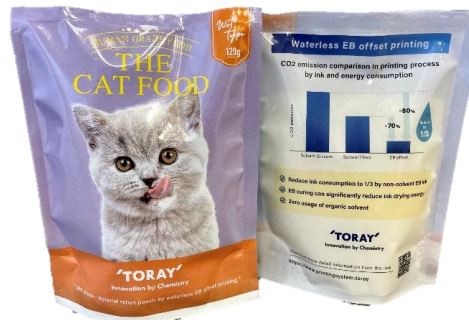
Ink Manufacturer

Printing Press
Manufacturer

Flexible Packaging
Converter

Recyclable Mono-material Packaging

European CEFLEX compliant



OPP mono-material packaging

- Recyclable
- For retort applications

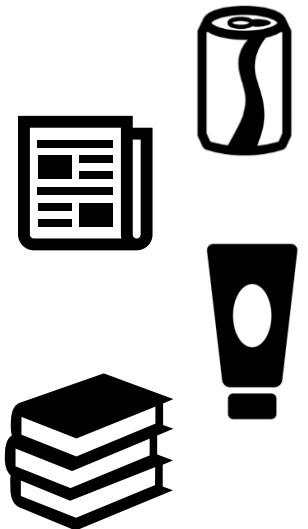


PE mono-structure packaging

- Recyclable
- For boil applications

Presented at Interpack 2023

Various Applications



III

**Medium-Term Management Program,
Project AP-G 2025
5. New Growth Markets**

New Proposal for Optical Communication Field: Multi-Core Plastic Optical Fiber

- Developed multi-core optical fiber by Toray's unique NANODESIGN™ technology and resin flow control technology.
- Evaluation is progressing in application to next-generation high-capacity optical communication systems.



Optical Communication

Post-5G
Ultra low latency,
Multiple simultaneous connections

Increase of communication data volume
Increase in demand for high-speed, high-capacity communications

Reduction of energy consumption

Silicon Photonics

Plastic Optical Fiber

Core
Clad

Double-Layer Structure

NANODESIGN™ tech.
Flow control tech.

Multi-Core Optical Fiber

Core
Clad
Sea

Multi-Layer Structure

Core
 $\Phi: 28\mu\text{m}$
Sea
Clad

Cross-Section Image of the 3-Components Multi-Core Fiber

Various polymer designs

Polymer A Polymer B

Various cross-section designs

Ability to combine 3 types of polymers

Contributing to High-Resolution Inspection: Scintillator Panel

- Ultra-thick film and high-aspect technology realized the world's highest resolution scintillator panel for digital X-ray inspection
- Promoting business expand in non-destructive digital testing applications

Analog
(Conventional)

Film

Developing work required, Storage space issue, Image modification not possible

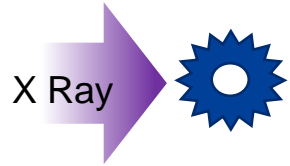


Digital

Scintillator

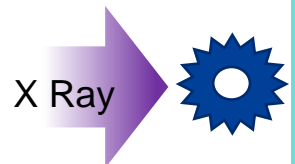
Immediate image analysis, Cloud storage, Image modification possible

