OJI HOLDINGS

Oji Holdings Corporation
FY2024 IR Briefing Session

December 10th, 2024

Agenda

Time	Titles	Presenter
3:00 PM	Opening	Moderator
3:05 PM	Introduction Growth Strategies of Oji Holdings ~Growing Forests, Utilizing Forests~	Representative Director of the Board President and Group CEO Hiroyuki Isono
3:15 PM	Growing Forests Initiatives to Establish the Economic Value of Oji Forests toward the Era of Natural Capital Accounting	Oji Forest Value-Creation & Promotion Department
3:25 PM	Utilizing Forests Introduction	Executive Officer　General Manager, Innovation Promotion Division Kohei Michikawa
3:35 PM	Utilizing Forests : Theme1 Utilizing Forest Resources, to Develop “Biomanufacturing Technology” (Sugar Solution・Ethanol・PLA (Polylactic Acid))	Innovation Promotion Division Biochemical Research Center
3:50 PM	Utilizing Forests : Theme2 Utilizing Forest Resources, to Develop Advanced Biomass Photoresist for Semiconductor Applications	Innovation Promotion Division Strategic Planning Department Incubation Section
4:05 PM	Q&A Session	PIC of each theme
4:35 PM	Closing	Moderator

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Introduction :

Growth Strategies of Oji Holdings
~Growing Forests, Utilizing Forests~

Representative Director of the Board
President & Group CEO
Hiroyuki Isono

Purpose

OJI HOLDINGS

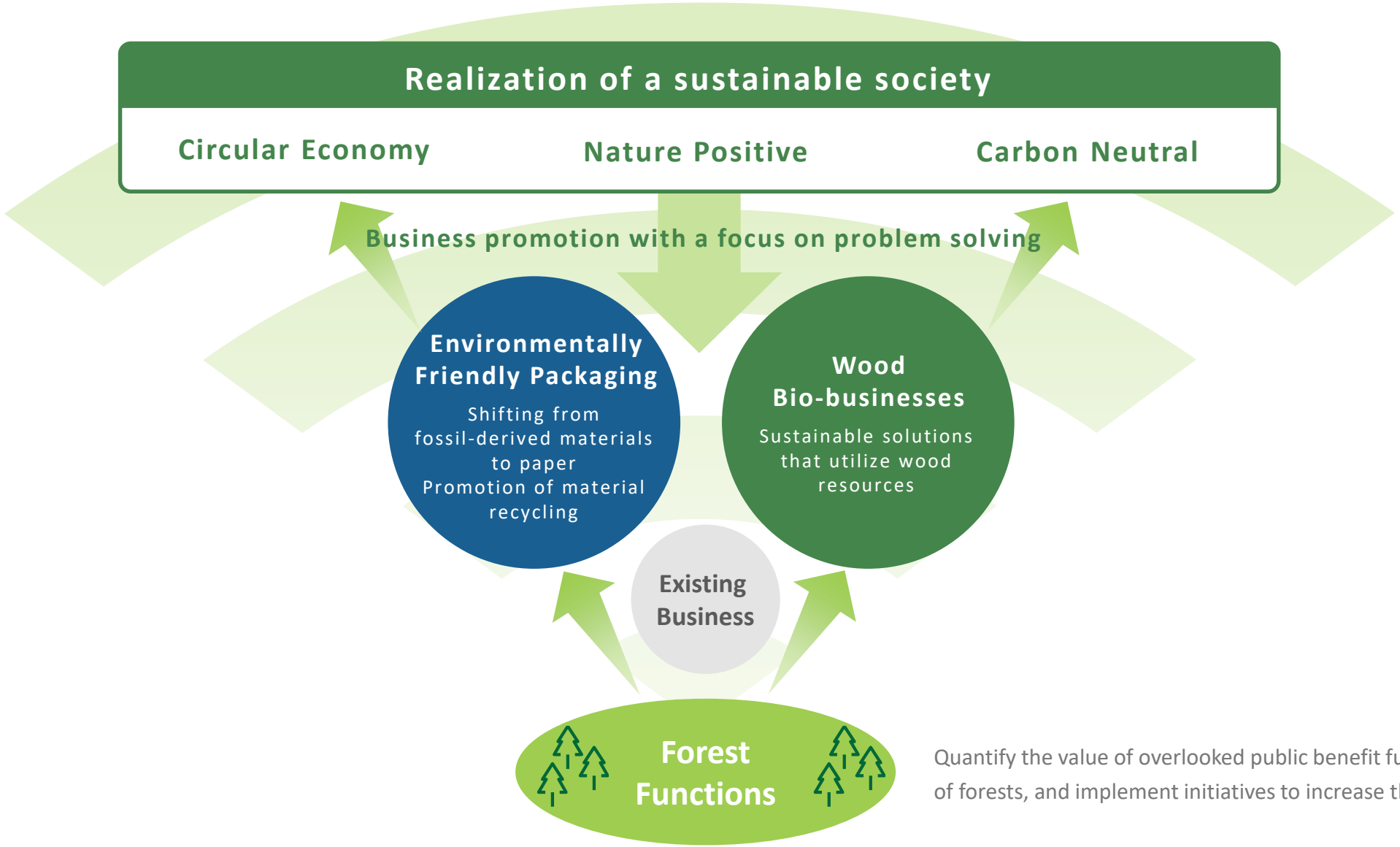
Grow and manage the sustainable forest

Develop and deliver the products from renewable forest

And

Oji will bring this world a brighter future filled with hope.

Initiatives for Sustainable Growth



Quantify the value of overlooked public benefit functions of forests, and implement initiatives to increase the value

Business Rooted in Forest Resources

Company Established by Eiichi Shibusawa

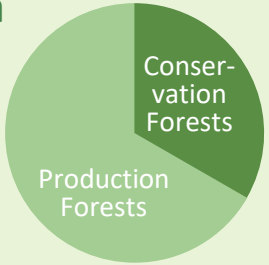
Established Oji Zorin (=Plantation)

CENIBRA(Brazil)

Oji Forest in the World

635 kha

Sustainable Management through reforestation



Focusing on forest conservation activities

1873 Construction of a Mill Oji, Tokyo
Used waste cloth as a raw material

1875

1890 Start of Wood Pulp Production

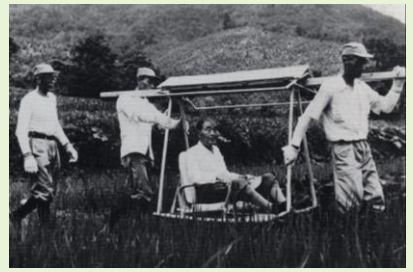
1937 Start of Full-scale Overseas Plantation
Fast-growing tree plantations become mainstreams

1992

2024 Continue Nature Positive Management Rooted in Forest Resources

“Those who use trees have the responsibility to plant trees”

Ginjiro Fujiwara
President, Oji Paper Co., Ltd. (1930s)



Forestry inspection in Hokkaido

Efforts to Provide a Solution for Plastic-free Products

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Existing business

Strengthening the product lineup, acquiring technology and know-how, expanding areas

Total packaging that contributes to Carbon Neutral

Products

Corrugated container
General packaging paper
General folding carton

Area

Japan
SEA
Oceania

- **IPI〔Italy : 2023〕**
  Acquisition of a liquid packaging company

- **Walki〔Finland : 2024〕**
  Acquisition of an advanced materials conversion company

- **Deluxe〔Taiwan :2024〕**
  Investments in a molded pulp company

Corrugated container
General packaging paper
General folding carton
Liquid packaging
High-performance packaging paper (Non-fluorine, high barrier etc.)
Molded pulp packaging

Japan
SEA
Oceania
India
EU

Efforts Toward a Carbon-Neutral World

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1890 Forest Resources for *PAPER*

Forest Resources for *MATERIALS BEYOND PAPER*

Realization of a carbon-neutral world through the sustainable use of wood resources

Wood-derived Sugar Solution • Ethanol

Development at the bench scale (completed) » Theme 1 Wood-derived sugar solution and ethanol pilot plant » Theme 2 Biomanufacturing ecosystem construction project

Identifying issues in the manufacturing process and conducting sample work

Full-scale production

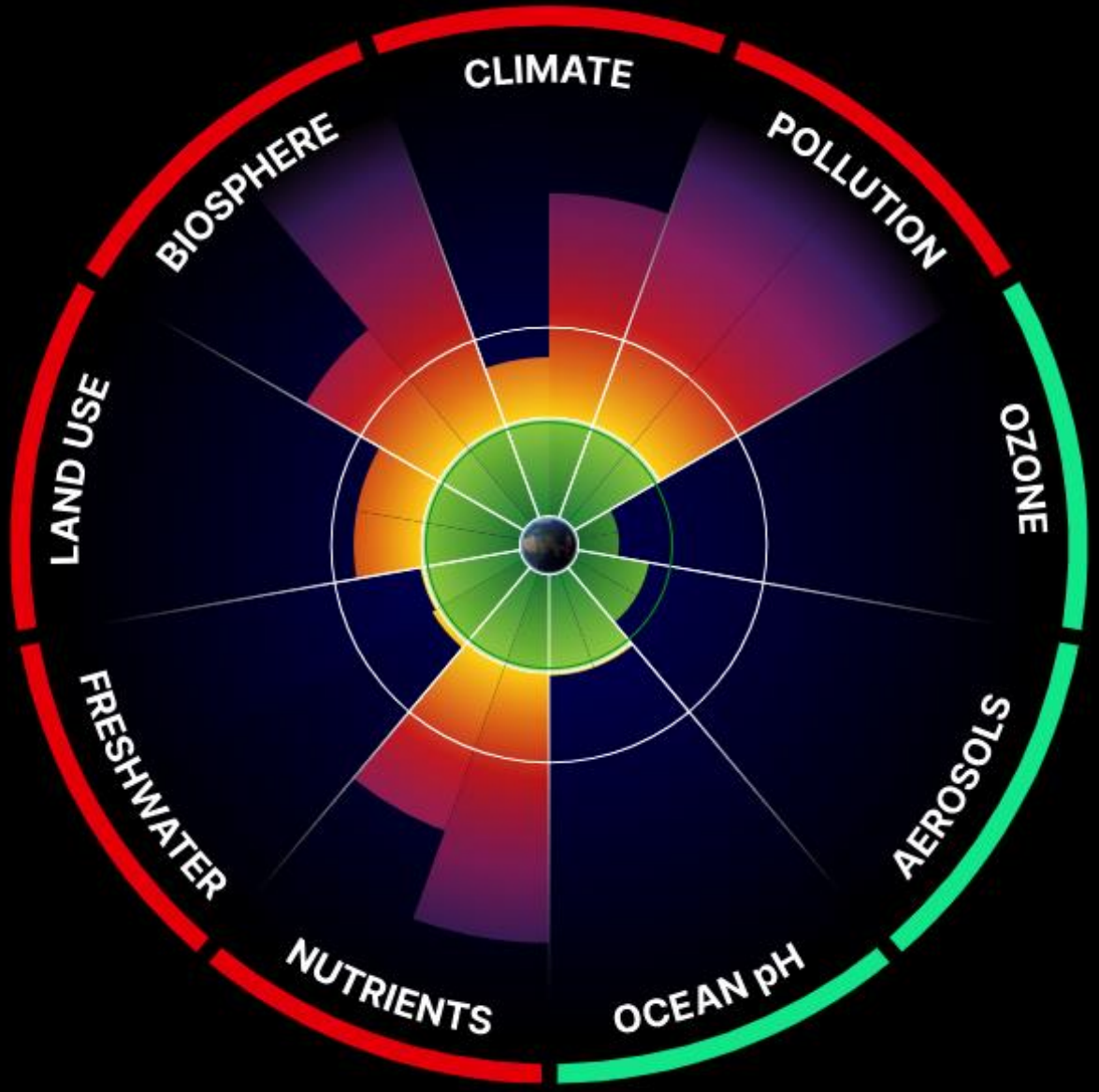
【Examples of our initiatives】

Introduction	CNF-based polymer electrolyte membranes for fuel cells
Introduction	Licorice • Wood-derived pharmaceutical Building a system for commercialization

Theme 1	Development of wood-derived petroleum alternatives (Sugar Solution・Ethanol・PLA (Poly-lactic acid))
Theme 2	Semiconductor materials Biomass Photoresist

- PLA that can be used for films and laminated paper
- Cellulose Resin Composite Pellets that can be used for automobile interior materials
- 100% Japan made e-methane etc.

Growth within the Planetary Boundaries is Essential



Caesar & Sakschewski et al., 2024.

International Trends in Natural Capital Accounting

Trend of Natural Capital Accounting

Origin of the concept of "Sustainability"

Progress in international collaboration to address climate change

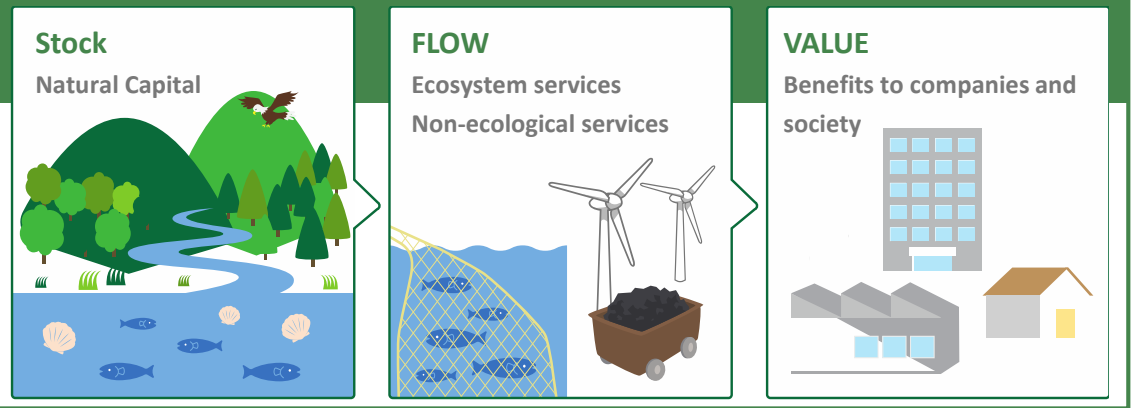
"Nature-positive" as a global trend

Moving towards nature capital accounting

What is Natural Capital?

Natural Capital refers to capital (stock) formed by nature, including forests, soil water, the atmosphere and biological resources

Discussion is underway in each country to assess the economic value of these elements of natural capital and reflect them in accounting standards.



Global Collaboration to Solve Global Issues

COP16 Side Event (1) (October 27th, 2024)

BUSINESS AND BIODIVERSITY FORUM (Went on a stage)
Rethinking Business as Usual:
Unleashing the Potential of Bioeconomy, Green Business and Innovative Solutions

COP16 Side Event (2) (October 28th,2024)

Sharing Business Opportunities - G7 Alliance on Nature Positive Economies
(Went on a stage)

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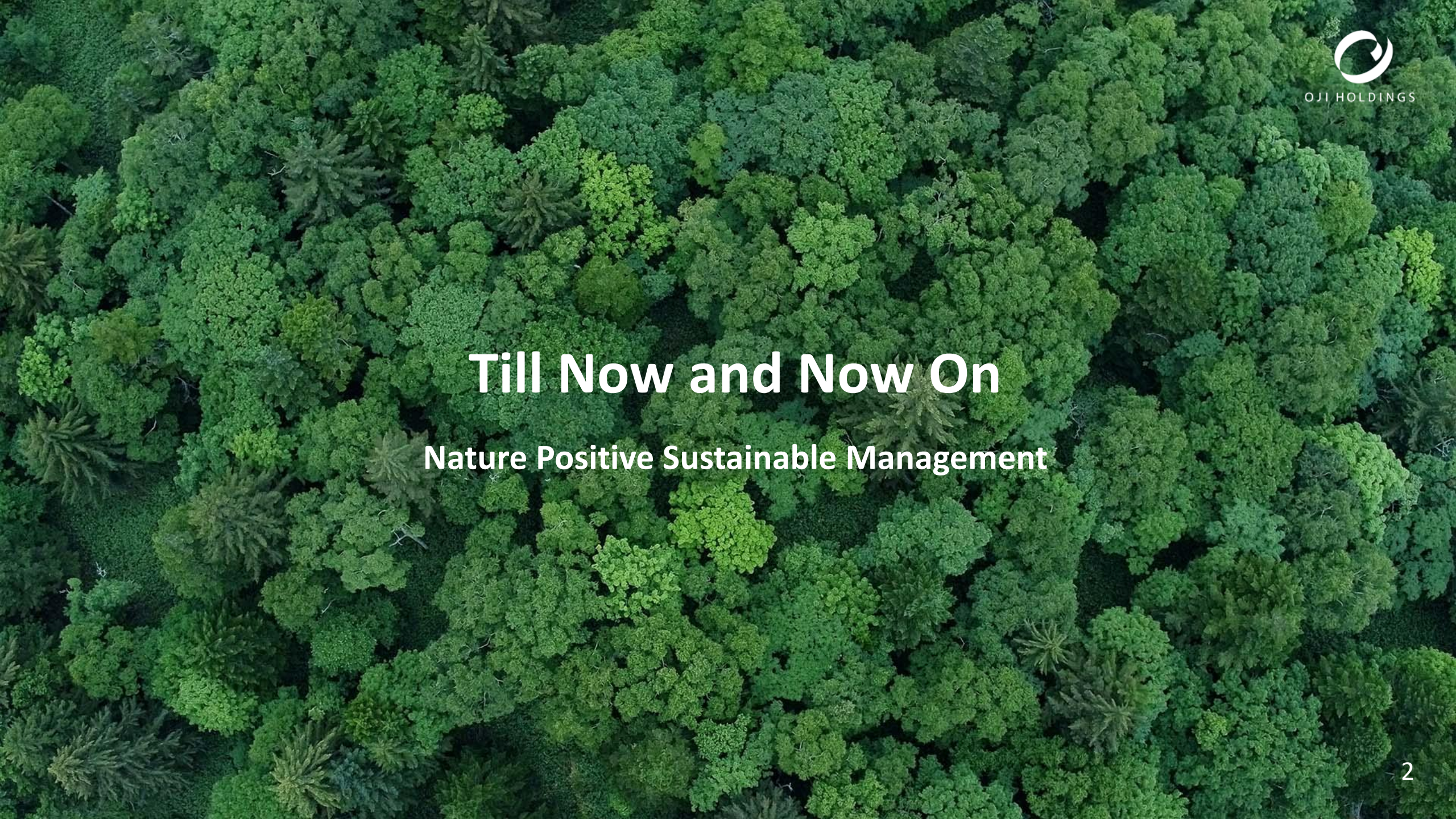
Growing Forests

Toward the Era of Natural Capital Accounting

Initiatives to Establish the Economic Value of Oji Forests


OJI HOLDINGS
Till Now and Now On
Nature Positive Sustainable Management

Words of Our Predecessor

OJI HOLDINGS

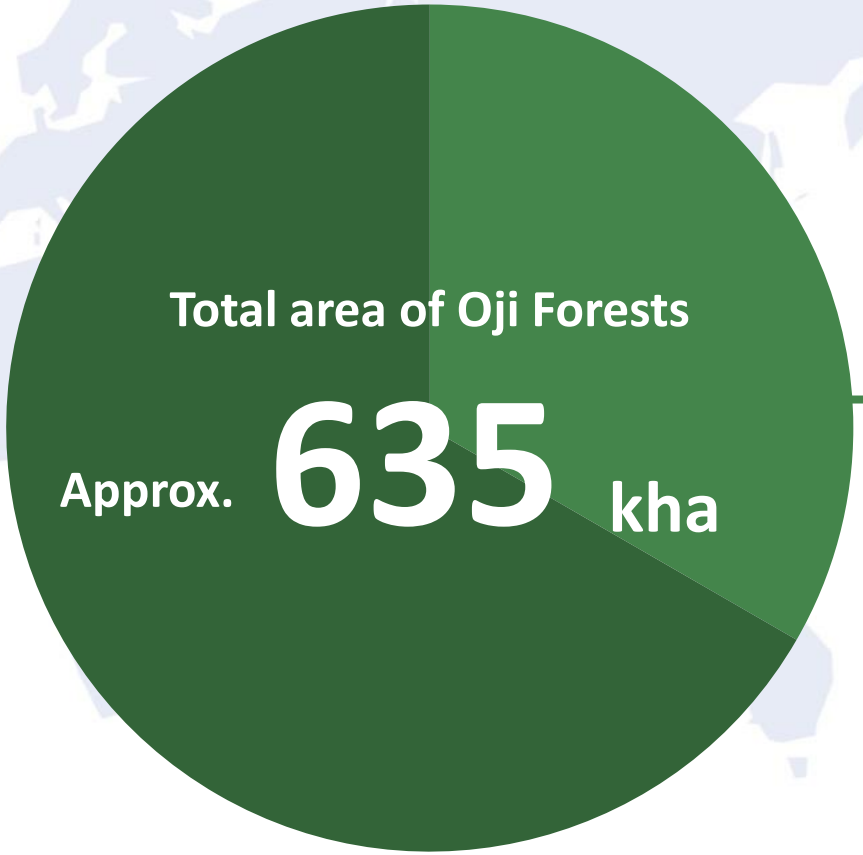
“Those who use trees
have the responsibility to plant trees.”

Ginjiro Fujiwara

President, Oji Paper Co., Ltd. (1933-1938)

Oji Forests

1/3 of global Oji Forests (635Kha) is Conservation Forests focusing on conservation of multiple forest functions.



Ratio of Conservation Forests

Approx. 1/3

*The approximate ratio of company-owned forests that are practically managed as environmental conservation forests

Oji Group’s Forest Management

Production Forests and Conservation Forests are maintained and managed together, to keep sustainable forests.

CENIBRA, Brazil

The Economic Value of Oji Forests (in Japan)

Estimated Economic Value of multiple functions of Oji Forests in Japan (announced in Sept. 2024)

Water resource cultivation

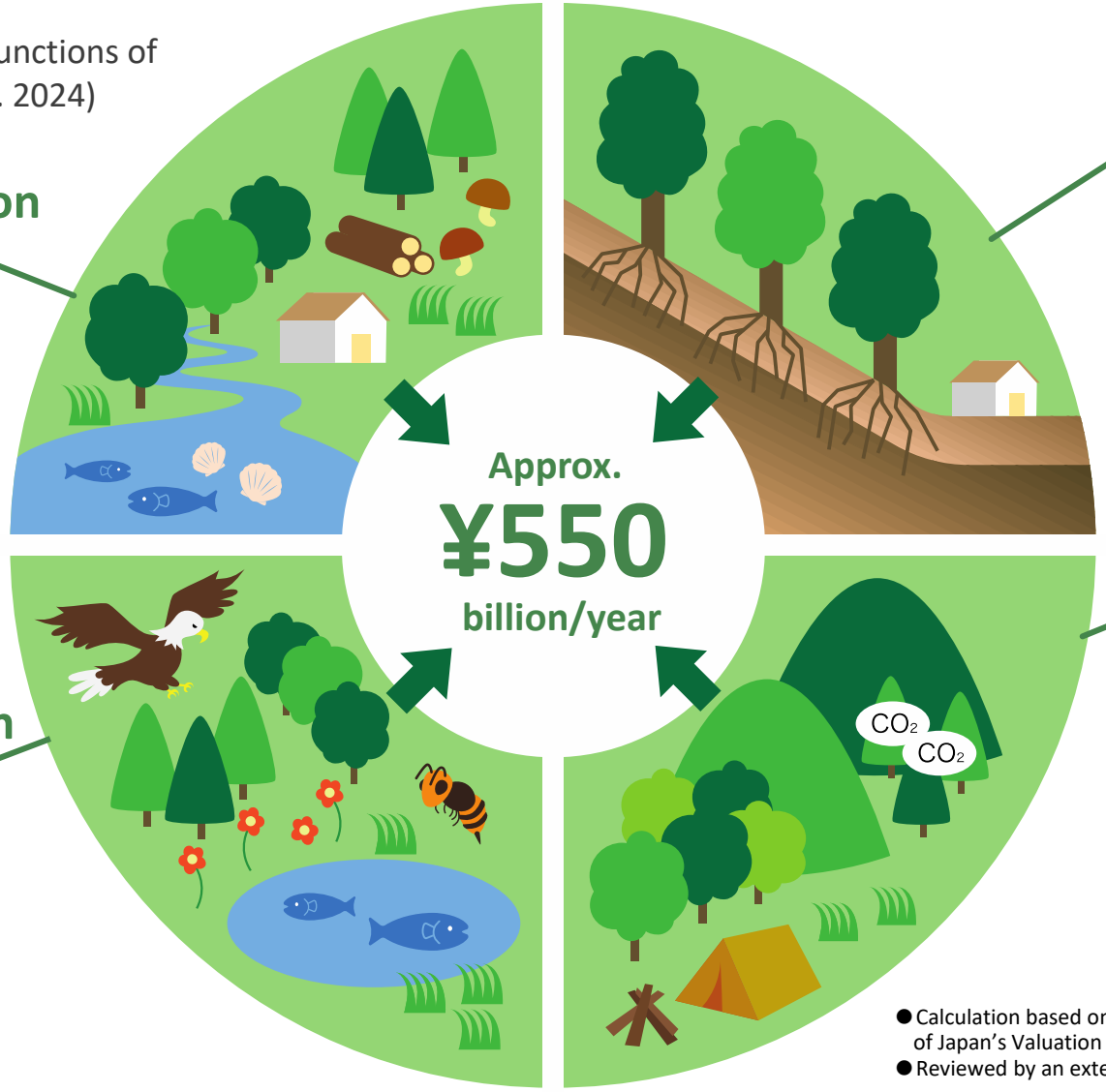
¥204 billion/year

Forest soil retains rainwater, regulates river flow, prevents floods and droughts, and purifies water.

Biodiversity conservation

¥43 billion/year

Forests are habitats for wild birds and animals.



Prevention of soil erosion and landslides

¥275 billion/year

Understory vegetation and litter of forest control surface erosion.
Forest root systems prevent Landslide.

Air quality, Absorb CO_2, Recreation etc.

¥28 billion/year

Forests absorb CO2 and produce oxygen as they grow.
Forests comfort people and provide leisure spaces.

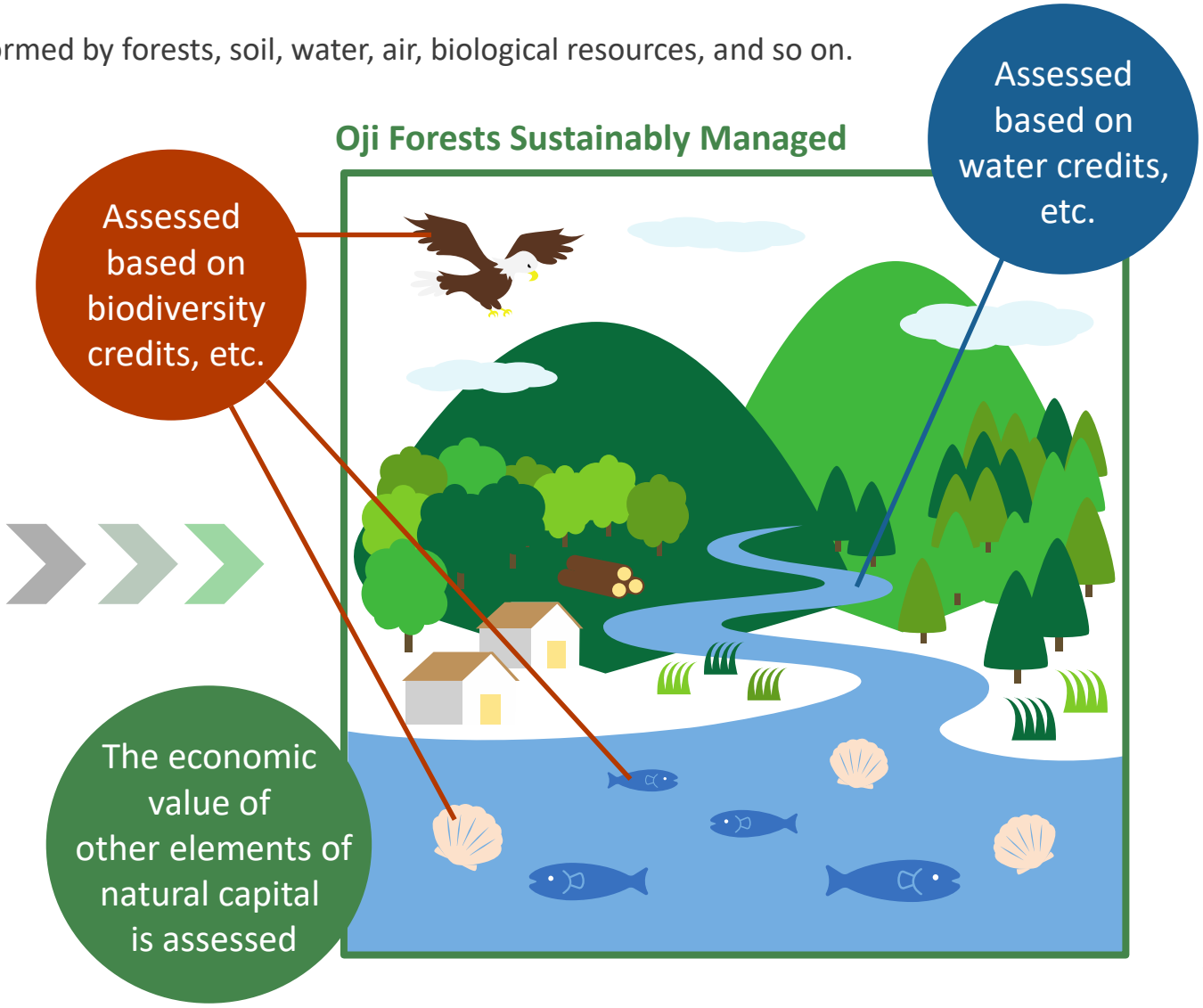
- Calculation based on the methodology used in the Forestry Agency of Japan's Valuation of the Public Benefit Functions of Forests
- Reviewed by an external environmental assessment company

Entering an Era When Natural Capital Will Generate Economic Value

Sustainably managed Oji Forests generate natural capital (stock) formed by forests, soil, water, air, biological resources, and so on.

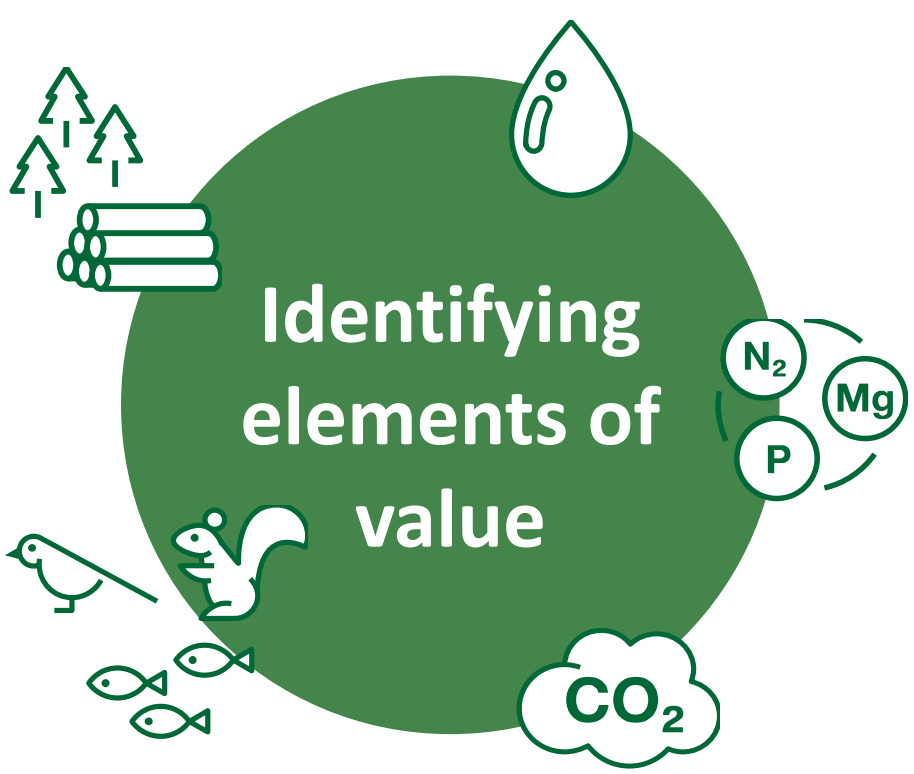
Forests NOT Sustainably Managed

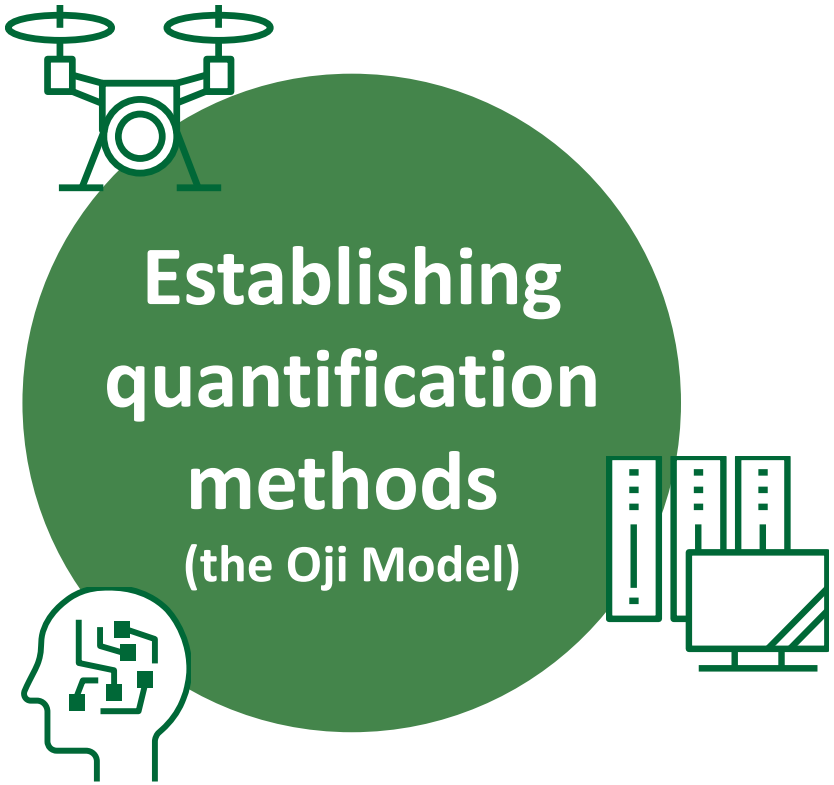
Oji Forests Sustainably Managed



Actions for Natural Capital Accounting

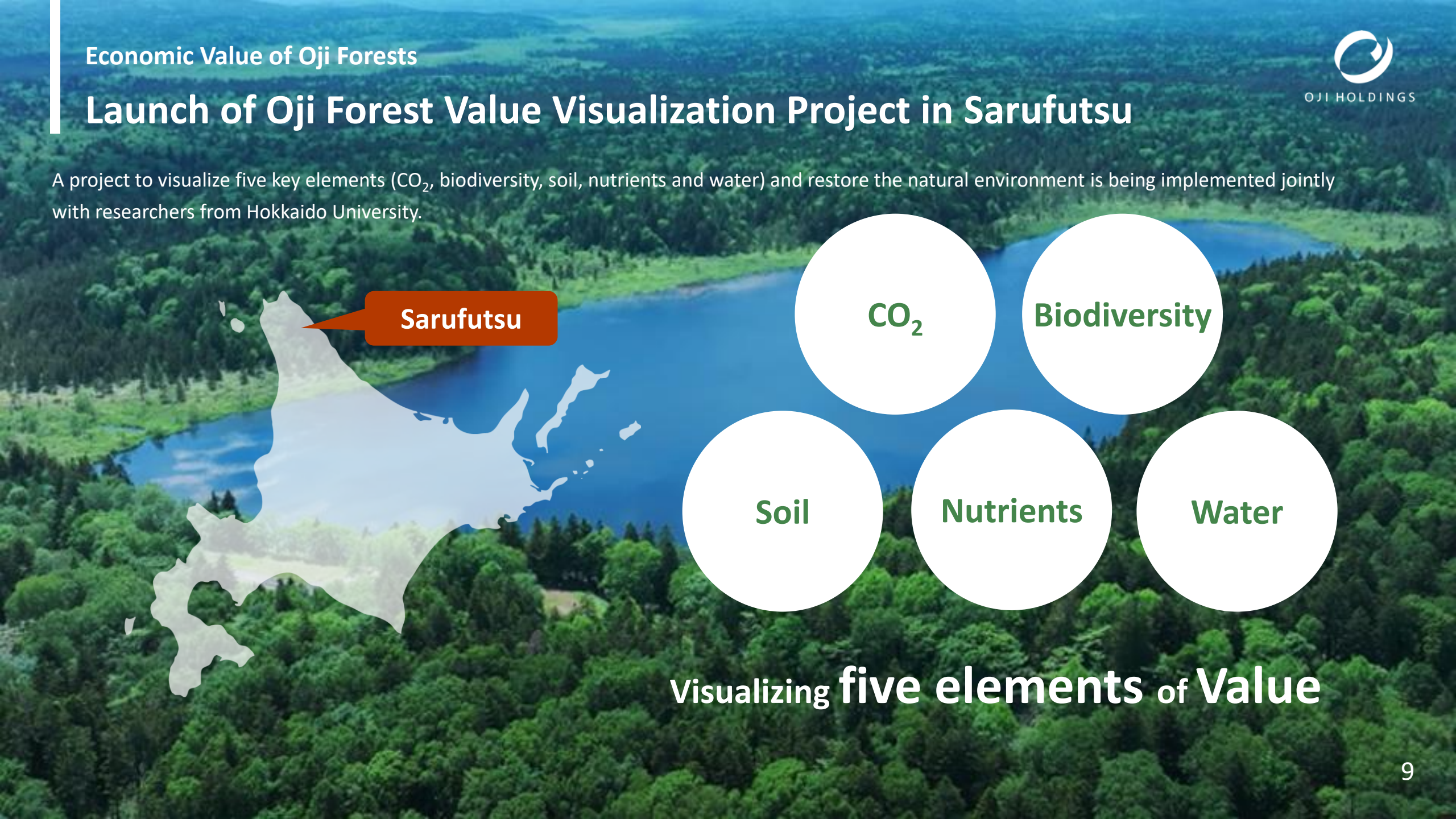
To assess the economic value, identifying elements of value and establishing quantification methods are firstly required.





Launch of Oji Forest Value Visualization Project in Sarufutsu

A project to visualize five key elements (CO_2, biodiversity, soil, nutrients and water) and restore the natural environment is being implemented jointly with researchers from Hokkaido University.



Visualizing five elements of Value

Sarufutsu: Five Value Visualization Project

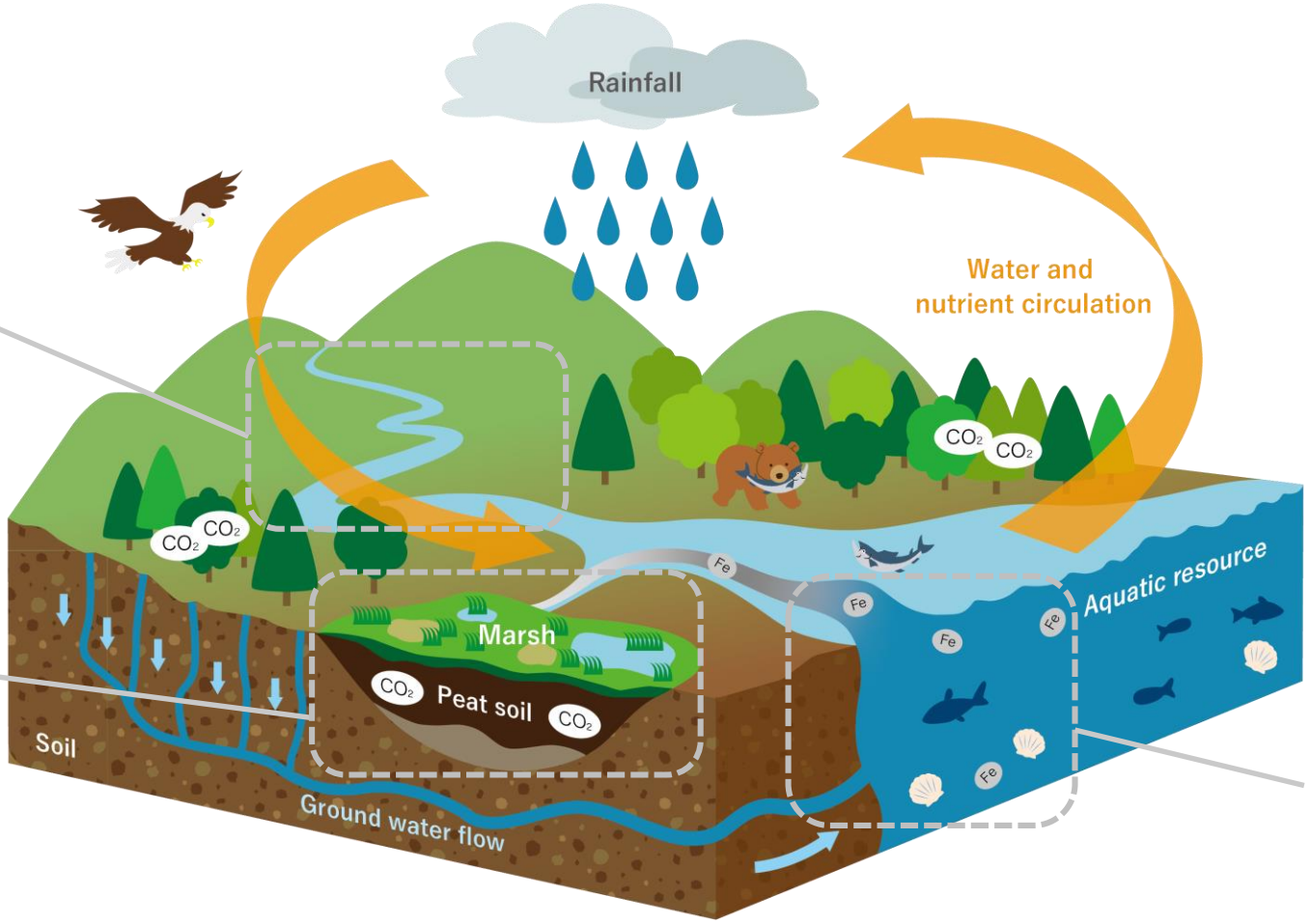
A project to visualize five key elements (CO_2, biodiversity, soil, nutrients and water) and restore the natural environment is being implemented jointly with researchers from Hokkaido University.