Plate Type



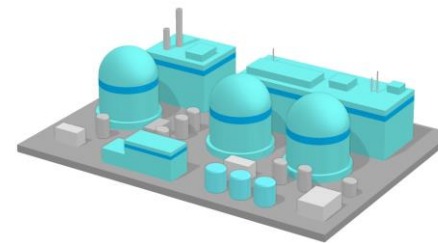
Blurred Image

TORAY Pixelated Type



Sharp Image

Nuclear Power Plants



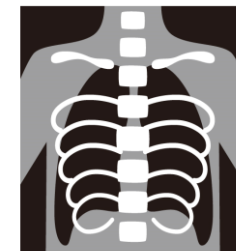
Aircraft Parts



Security Inspection



Medical Tests

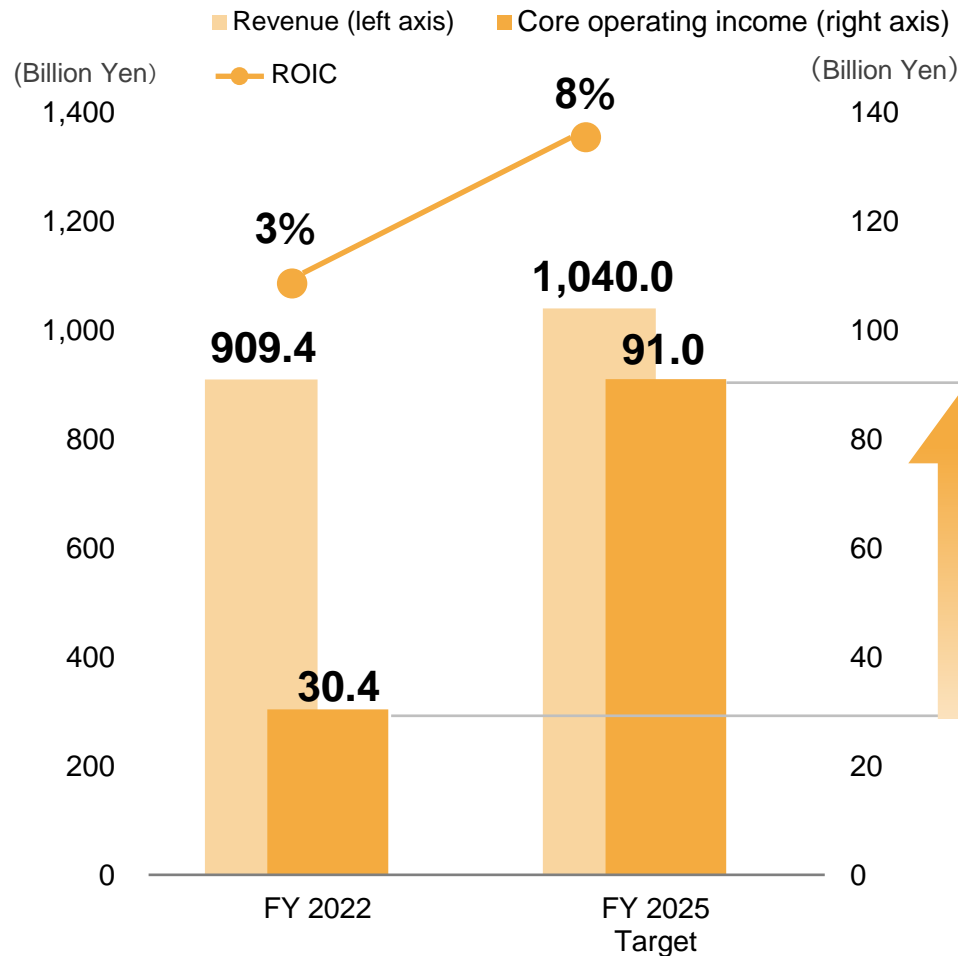


III

Medium-Term Management Program, Project AP-G 2025 6. Target for FY 2025

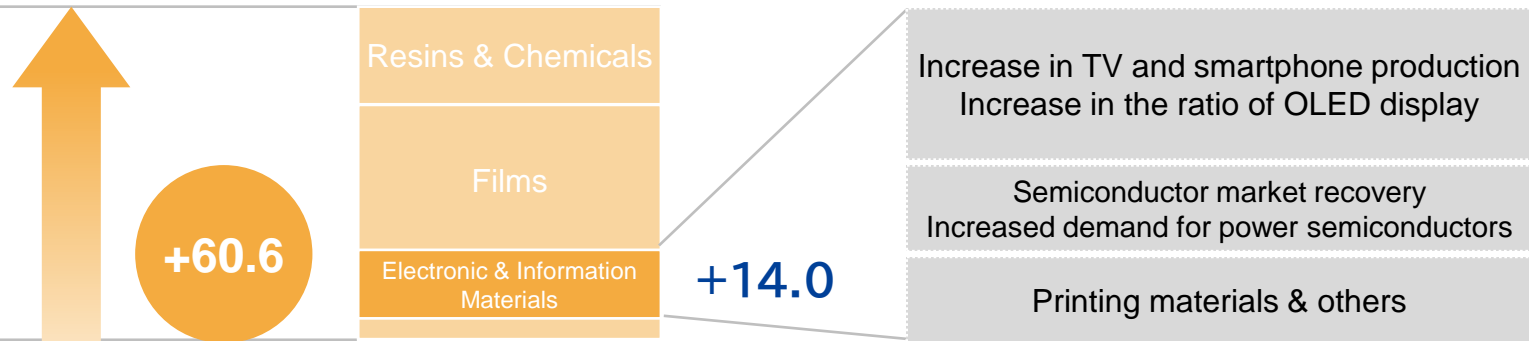
FY 2025 Target

Performance Chemicals FY 2025 Target



- Expanding market share in growth business fields
 - OLED Display
 - Power semiconductors
- Promoting business diversification by launching new businesses following the flexible printed circuit board business at an overseas subsidiary