River structure improvement to promote Ito to swim upstream and spawn

Degraded marsh restoration

and

Soil carbon assessment of swamp forest and marsh



Biodiversity assessment

[Whole the area]

Iron supply function assessment

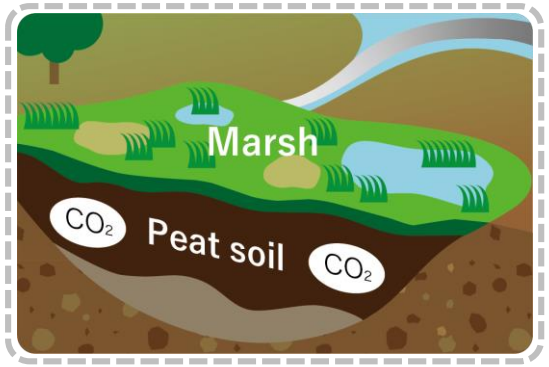
Sarufutsu: Five Value Visualization Project

A project to visualize five key elements (CO_2, biodiversity, soil, nutrients and water) and restore the natural environment is being implemented jointly with researchers from Hokkaido University.

River structure improvement to promote Ito to swim upstream and spawn

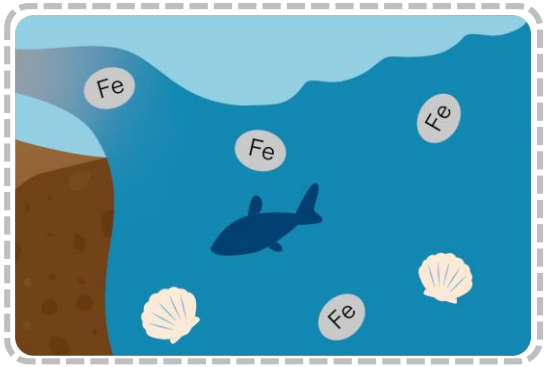
River structure (e.g., culverts) improvements and re-meandering small rivers

Degraded marsh restoration and soil carbon assessment



Elevate water level in marsh to prevent aridification and soil carbon assessment

Iron supply function assessment



Assess iron supply function from marsh to ocean via river. Visualize marsh's impact to ocean

Sarufutsu: Biodiversity Visualization Project

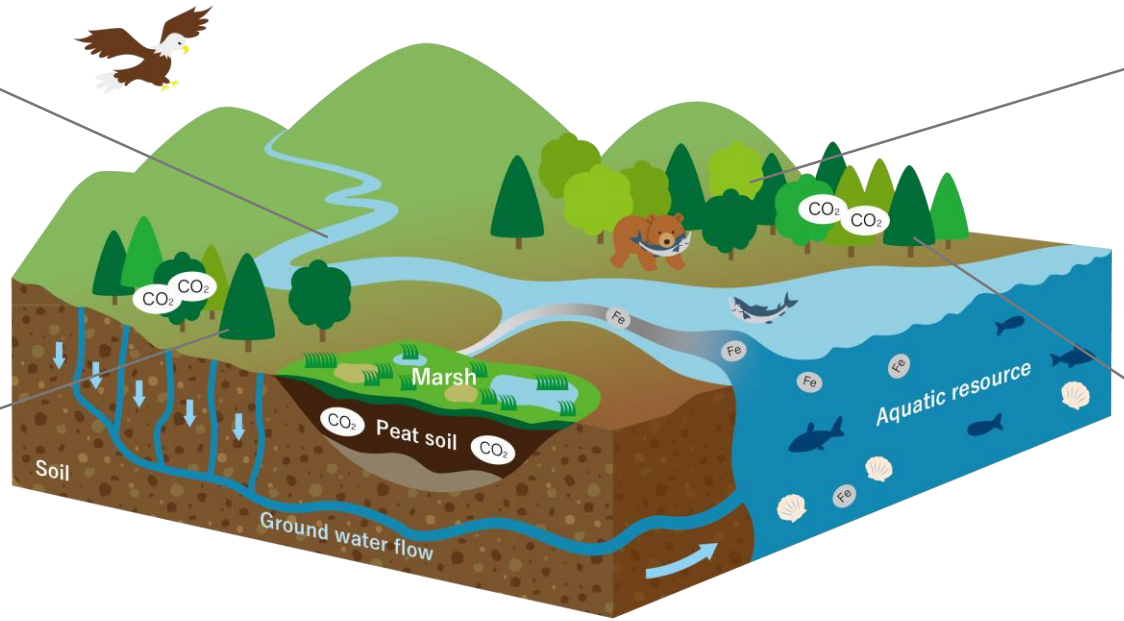
A project to measure biodiversity of the Oji Forest in Sarufutsu by analyzing data about various species using a combination of cutting-edge technologies, including acoustic sensors, drones, cameras, and environmental DNA, is being implemented jointly with an overseas startup.

Environmental DNA analysis for fish

Monitoring animals with fixed-point cameras

Biodiversity assessment

[Whole the area]



Comprehensive analysis of biodiversity by AI

Imagery of vegetation using drones

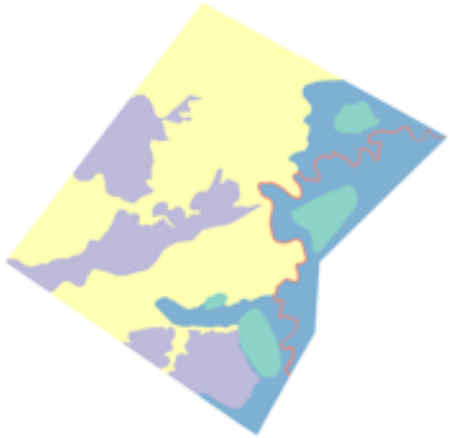
Acoustic sensors for animal sounds

Sarufutsu: Biodiversity Visualization Project

Information obtained from assessments of biodiversity will be used as basic information for economic valuation, and will also be disclosed through TNFD and other frameworks.

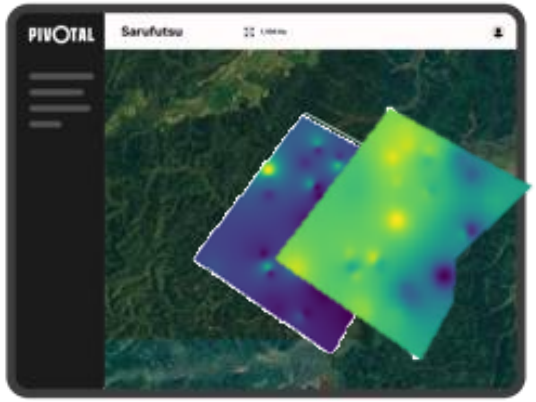
Biodiversity assessment

[Whole the area]

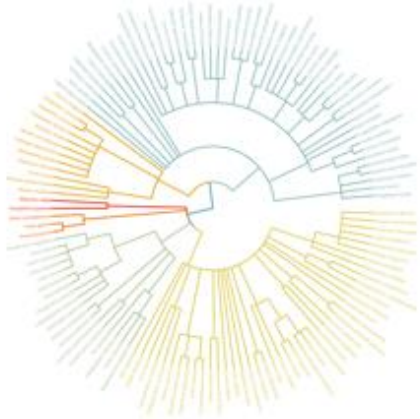


Habitat classification & extent

Habitat health & connectivity



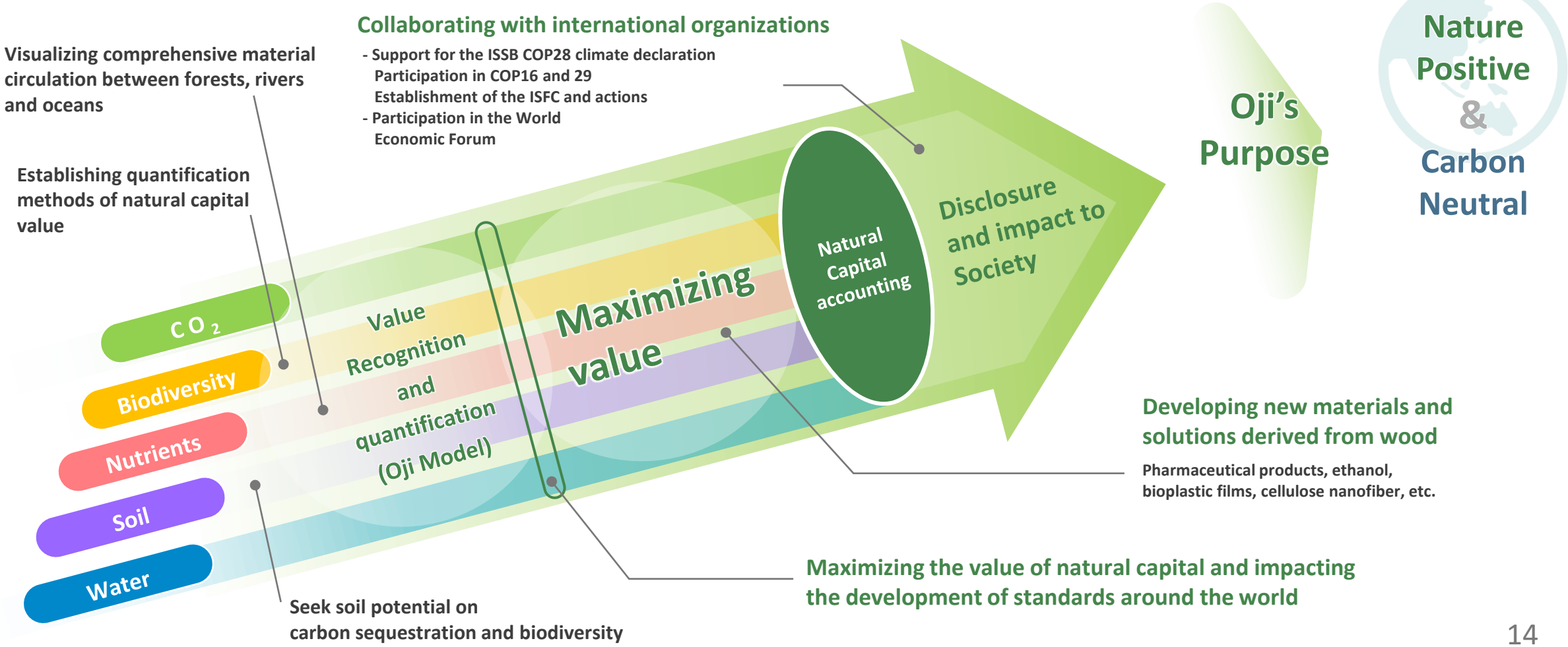
Species Richness & Species Diversity



Taxonomic dissimilarity

Our Challenge With Forests: Towards the Next 150 years

Because climate change and changes in natural capital affect each other, we will act to move toward the era of natural capital accounting, aiming to achieve both nature positive outcomes and carbon neutrality.

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Growing Forests, Utilizing Forests.

OJI HOLDINGS

Utilizing Forests

Introduction

Role of Innovation Promotion Division

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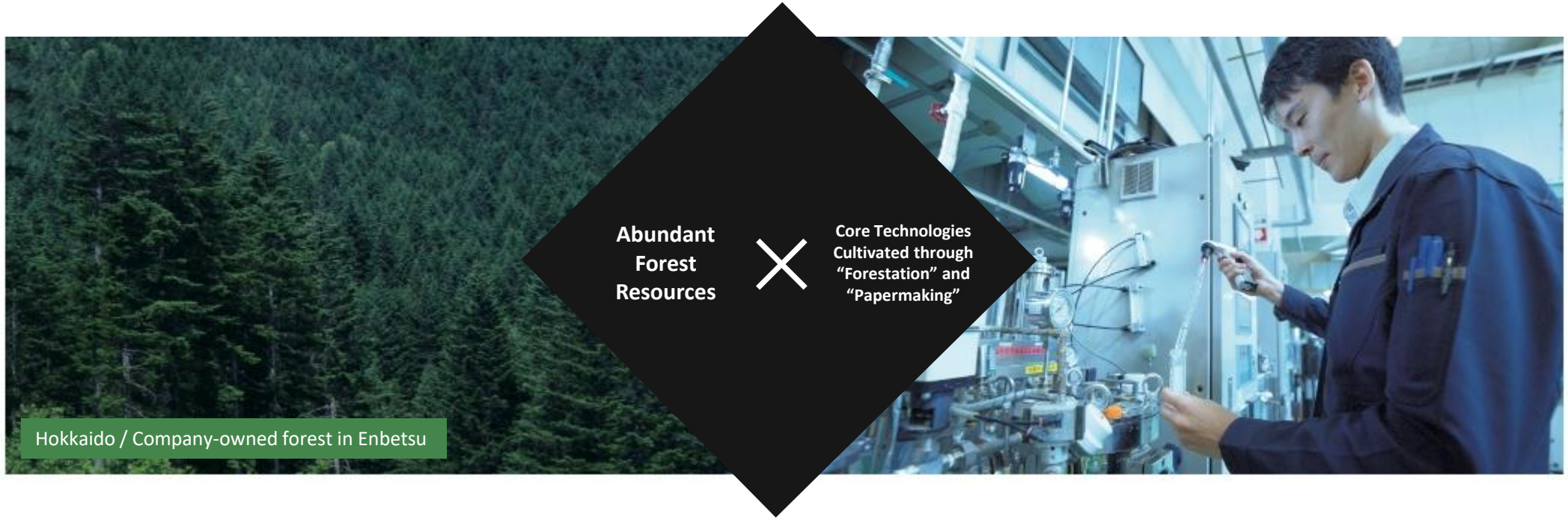
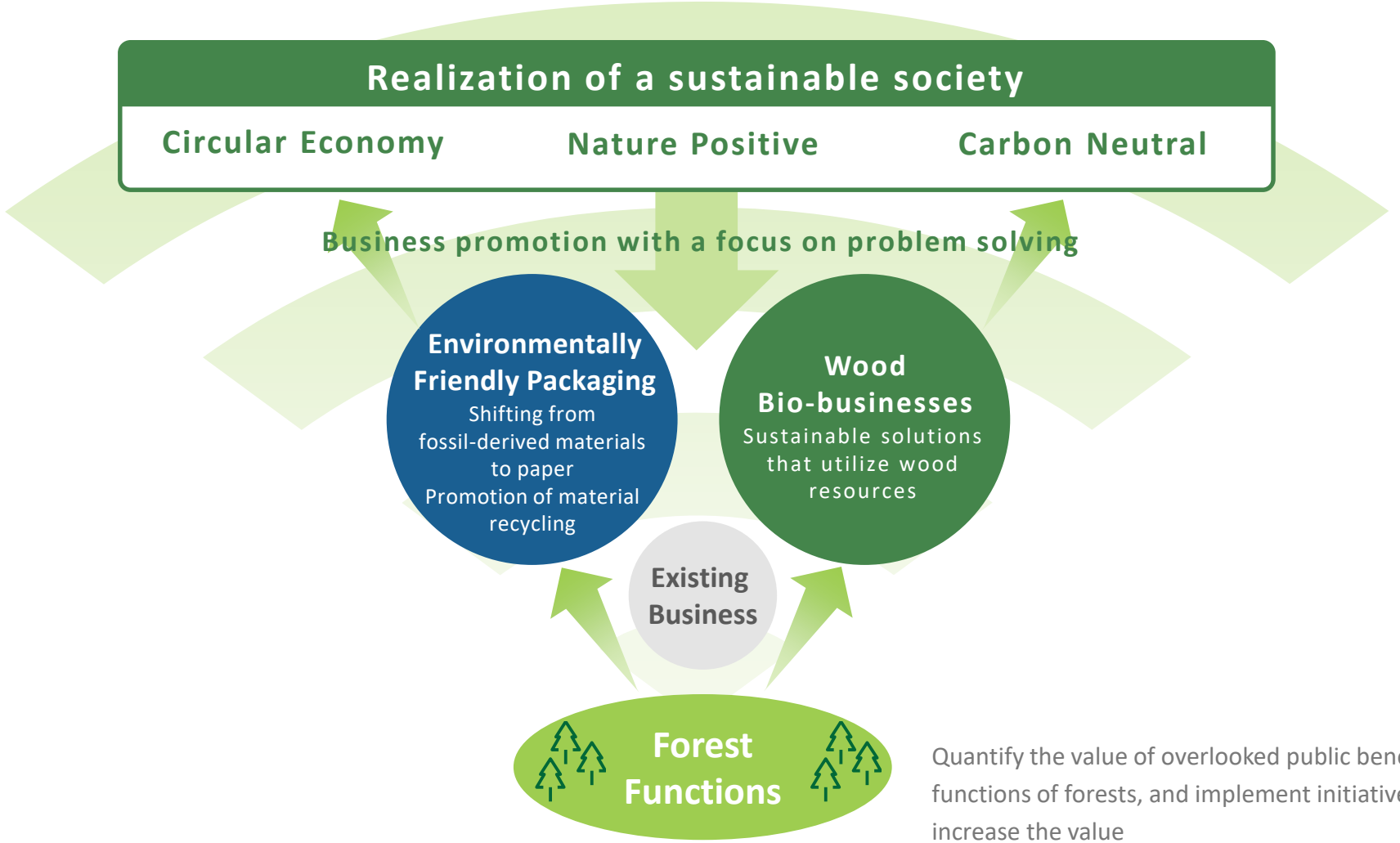
We aim to fully utilize our forest resources to address social issues and create new value.



Initiatives for Sustainable Growth-State

We are promoting R&D of new materials that utilize forest resources, calling it the “wood bio-business” as a core business for the next generation.
We aim to address social issues by replacing materials and products derived from fossil resources.



Quantify the value of overlooked public benefit functions of forests, and implement initiatives to increase the value

The Vision of Our Wood Bio-businesses

We will contribute to the realization of a carbon-neutral society through the development of wood-derived new materials, utilizing the resources of the Oji Group.

Existing Business Infrastructure

- Pulp Manufacturing Equipment
- Recovery Boiler
- Wastewater Equipment
- Hydroelectric Power Plant

Making efficient use of Oji resources

Hemi-cellulose

Cellulose

Lignin (Black liquor)

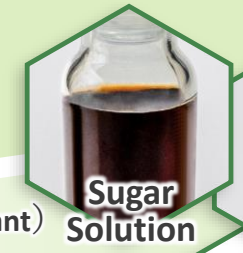
Paper mill portfolio conversion

CO_2 Recovery

E-methane

H_2

Medical ＆Healthcare
（Pharmaceuticals Medicinal Plant）



Sugar Solution

Ethanol

Poly (lactic acid)

Utilizing forest resources
Converting waste and by-products into valuable resources

Biomass Energy

Biomass Composite Materials

CNF

Semiconductor Photoresist

Business development in line with needs and megatrends

- Mobility
- Rechargeable Battery
- Semiconductor
- Healthcare

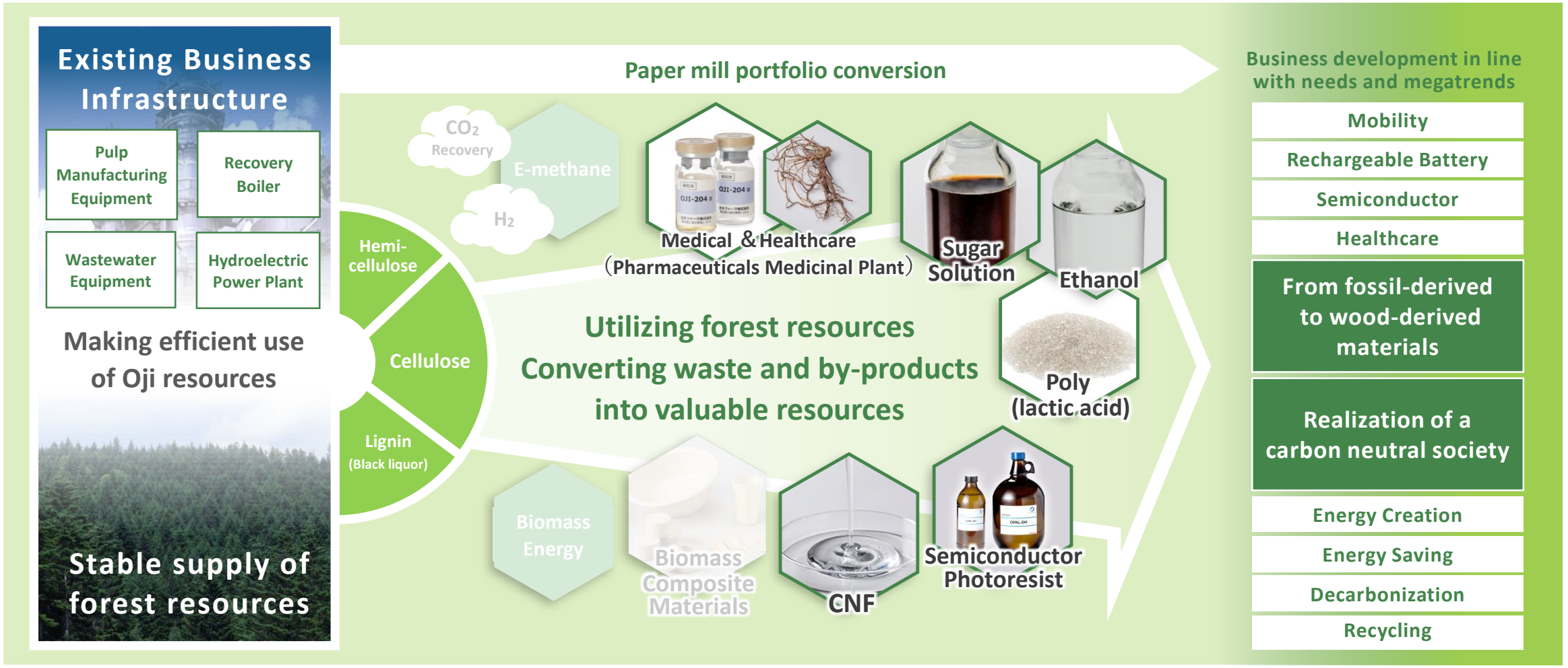
From fossil-derived to wood-derived materials

Realization of a carbon neutral society

- Energy Creation
- Energy Saving
- Decarbonization
- Recycling

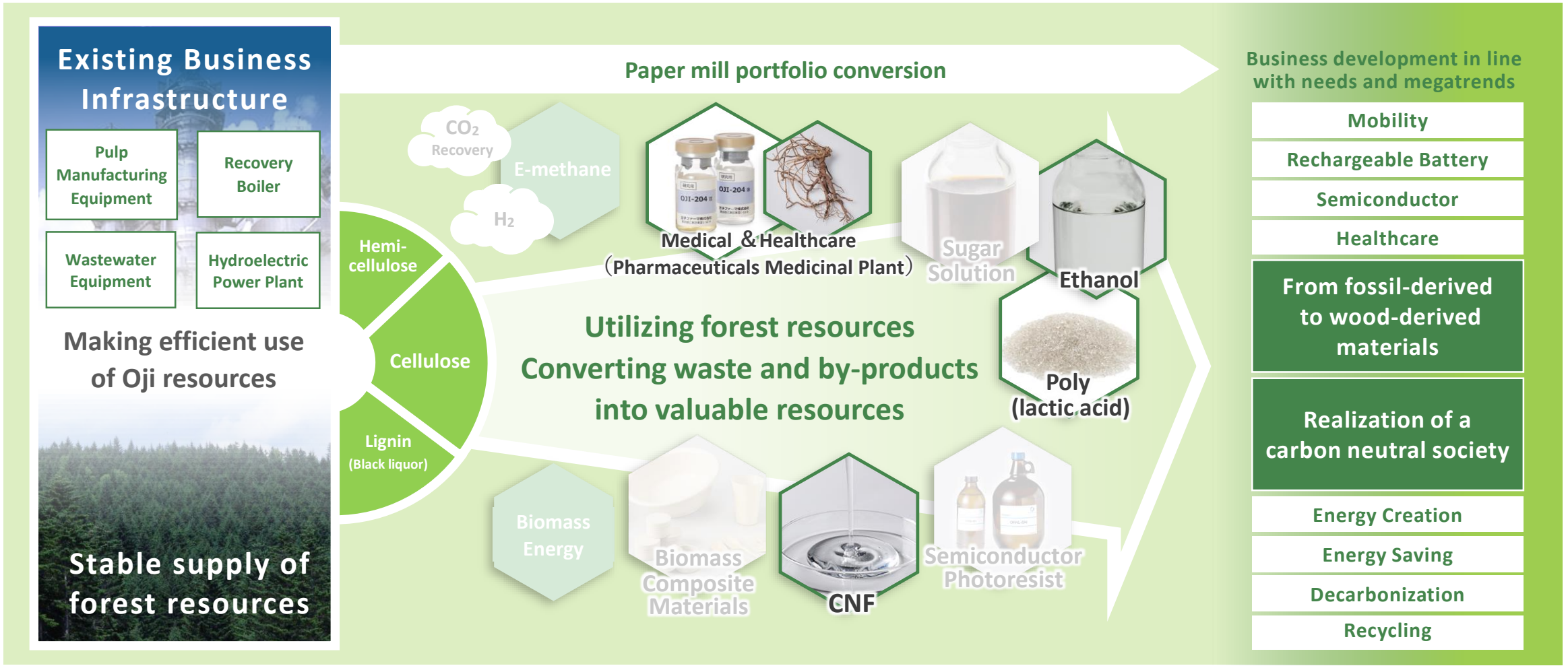
The Vision of Our Wood Bio-businesses

We will introduce four R&D themes from the Wood Bio-businesses.



Review of the FY2022 R&D IR Briefing Session

We will report on the progress of the R&D themes introduced in October 2022.



1. CNF Composite Materials

A sustainable composite material made from natural rubber and cellulose. In May 2024, we introduced a mass production test equipment.

CNF-Natural Rubber Composite

Natural Rubber

- Natural material collected from rubber trees
- Properties such as flexibility, resilience, and vibration damping

CNF

- Natural material made from wood fiber (pulp) that has been finely ground

CNF・Natural Rubber Composite

- **Both natural rubber and CNF are natural materials**
- **Solving the balance between toughness and elasticity**

CNF-Natural Rubber Composite

2024

2030

Special-purpose/High-value-added use applications	Expansion of applicable components	Full-scale adoption for tire applications
Introduction of a mass production test equipment	Expansion of supply structure	

2030 Sales target

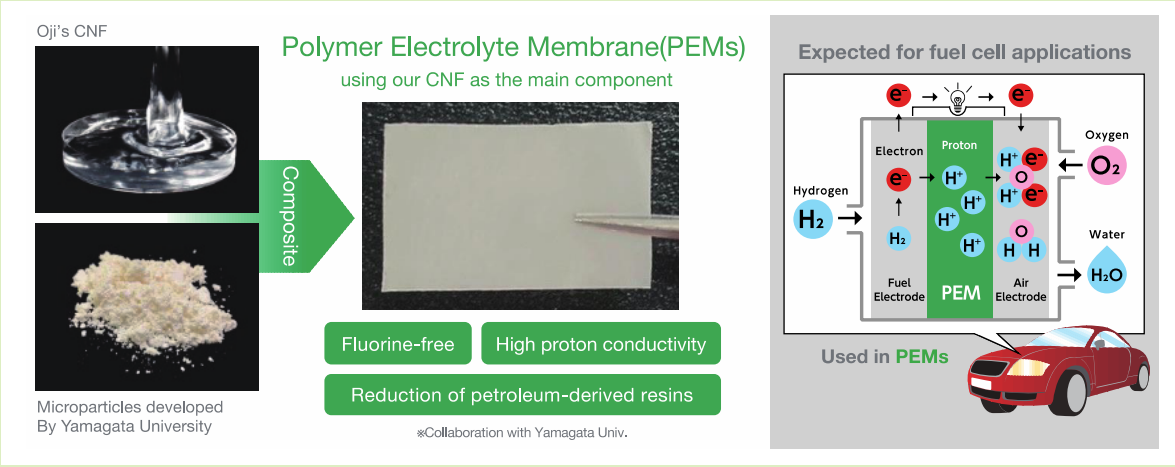
More than ¥6.0 Billion/year

1. CNF Composite Materials

In addition to CNF-Natural rubber composite, we will introduce topics on new composite materials.

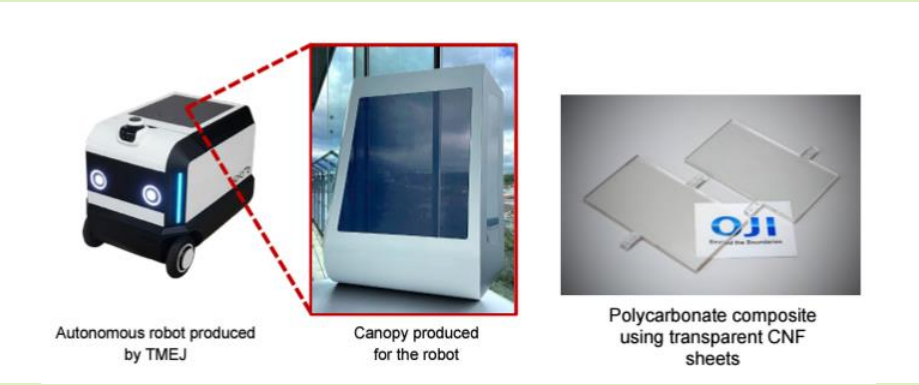
Development of Polymer Electrolyte Membrane for Fuel Cell Using CNF

- In joint research with Yamagata University, we have succeeded in developing a polymer electrolyte membrane with our unique CNF as the main component.
- High proton conductivity and film-forming properties
- It is composed primarily of wood-derived CNF and is PFAS-free
- Possibility of application as a polymer electrolyte membrane for water electrolysis equipment that produces hydrogen



Development of an Autonomous Robot Component Using CNF

- Joint Development with Toyota Motor East Japan, Inc.
- Polycarbonate resins combined with CNF Sheets are used for the canopy
- The high transparency and rigidity of CNF enables new see-through designs. No reinforcing materials are required, contributing to simplified assembly processes and increased loading capacity.



2. Medical ＆Healthcare— Promoting Commercialization of Medicinal Plants (Licorice)—

Oji Medicinal Plants Laboratory Co., Ltd. has established large-scale cultivation technology for Japanese licorice, and is promoting its commercialization.

Overview

Established cultivation technology for domestic licorice in Hokkaido

- Established large-scale cultivation technology in Hokkaido
- This allows us to achieve a “sustainable business” that does not rely on collection of wild products
- High level of safety and traceability enable us to expand into the fields of pharmaceuticals, cosmetics, and food

With its high level of safety and traceability, we are expanding into the fields of pharmaceuticals, cosmetics, and food.

Expansion into food industry

Promotion to the food and beverage industry in a form that suits the purpose

Expansion into the pharmaceuticals and cosmetics industry

Commercialization of medicinal plants

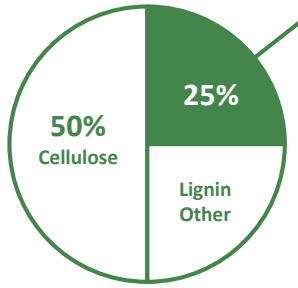
	2024	2030	2030 Sales Target
Application Development and Sales Channel Expansion	→	Sales Expansion	More than **500** Million Yen/year
Yield Amount of Licorice	Several tons per year	20 tons ／year	

2. Medical ＆Healthcare— Development of Wood-derived Pharmaceuticals —

Oji Pharma Co., Ltd. will accelerate the launch of its pharmaceutical business, focusing on the development of sulfated hemicellulose-based pharmaceuticals.

Development Concept

Utilization of unused wood components, Increasing added value



Hemicellulose

Sulfated hemicellulose

- Sustainable Development
- Halal-friendly
- Stable supply
- Reducing dependence on China

Accelerating the launch of business centered on the development of pharmaceuticals using sulfated hemicellulose

Pharmaceuticals for animal use

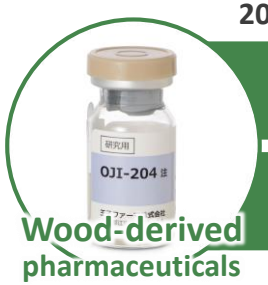
Currently acquiring approval for a drug for animal use

Confirmed effectiveness for horses with walking difficulties

Pharmaceuticals for human use

Obtained the first-class and the second-class marketing licenses for pharmaceuticals in Japan

The First Class	The Second Class
Now possible to sell in-house manufactured pharmaceuticals to	Proprietors of pharmacies Wholesalers Store-based distributors Household distributors



Wood-derived pharmaceuticals

2024

Marketing Approval & Sales

Clinical Trials

2030

Sales Expansion

Marketing Approval & Sales

2030 Sales Target

More than **10.0** Billion/year

2. Medical ＆Healthcare —Sales of Kampo Products Containing Domestic Licorice—

Oji Pharma Co., Ltd., is commercializing Kampo products containing domestic licorice from Oji Medicinal Plants Laboratory Co., Ltd. .Test sales are scheduled.

Oji Pharma Co., Ltd.

R&D, manufacturing and sales systems as a pharmaceutical company

Oji Medicinal Plants Laboratory Co., Ltd.

Cultivation technology of Japanese licorice

Utilizing the internal synergy of the Oji Group

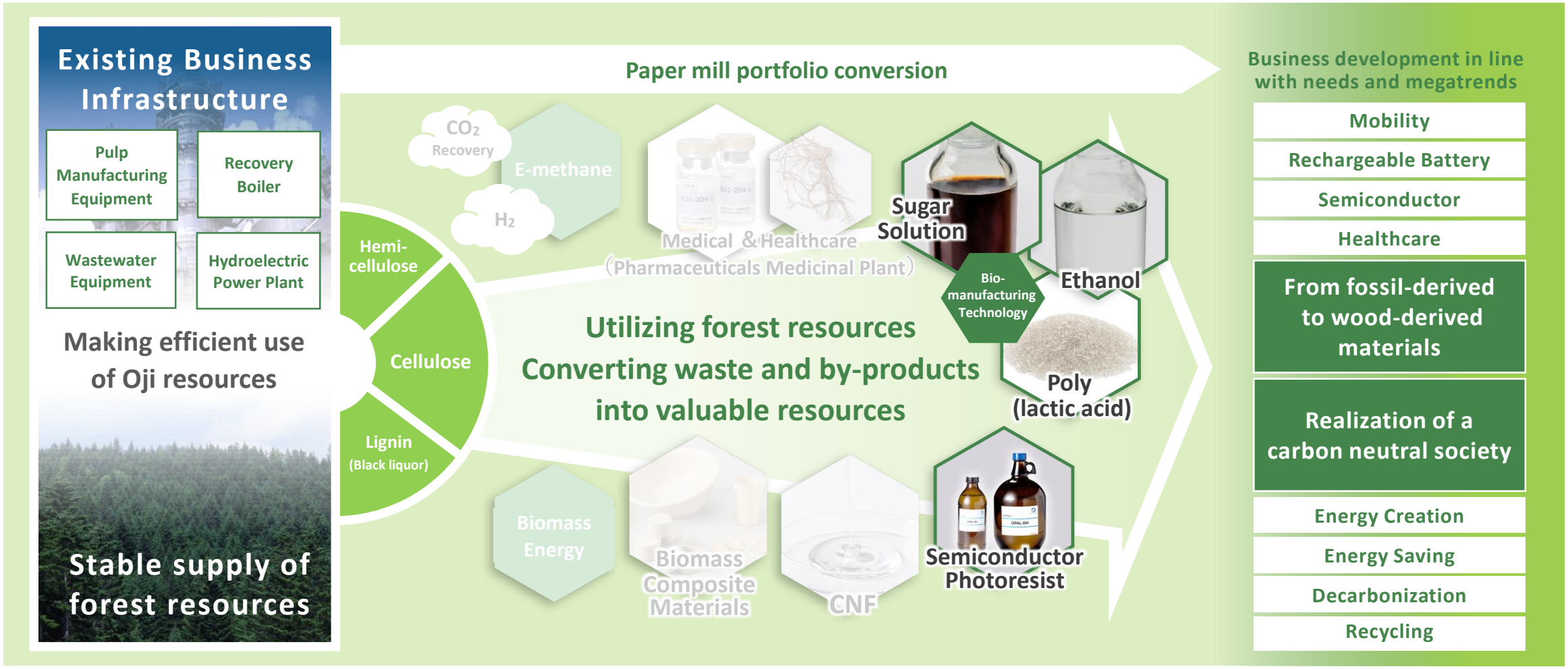
Kampo Products Containing Domestic Licorice

*Image of a product under development

Test sales are scheduled to begin in December 2024

Announced theme for FY2024

We will explain the current situation of “sugar solution, ethanol, and polylactic acid” and “biomass photoresist for semiconductors” as a new focus of development in the biomass field.



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Utilizing Forests：Theme1

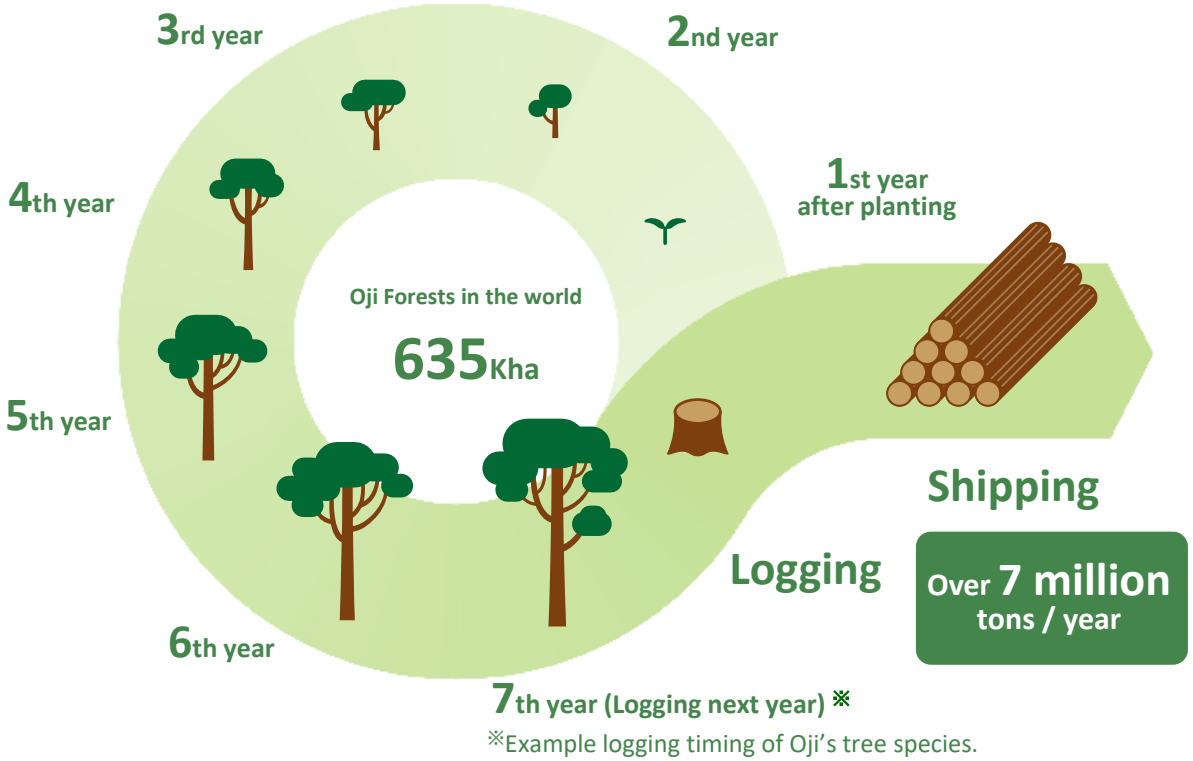
Utilizing Forest Resources, to Develop “Biomanufacturing Technology”

Sugar Solution・Ethanol・Poly(lactic acid) (PLA)

Utilizing Forest Resources, to Develop “Biomanufacturing Technology”

Value of Wood as Biomass Material

Under sustainable forest management, over 7 million tons of woods are harvested annually. Woods are utilized as low environmental impact biomass materials.