Target: +14.0 billion yen in core operating income vs FY 2022



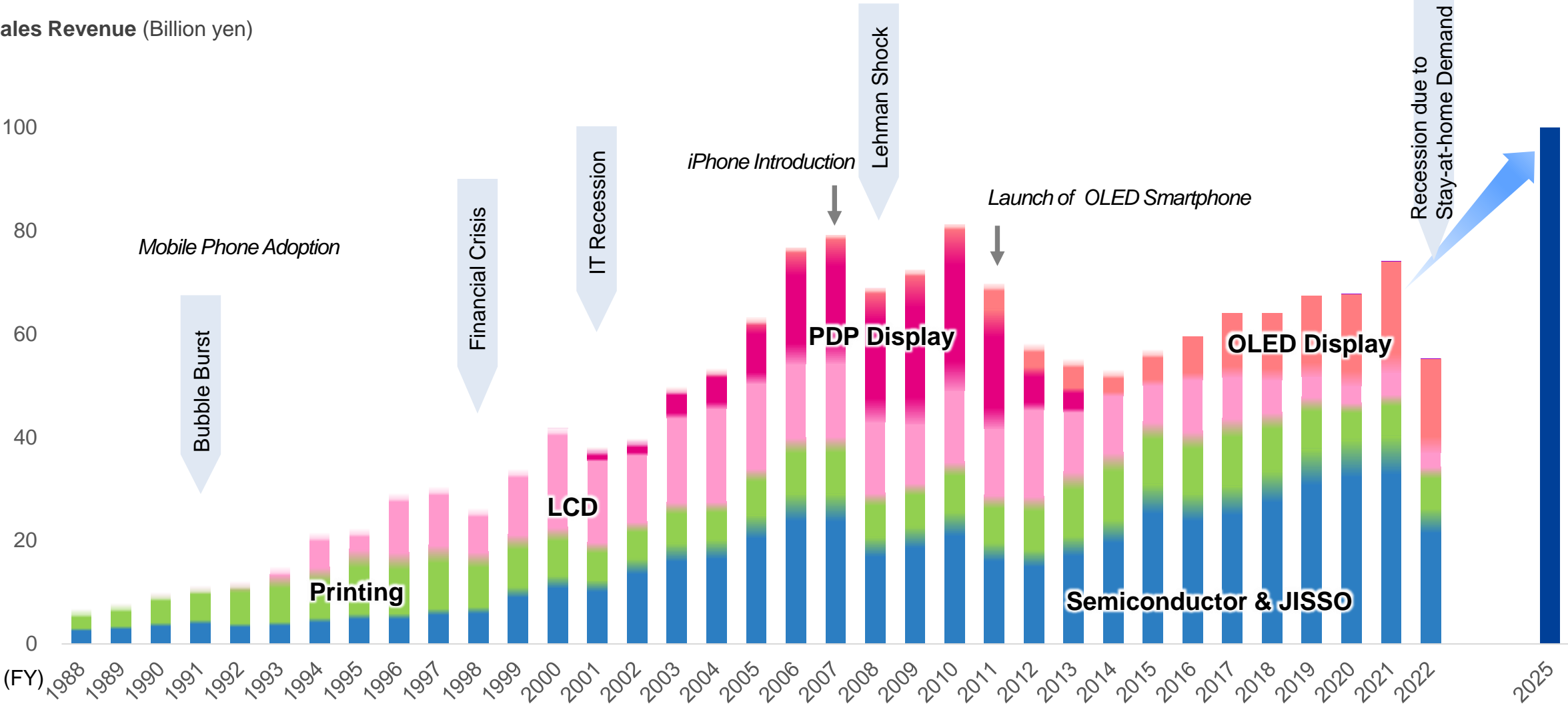
Increase in TV and smartphone production
Increase in the ratio of OLED display

Semiconductor market recovery
Increased demand for power semiconductors

Printing materials & others

Electronic & Information Materials FY2025 Target

Sales Revenue (Billion yen)



Descriptions of predicted business results, projections and business plans contained in this material are based on assumptions and forecasts regarding the future business environment, made at the time of publication. Information provided in this material does not constitute any guarantee concerning the Toray Group's future performance.

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