※Example logging timing of Oji’s tree species.

Oji’s biomass, with a focus on forests

Compared to **Agriculture**

- **Coexistence with food production**
- **Reduced fertilizer amount** (Material Circulation in Forest Ecosystems)
- **Water source cultivation functions※**
  ※Water storage and purification effects of forests

Utilize abundant forest resources as biomass materials with low impact on the global environment

Pulp Manufacturing Infrastructure and Biomass Energy

Energy-efficient "Kraft pulping method" and total production capacity of over 2 million tons / year in 6 domestic mills.

Tomakomai Mill

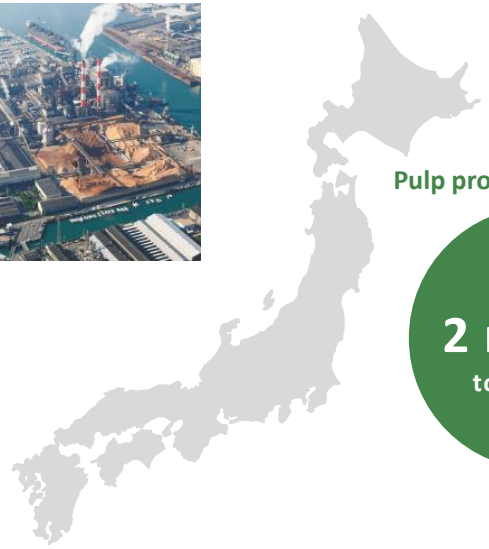
Kasugai Mill

Yonago Mill

Tomioka Mill

Kure Mill

Nichinan Mill



Pulp production capacity

Over **2 million** tons / year

Efficient pulp manufacturing method with minimal waste in chemicals and energy

“Kraft Pulping Method”

Combustion of black liquor (lignin, etc.) in a recovery boiler

Utilization of biomass energy generated during the pulp manufacturing process

Pulp manufacturing using sustainable forest resources and renewable energy

Utilizing Forest Resources, to Develop “Biomanufacturing Technology”

Market Trends and Oji Group’s Competitive Advantage

Develop eco-friendly biomass (wood-derived) alternative materials, leveraging Oji’s competitive advantage, to meet market demands

【Oji Group’s Competitive Advantage】

Value of wood as biomass	Pulp manufacturing infrastructure	Biomass energy
Wood is a biomass material with a low impact on the global environment.	Pulp = Substitute raw material for fossil resources Domestic pulp production volume of over 2 million tons/year	Lean circulation system Black liquor combusted in recovery boilers.

Domestic demand for paper is slowing down. To utilize forest resources, business structure transformation is essential.

×

【National policies (Social trends)】

*National target for 2030

Biofuels (SAF, Bioethanol-gasoline blends)	Biomass plastic (Plastic Resource Recycling Strategy)	Biomanufacturing revolution Biomass x Microbes → Substitutes for fossil-derived materials
10% of domestic fuel will be replaced with SAF	2 millions tons/year will be introduced	Commercialization of various bio-based chemicals

Carbon neutral measures are being promoted in various fields.

Commercialization of Wood-derived Sugar solution, Ethanol, Poly(lactic acid) (PLA)

OJI HOLDINGS

1. Wood-derived Sugar Solution

Expectations for a wide range of applications as a key material in biomanufacturing

2. Wood-derived Ethanol

Demonstration of production and application of bioethanol from pulp

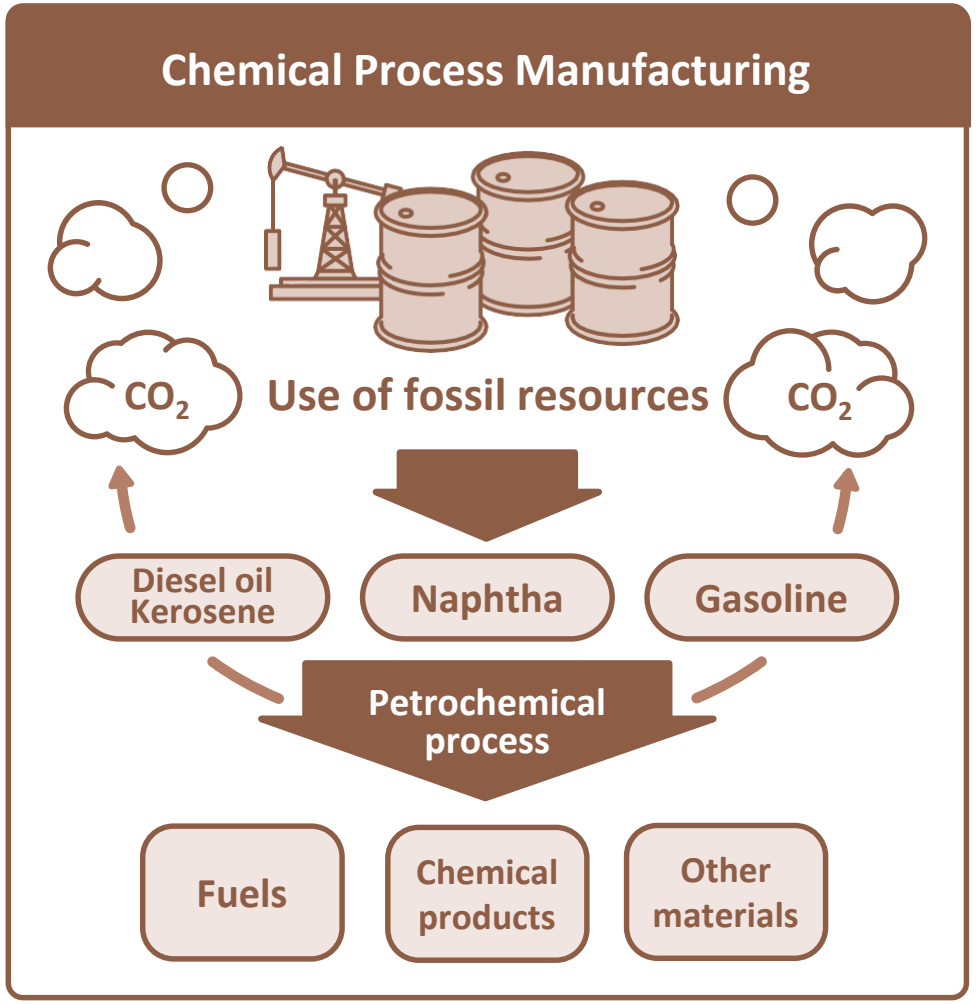
3. Wood-derived PLA

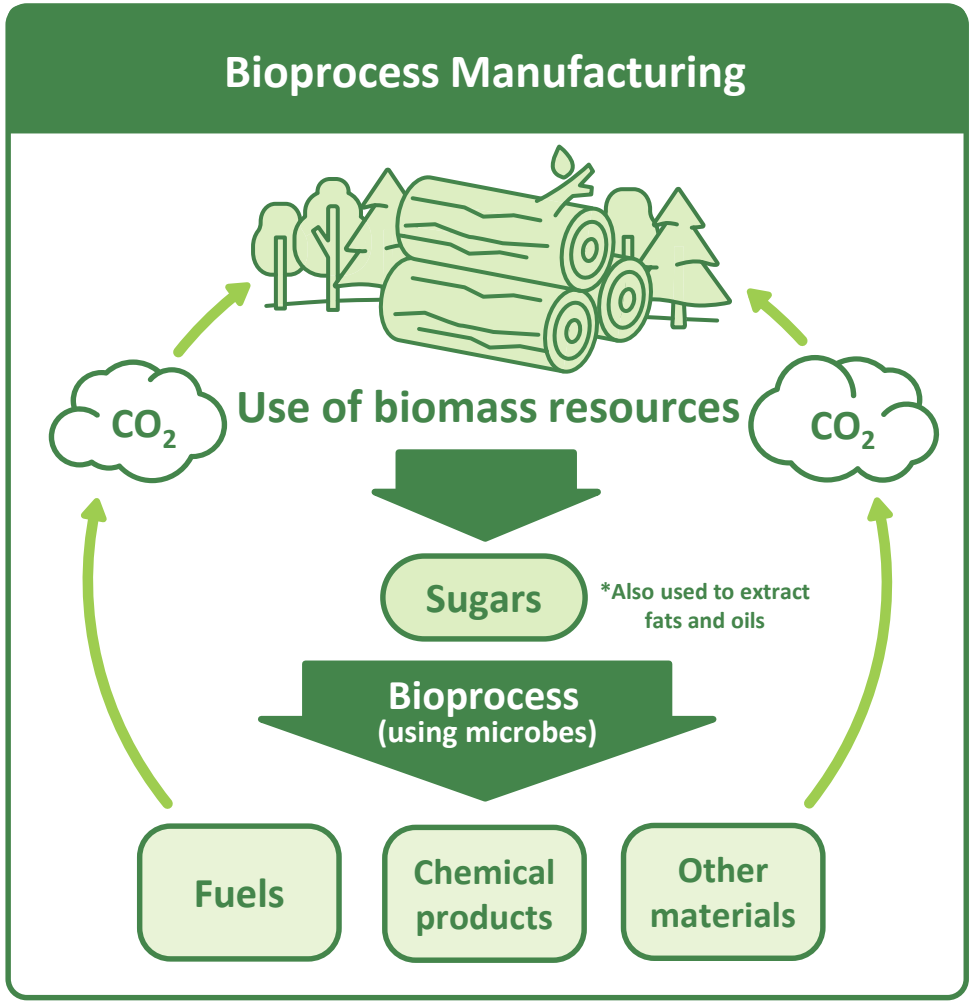
Demonstration of production and application of PLA, a type of biomass plastic made from pulp

Leverage Oji's competitive advantage to develop alternative wood-derived materials to meet market demands and replace fossil resources.

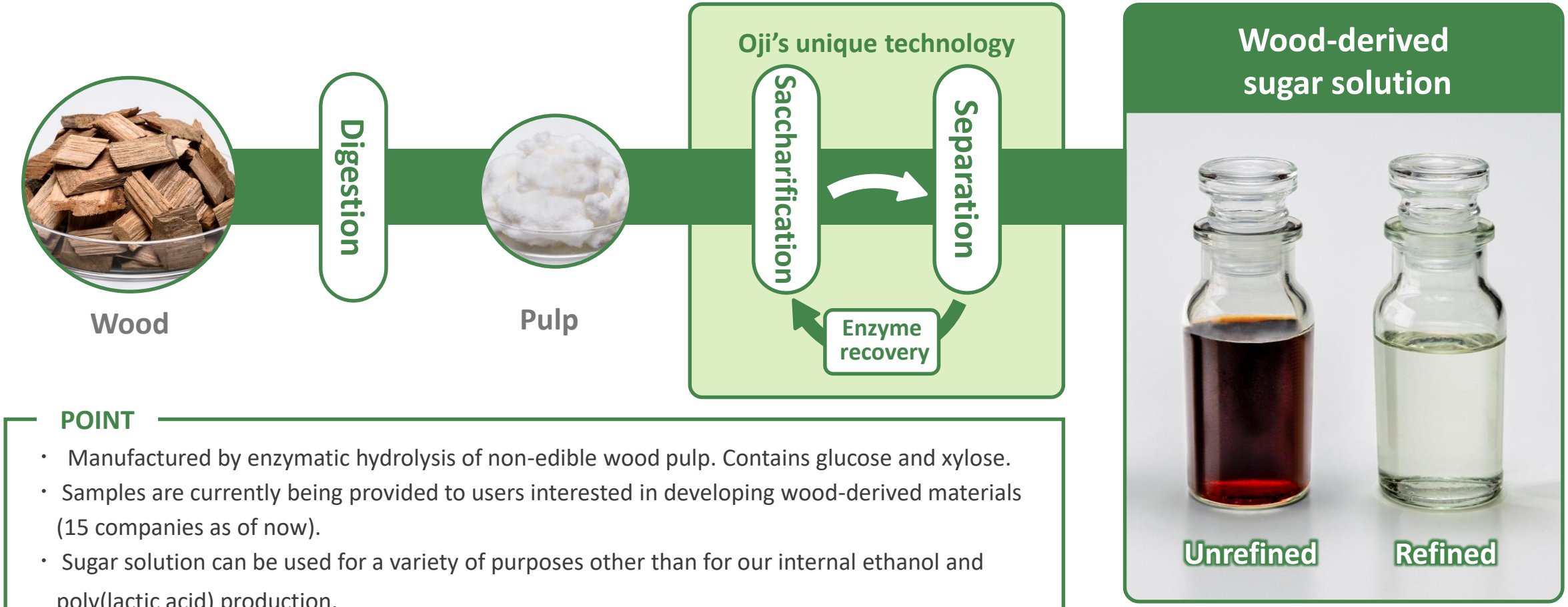
1. Sugar Solution : Biomass Materials World Trends

Growing momentum to commercialize a wide range of wood-derived chemicals that do not rely on fossil resources





1. Sugar Solution : Oji’s Wood-derived Sugar Solution



POINT

- Manufactured by enzymatic hydrolysis of non-edible wood pulp. Contains glucose and xylose.
- Samples are currently being provided to users interested in developing wood-derived materials (15 companies as of now).
- Sugar solution can be used for a variety of purposes other than for our internal ethanol and poly(lactic acid) production.

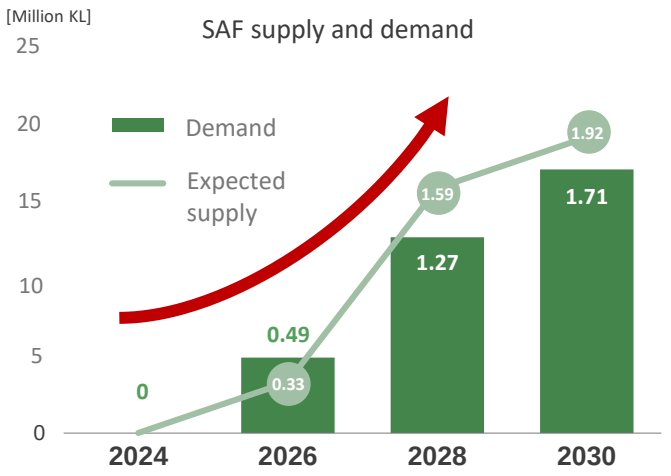
Expecting growing demand for the sugar solution, a raw material for “biomanufacturing”

2. Bioethanol : World Trends

Key bioethanol-derived materials with potential for significant market expansion

Biofuels (SAF, Bioethanol-gasoline blends)

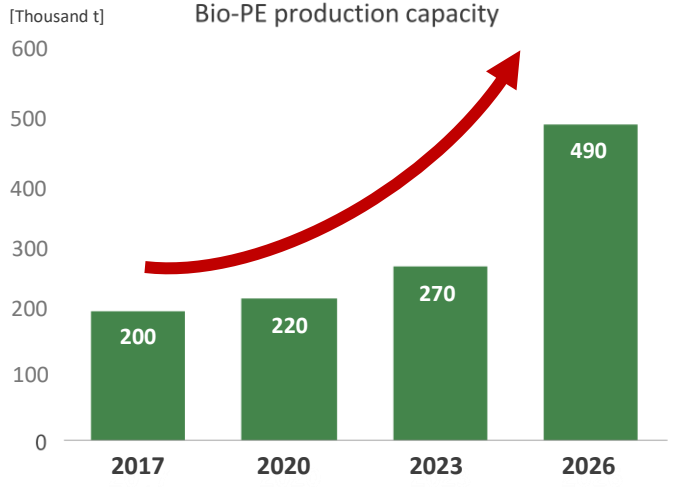
The Ministry of Land, Infrastructure, Transport and Tourism has set a target of “replacing 10% of the fuel used by Japanese airlines with SAF (Sustainable Aviation Fuel)” as the amount of SAF used in 2030.



Prepared by our company based on “Interim Summary (Draft) of Policies for Promoting the Introduction of Sustainable Aviation Fuel (SAF)” (Ministry of Economy, Trade and Industry)（https://www.meti.go.jp/shingikai/energy_environment/saf/pdf/003_07_00.pdf ）

Biomass plastic (Bio-PE, PP)

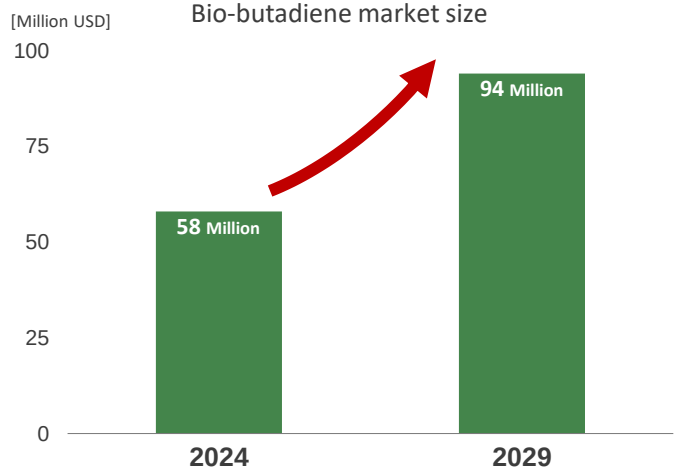
Demand for bio-based PE and PP is growing, especially for flexible packaging materials.



Prepared by our company based on “Bioplastic Market Development Update 2017, 2020, 2023” (European Bioplastics Association)（https://www.european-bioplastics.org/market/ ） (also referred to past data)

Biomass-derived synthetic rubber (Butadiene*)

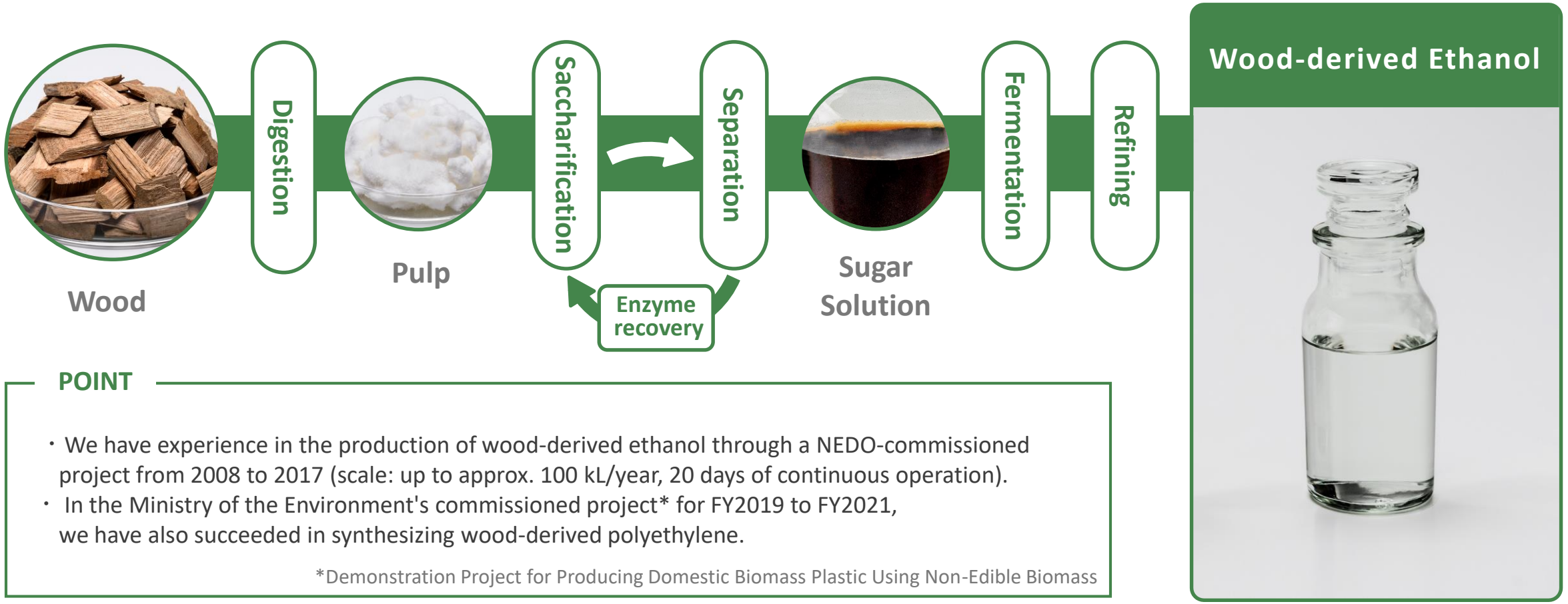
Market expansion is expected, once the value of bio-conversion is recognized, such as the aim to make sustainable materials for tire rubber of major manufacturers.



Prepared by our company based on https://www.gii.co.jp/report/mama1488306-bio-butadiene-market-by-type-sbr-sbl-nbr-abs-pb.html

*Synthetic rubber, especially raw materials for automobile tires

2. Bioethanol : Oji’s Wood-derived Ethanol



POINT

- We have experience in the production of wood-derived ethanol through a NEDO-commissioned project from 2008 to 2017 (scale: up to approx. 100 kL/year, 20 days of continuous operation).
- In the Ministry of the Environment's commissioned project* for FY2019 to FY2021, we have also succeeded in synthesizing wood-derived polyethylene.

*Demonstration Project for Producing Domestic Biomass Plastic Using Non-Edible Biomass

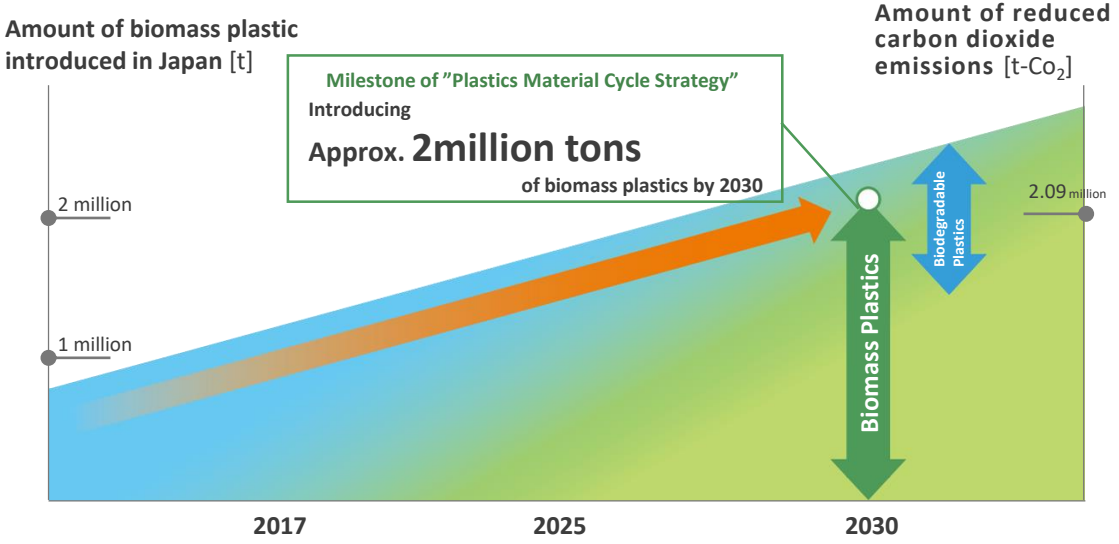
It is expected to enter a market where demand is expanding significantly

3. PLA : World Trends

Representative biomass plastics with potential for large-scale market expansion

Domestic Trends

According to ”Plastics Material Cycle Strategy” by Ministry of the Environment (Formulated in May 2019), they will introduce 2 million tons of biomass plastics by 2030



This table was created by our company by processing the “Bioplastic Introduction Roadmap - Towards the Sustainable Use of Plastics” (Ministry of the Environment, Ministry of Economy, Trade and Industry, Ministry of Agriculture, Forestry and Fisheries, and Ministry of Education, Culture, Sports, Science and Technology). （https://www.env.go.jp/content/900534511.pdf）

Overseas Trends

The production of biomass plastics is also growing worldwide.

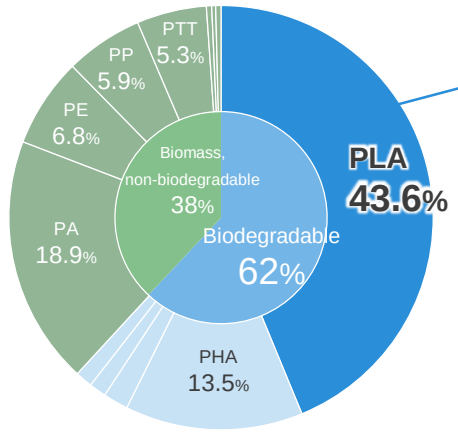
Among these, polylactic acid is a typical biomass plastic that is growing worldwide (CAGR of over 15%)

Global bioplastic production capacity (forecast for 2028)

Production Capacity
7.43 million tons

[Biodegradable]
PLA/ 43.6%
PHA / 13.5%
SCPC / 1.9%
PBS / 0.3
PBAT / 1.3
CR / 1.3

[Biomass, non-biodegradable]
PA / 18.9
PEF / 0.3
PE / 6.8
PET / 0.4
PTT / 5.3
PP / 5.9
Others/ 0.4



PLA accounts for about 40% of the total.

This table was created by our company based on 「BIOPLASTICS MARKET DEVELOPMENT UPDATE 2023」(European Bioplastics) （european-bioplastics.org）

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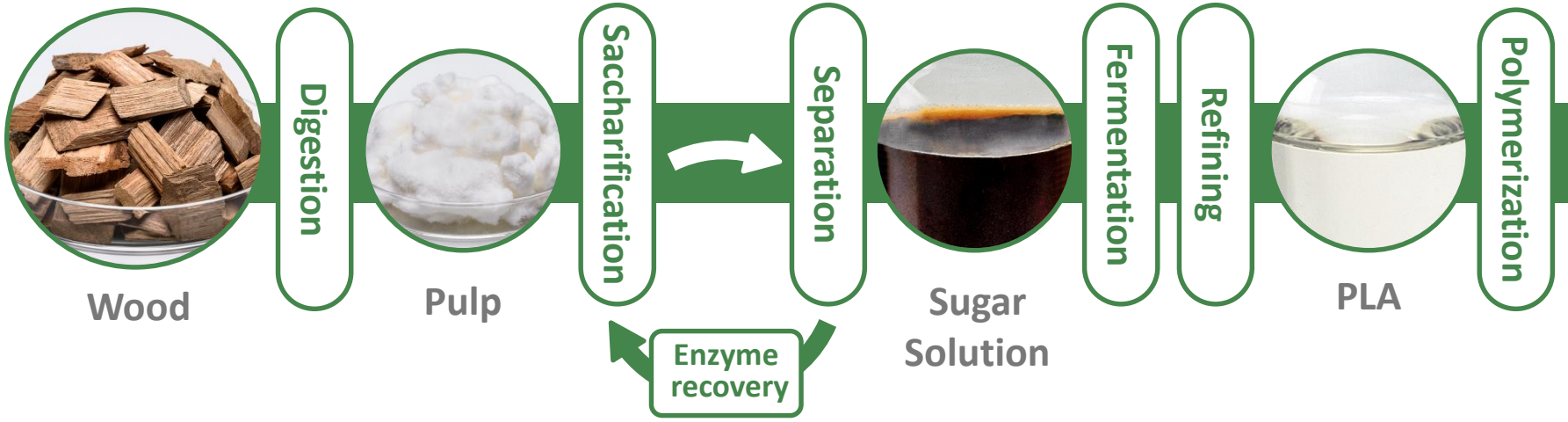
3. PLA : Oji’s Wood-derived PLA



POINT

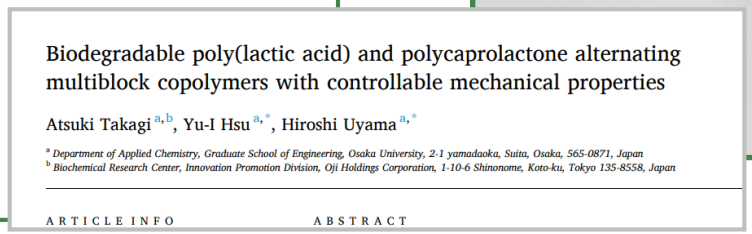
Development of commercial-grade PLA

We have demonstrated that it is possible to obtain PLA of a quality equivalent to that of commercial products from wood, and we will be conducting user work, etc. in the future, including for our own group's products (films, non-woven fabrics, paper laminates, etc.).

Development of PLA-based composite materials

Conducting joint research with Osaka University to supplement the mechanical properties and marine biodegradability of PLA.

Published two academic papers in international journals→



Biodegradable poly(lactic acid) and polycaprolactone alternating multiblock copolymers with controllable mechanical properties

Atsuki Takagi [a,b], Yu-I Hsu [a,*], Hiroshi Uyama [a,*]

[a] Department of Applied Chemistry, Graduate School of Engineering, Osaka University, 2-1 yamadaoka, Suita, Osaka, 565-0871, Japan
[b] Biochemical Research Center, Innovation Promotion Division, Oji Holdings Corporation, 1-10-6 Shinonome, Koto-ku, Tokyo 135-8558, Japan

ARTICLE INFO ABSTRACT

Proceed with sample work and accelerate social implementation

Future Plans

OJI HOLDINGS

Business feasibility assessment

Pilot plant construction

2024

Trial Sales

Consideration and construction of full production facility

3000t /year

*including sugar solution for Producing ethanol

2030

2033

Start of full production

200,000t /year

Business feasibility assessment

Pilot plant construction

2024

Trial Sales

Consideration and construction of full production facility

1000KL /year

2030

2033

Start of full production

100,000KL /year

Business feasibility assessment at bench plant

0.5t /year

2025

Pilot plant construction

2028

Trial sales

Consideration and construction of full production facility

1000t /year

2033

Start of full production

Tens of Thousands of tons /year

2030’s Sales Target

More than

30

Billion yen/year

Utilizing Forest Resources, to Develop “Biomanufacturing Technology”

Set Up of Bench Plant for Wood-derived PLA

Successful synthesis of "wood-derived PLA" at the world's first bench plant installed at the Biochemical Research Center (Edogawa)

Bench Plant for the synthesis of wood-derived polylactic acid

※2024/5/13 Press Released

Selected as a commissioned project and subsidized project of the Ministry of the Environment

2019-2021：”Demonstration Project for a Plastic Resources Circulation System toward a Decarbonized Society”

2022-2023：”Project to Promote the Establishment of a Decarbonized Circular Economy System”

Optimizing manufacturing conditions, etc., and proceed with sample work, accelerating the implementation of paper lamination and film applications in society!

Utilizing Forest Resources, to Develop “Biomanufacturing Technology”

Set Up of Pilot Plant for Wood-derived Sugar Solution and Ethanol

Constructing a pilot plant for "wood-derived sugar solution" and "wood-derived ethanol" at Oji Paper Yonago Mill

【Equipment capacity】

Sugar solution	Up to 3,000 t/year
Ethanol	Up to 1,000 kl/year

Pilot plant for wood-derived sugar solution/ethanol
(At the start of construction)

*2023/5/12
Press Released

Support from Tottori Prefecture, Hiezu Village, and Yonago City

Signing ceremony for agreement between the four parties
(December 22, 2023)

【Scheduled completion】
Sugar Solution：December, 2024
Ethanol：March, 2025

Working on sample work with the aim of practical application, and accelerating social implementation.

Utilizing Forest Resources, to Develop “Biomanufacturing Technology”

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【Equipment capacity】

Sugar solution	Up to 3,000 t/year
Ethanol	Up to 1,000 kl/year

Pilot plant for wood-derived sugar solution/ethanol
(Near completion (as of November 21))

*2023/5/12
Press Released

Support from Tottori Prefecture, Hiezu Village, and Yonago City

【Scheduled completion】
Sugar Solution：December, 2024
Ethanol ：March, 2025

Working on sample work with the aim of practical application, and accelerating social implementation.

Utilizing Forest Resources, to Develop “Biomanufacturing Technology”

Ecosystem for Biomanufacturing

Convert paper mills into biomanufacturing mill to create a competitive biomanufacturing hub.

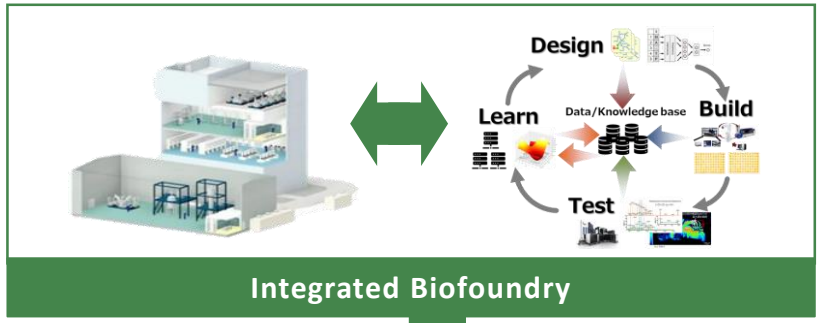
*2024/7/29 Press Released

Consortium of six companies

- **Oji HD** — Managing company —
- Bacchus
- JGC HD
- ENEOS Materials
- Osaka Gas
- TORAY

Selected as NEDO Research and Development of Technologies to Promote Biomanufacturing

Abundant forest resources and paper mills



Integrated Biofoundry

Pulp

Microbes

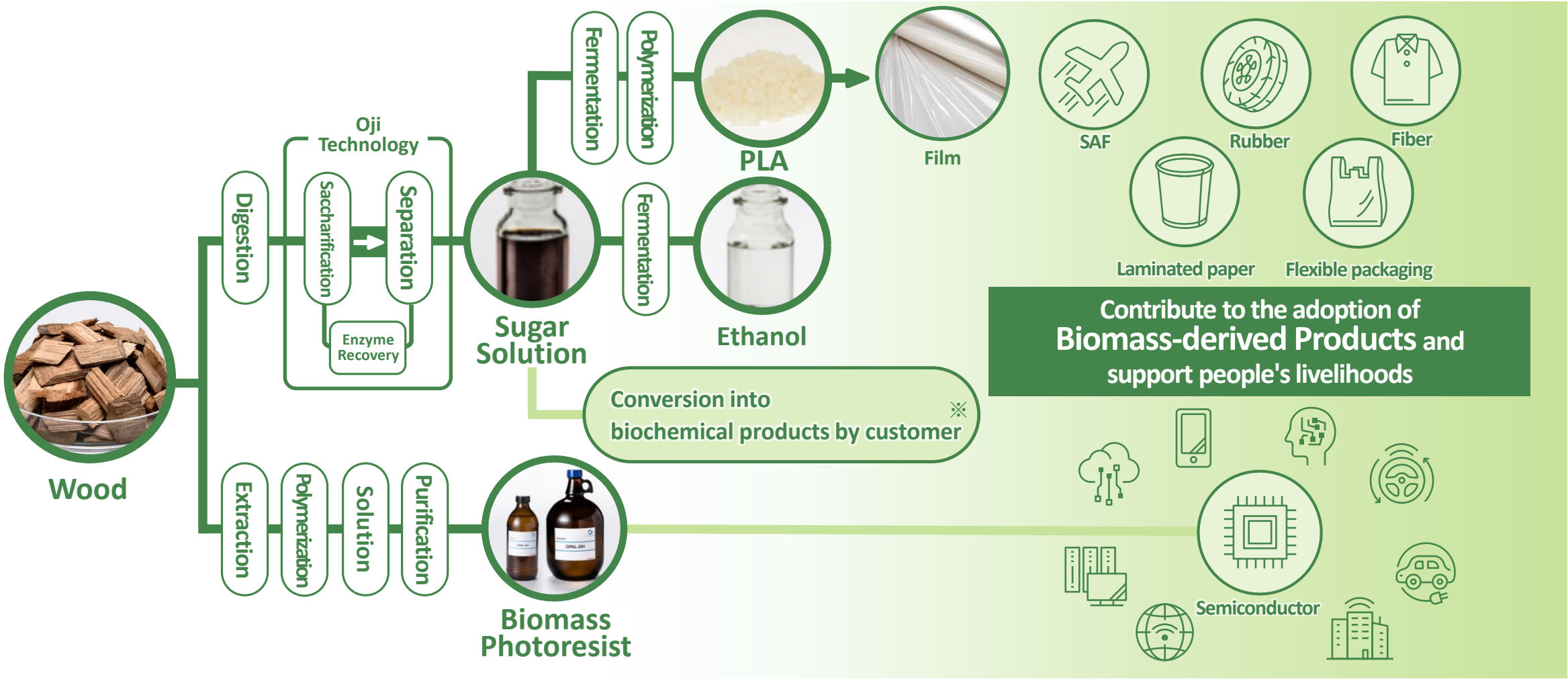
Converting a paper mill into a biomanufacturing plant

Scale-up and production process

Contributing greatly to the spread of “biomass-derived products”

Chemical products | Clothing | Transportation fuel | Rubber | Food | Medical | Other

Leveraging Biotechnology for Significant Societal Contributions



※ Biochemical production companies produce petroleum alternative materials by combining fermentation and other technologies. “PLA” and “Ethanol” are representative examples of biochemical products produced by OJI

Our processes under consideration

Collaboration with users

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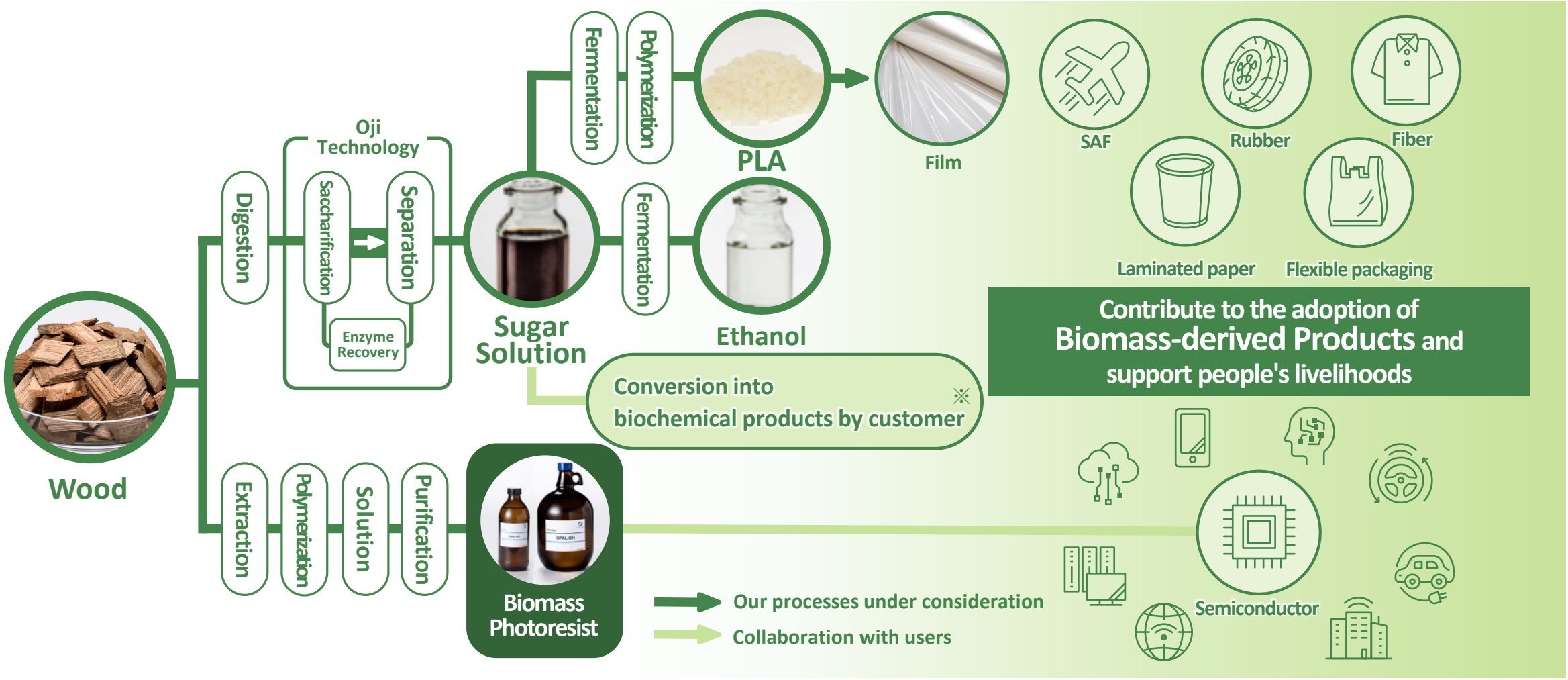
Utilizing Forests：Theme2

Utilizing Forest Resources, Development of Advanced Biomass Photoresist for Semiconductor Applications

OJI HOLDINGS

Positioning in Oji Group's Bioconversion

Contribute to decarbonization by replacing petroleum-based fuels and plastics with "wood-based" alternatives



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"PLA" and "Ethanol" are representative examples of biochemical products produced by OJI

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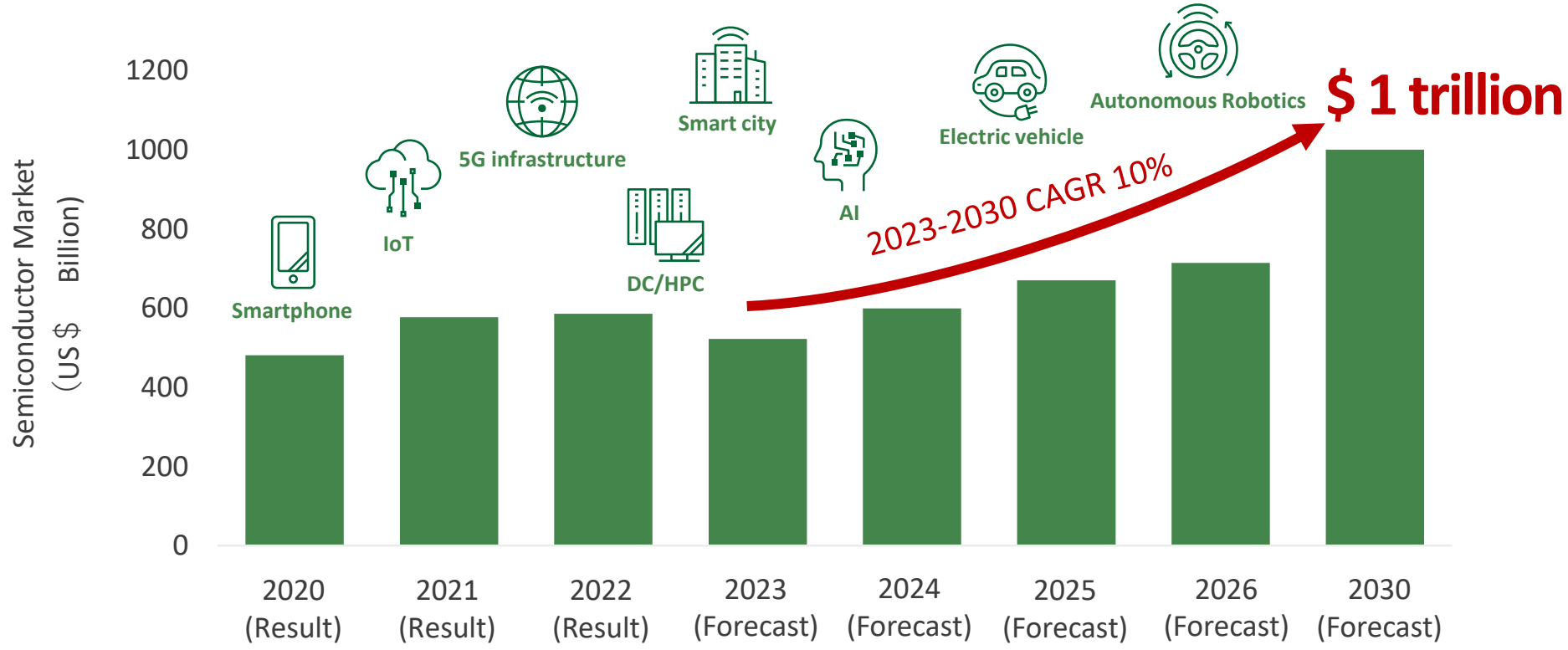
Market Trends of Semiconductors

The semiconductor market is expected to reach $1 trillion by 2030, driven by increasing demand in areas such as AI and autonomous driving.



Created by Oji based on data from SEMI Japan (https://eetimes.itmedia.co.jp/ee/articles/2401/16/news094_2.html)

Market expansion and performance improvements are needed

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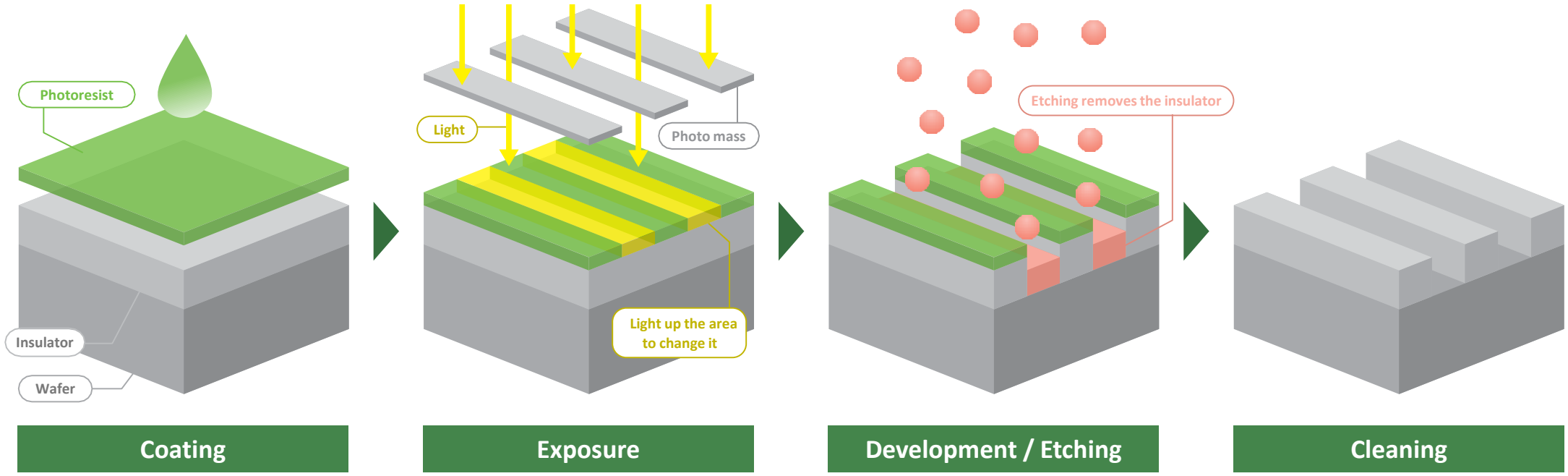
What is Photoresist?

Photosensitive materials are used to form circuit patterns in semiconductors. They typically consist of polymers, photosensitizers, and solvents. As performance improves, there is a growing demand for advancements in fine patterning technologies for circuit patterns.



Further miniaturization of semiconductors requires technological advancements in exposure equipments , photoresists, and more

OJI HOLDINGS

Technology Roadmap for Miniaturizing Semiconductors

The next-generation EUV lithography system, High-NA, is expected to be introduced to the market around 2027.

	2022	2025	2028	2031	2034	2037
Technology nodes (Manufacturing process generation)	3 nm	2 nm	1.5 nm	1.0 nm eq	0.7 nm eq	0.5 nm eq
Types of EUV lithography tools (light systems)	Current EUV lithography tools 0.33 NA					
		Next generation EUV lithography tools	High-NA (0.55 NA)			
					NA: Numerical aperture of the exposure system	
Minimum line width of EUV lithography tools	13 nm		8 nm	More finely!		

Photoresists that correspond to the minimum line width of High-NA is needed

This table was created by our company based on data from IRDS2022 (https://irds.ieee.org/editions/2022) and SEMI Japan (https://eetimes.itmedia.co.jp/ee/articles/2401/16/news094_2.html)

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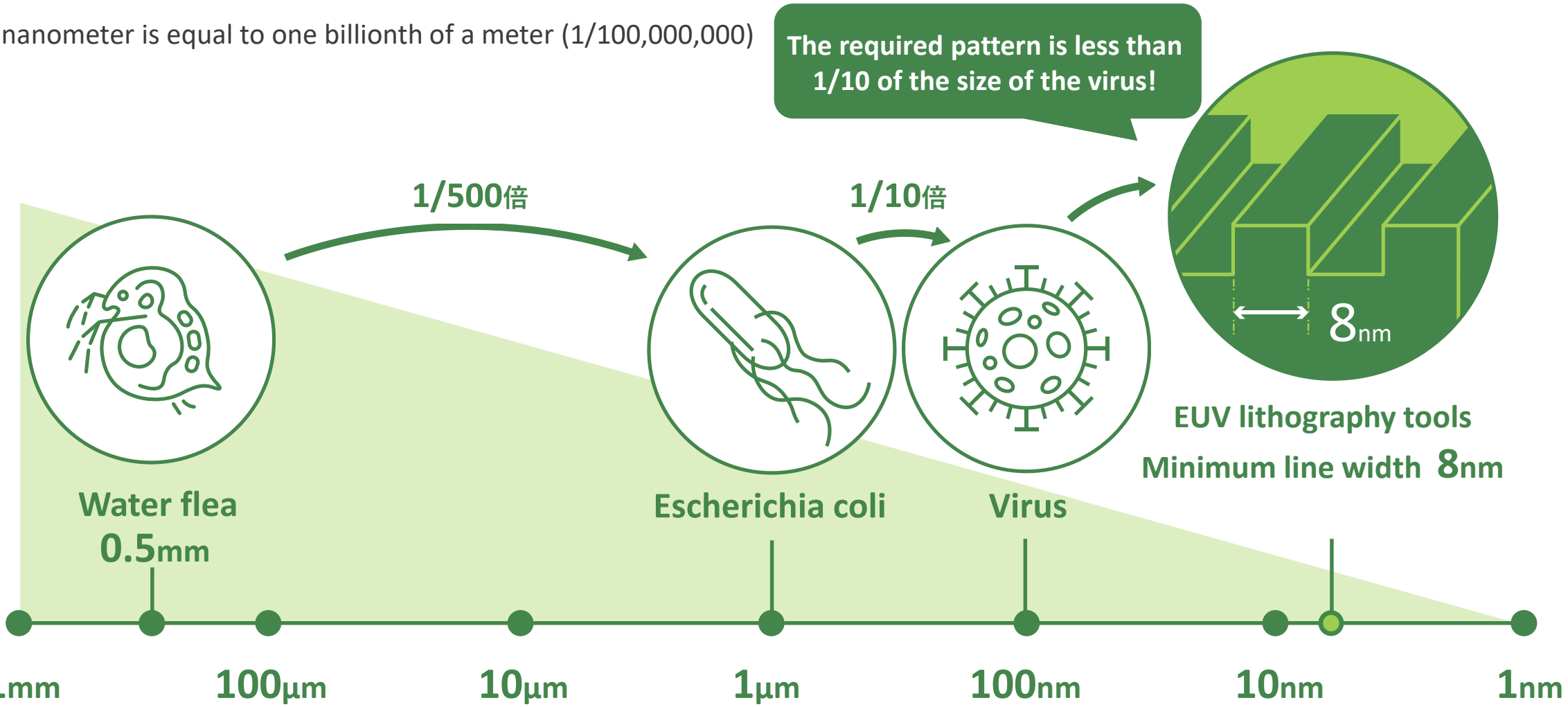
What is a Nanometer?

One nanometer is equal to one billionth of a meter (1/100,000,000)



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Oji Group's Biomass Photoresists

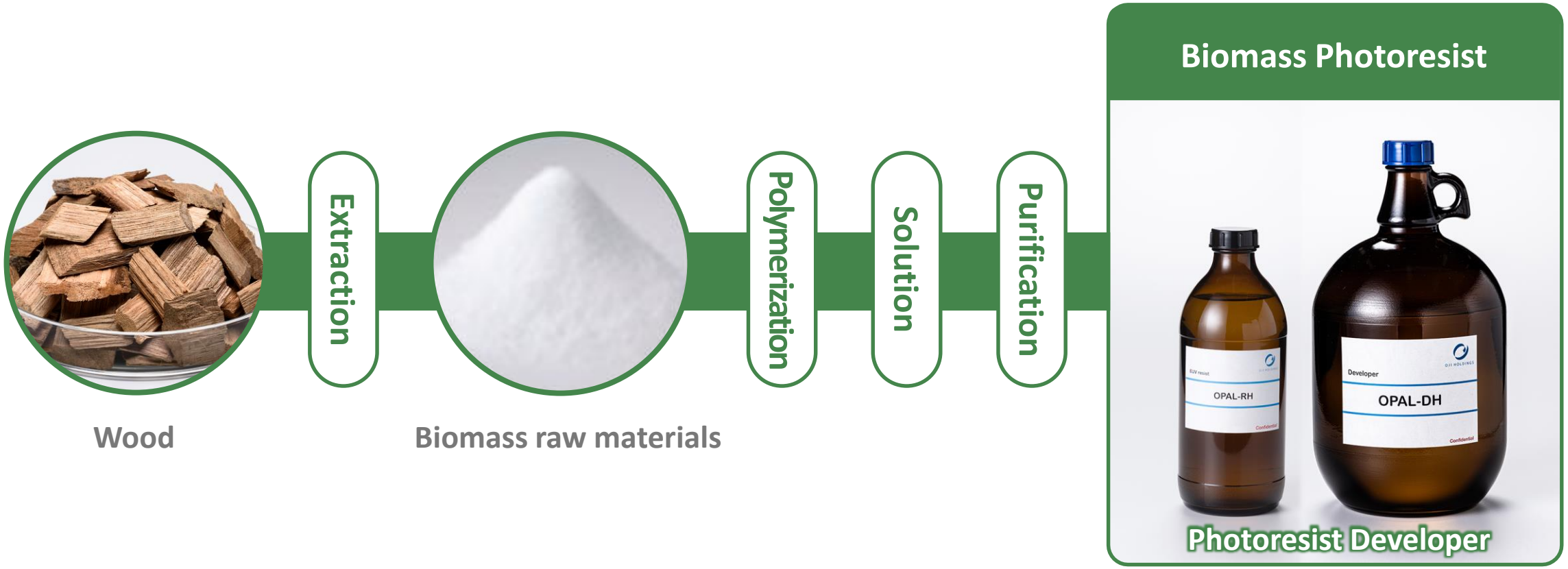
A new type of EUV resist enabled by "wood-derived" biomass materials

1. Non-edible biomass materials derived from wood
2. Achieving PFAS-free raw materials
3. Achieving high resolution for next-generation EUV lithography

OJI HOLDINGS

1. Non-edible Biomass Materials Derived from Wood

Using proprietary technology, we achieved semiconductor-grade quality by extracting and synthesizing wood-derived biomass.



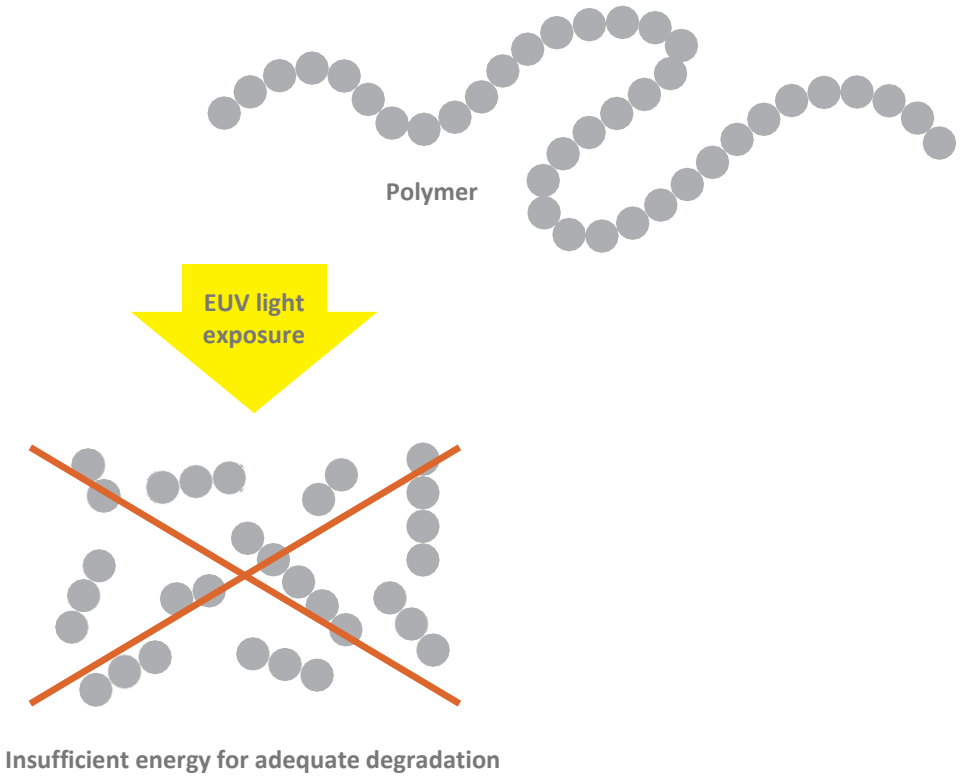
World's first EUV photoresist made with environmentally friendly and high-performance technology

2. Achieving PFAS-free Raw Materials

To meet PFAS regulations, the development of PFAS-free photoresists is essential.
PFAS is known to be persistent, bioaccumulative, and potentially harmful to human health.

※A general term for perfluoroalkyl compounds and polyfluoroalkyl compounds

Conventional Photoresist



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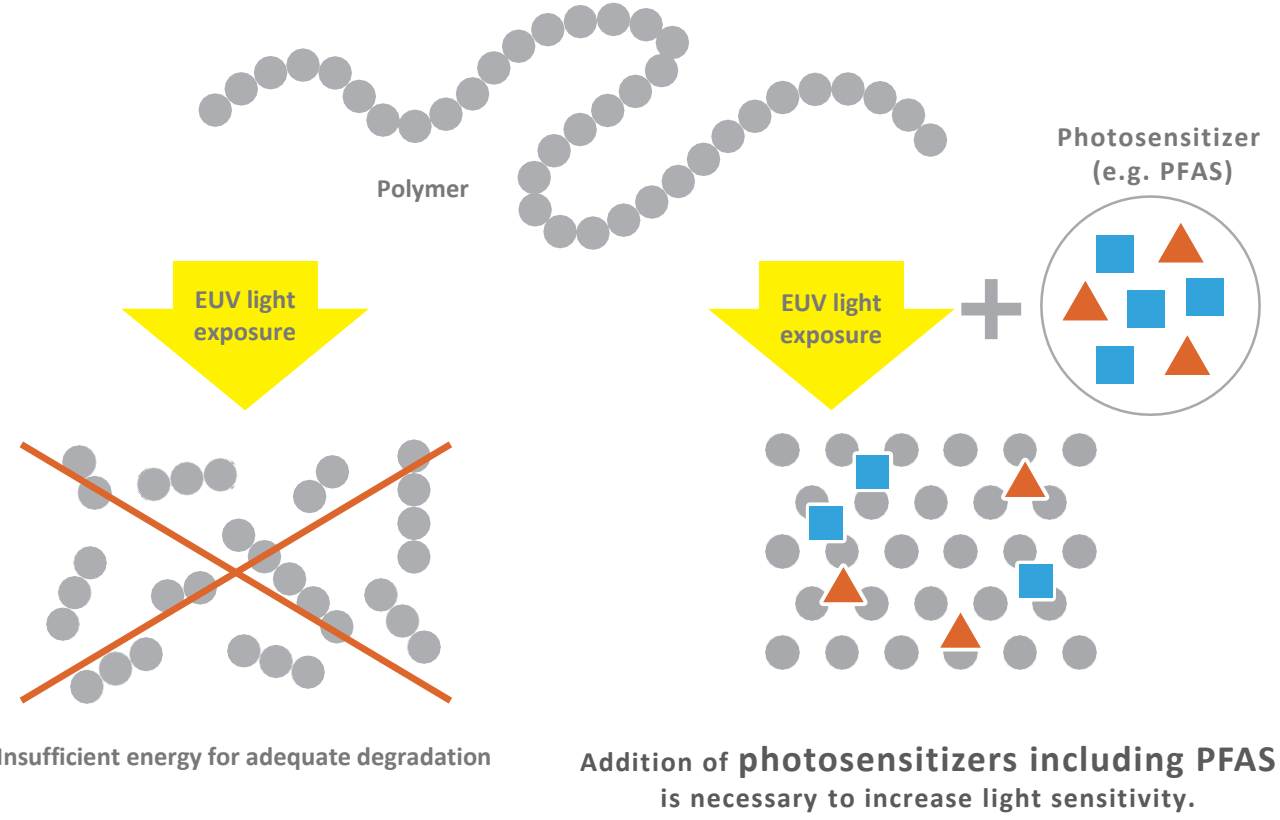

Insufficient energy for adequate degradation

Addition of **photosensitizers including PFAS**
is necessary to increase light sensitivity.

2. Achieving PFAS-free Raw Materials

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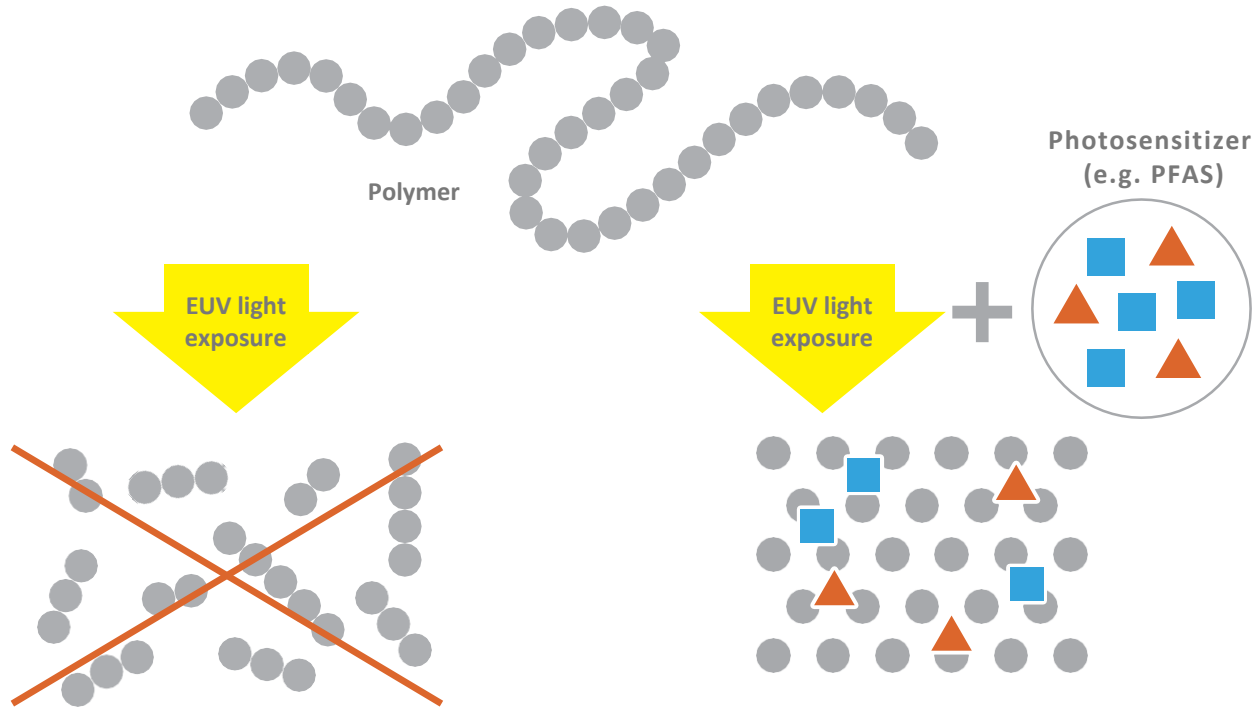

Insufficient energy for adequate degradation

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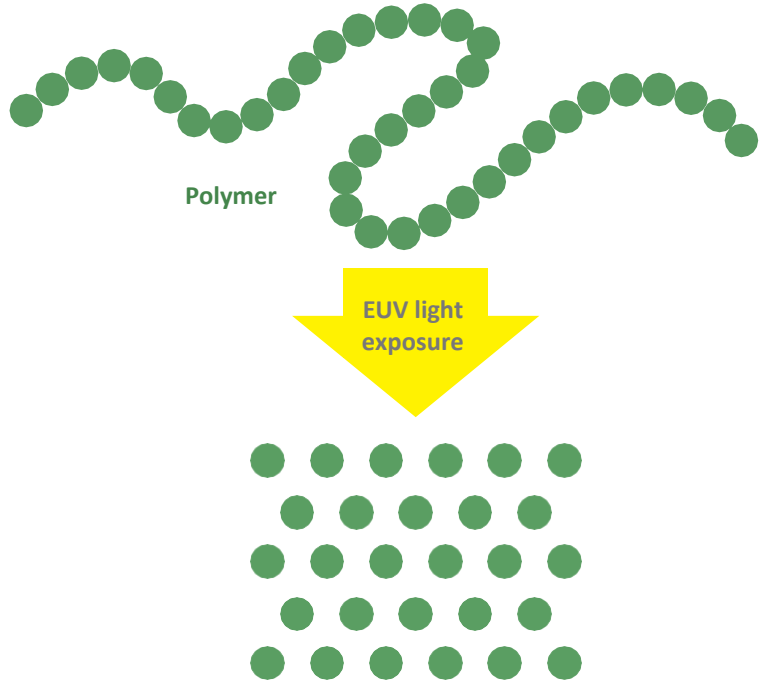
Oji's Photoresist



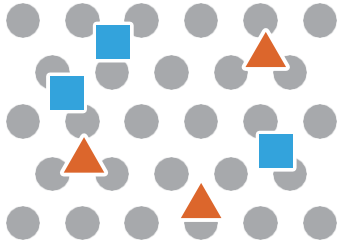
There is no need for PFAS
because the polymer itself has high light sensitivity.

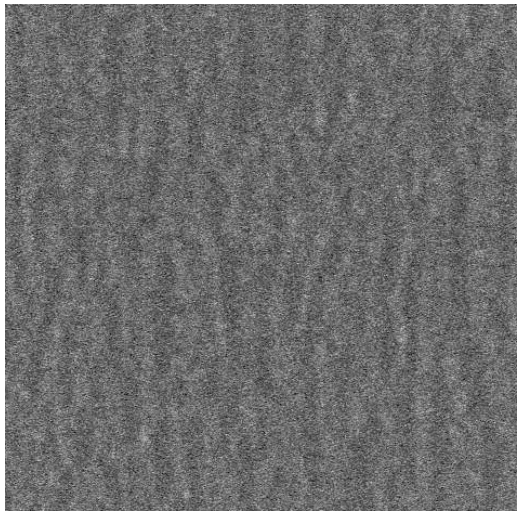
3. Achieving High Resolution for Next-gen EUV Lithography

Oji Group’s biomass resist is compatible with the next-generation EUV lithography system, High-NA

Conventional Photoresist

Challenging to achieve precise pattern formation due to complex composition of multiple components.

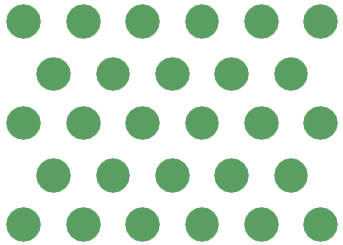


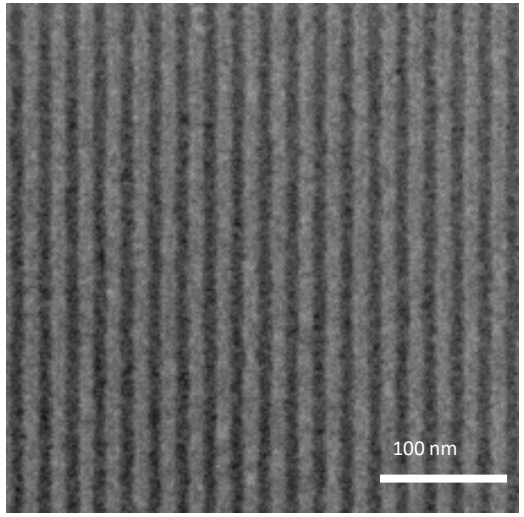


Pattern Example
(Scanning Electron Microscope (SEM) image of photoresist pattern)

Oji’s Photoresist

Achieve uniform and precise pattern formation without the use of additives such as PFAS.





Pattern Example
(Scanning Electron Microscope (SEM) image of photoresist pattern)

OJI HOLDINGS

Oji Group's Biomass Photoresists

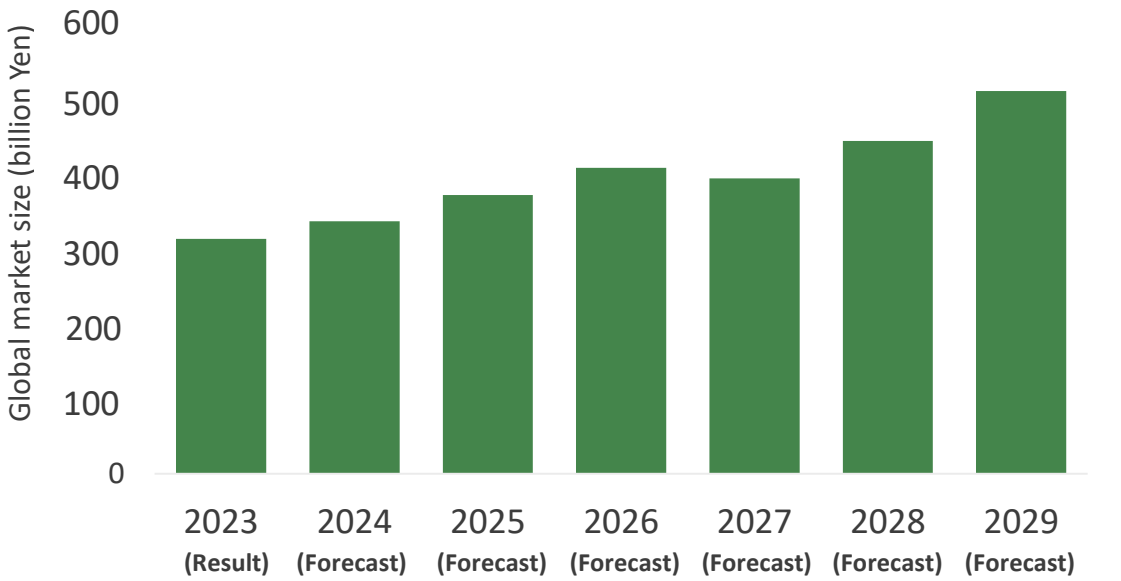
A new type of EUV resist enabled by "wood-derived" biomass materials

1. Non-edible biomass materials derived from wood
2. Achieving PFAS-free raw materials
3. Achieving high resolution for next-generation EUV lithography

Market Trends of Semiconductor Photoresists

The photoresist market is growing with the expansion of the semiconductor market

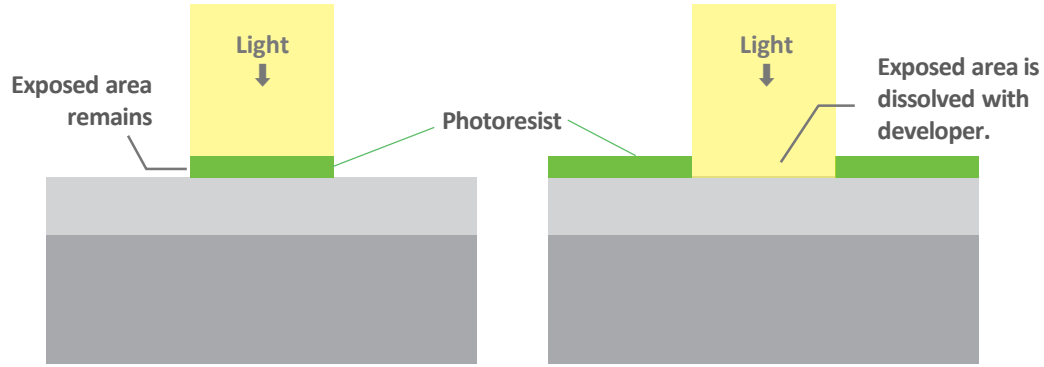
Market Size of Semiconductor Photoresists



Created based on the Fuji Economy report "Current Status and Future Outlook of the Semiconductor Materials Market in 2024"
(calculated by our company with 1 dollar = 150 yen)

Positive and Negative Tone Types

While the current mainstream of next-generation EUV photoresists is negative tone, Oji's biomass photoresist, which is technologically challenging and one of the few positive tone photoresists, has gained attention in the market.



The mainstream of next-generation photoresist (Negative tone)

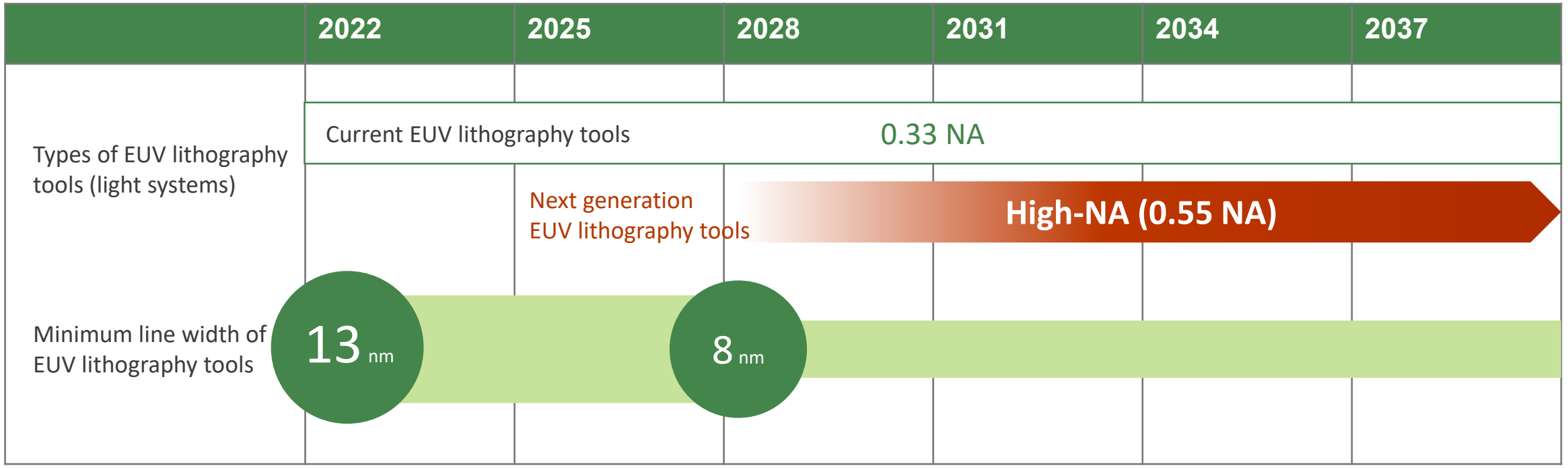
Oji's biomass photoresist (Positive tone)

Oji's positive-type photoresist, capable of accommodating high-NA minimum line widths, Is of significant value and has attracted attention in the market!

OJI HOLDINGS

Business Plan

Our development progress is on track for commercialization in the high-NA market expected to emerge around 2028.
Customer evaluations have begun and are showing promising results



Created based on IRDS2022 (https://irds.ieee.org/editions/2022) and data from SEMI Japan (https://eetimes.itmedia.co.jp/ee/articles/2401/16/news094_2.html)

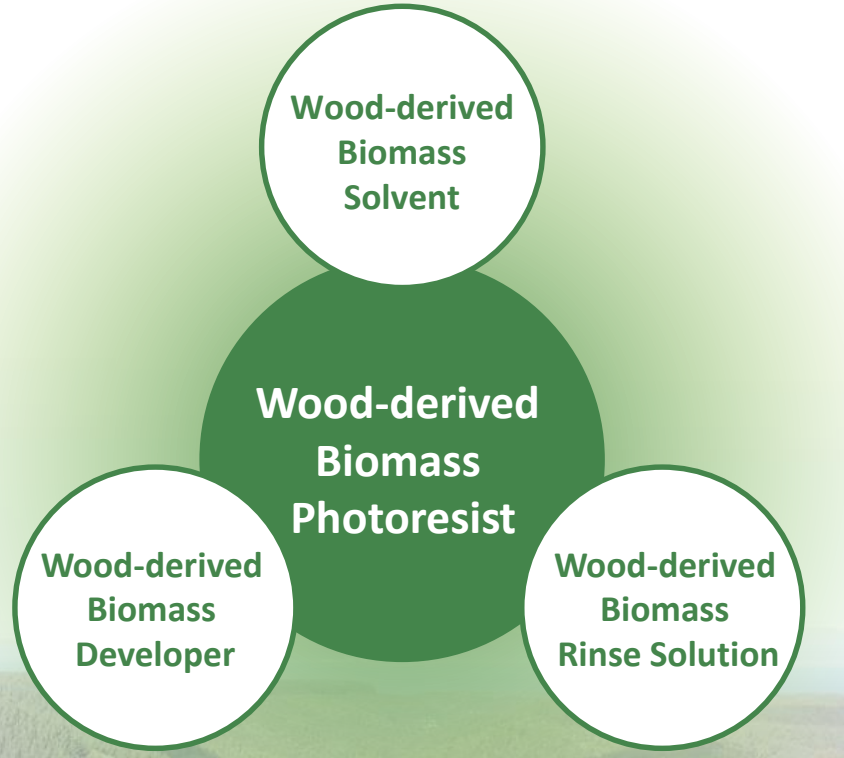
2024 Customer evaluations during the research and development phase

2028 Commercialization → Lineup expansion

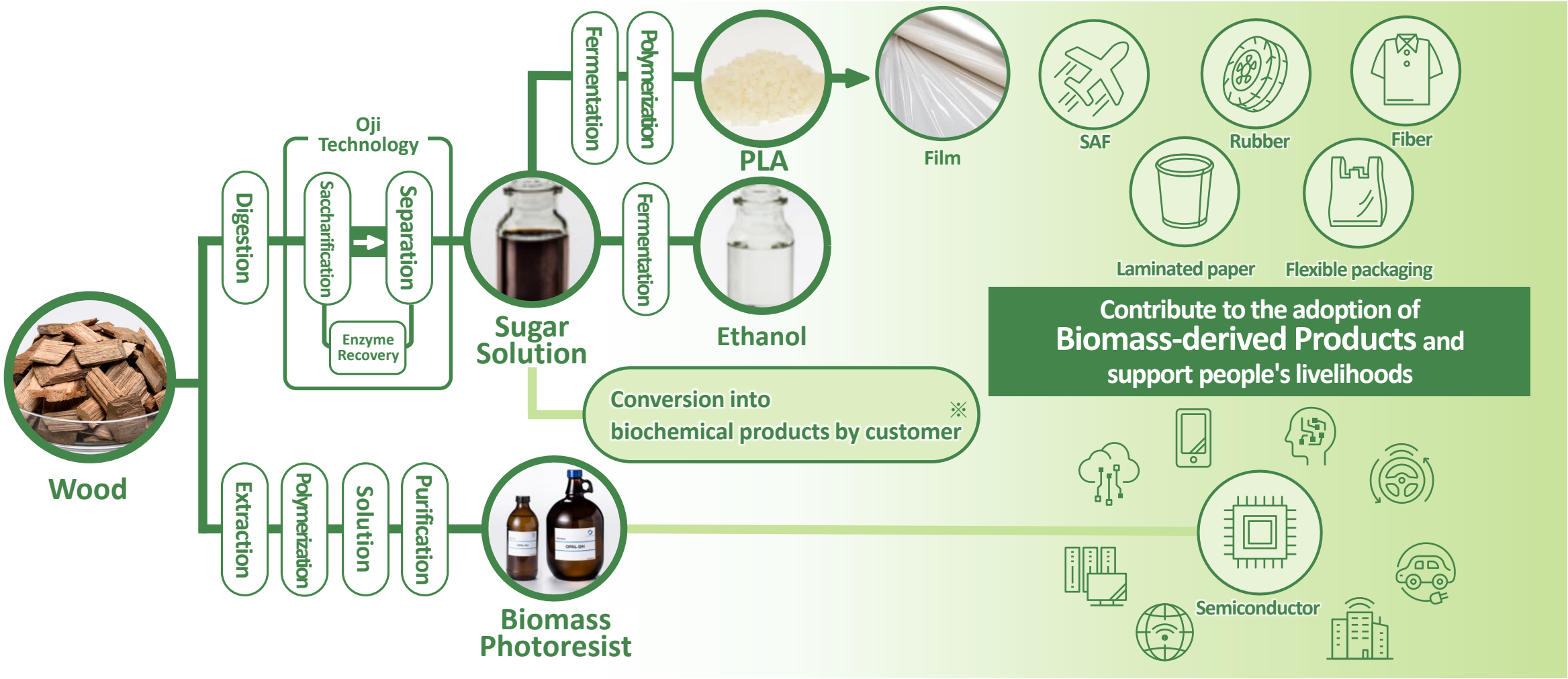
Sales target for the 2030's
10 billion yen/year

Aiming for Further Biomass Utilization in Semiconductor Processes

We will also propose the use of biomass for solvents, developer solutions, and rinse solutions for semiconductors



Leveraging Biotechnology for Significant Societal Contributions



※ Biochemical production companies produce petroleum alternative materials by combining fermentation and other technologies. “PLA” and “Ethanol” are representative examples of biochemical products produced by OJI

Our processes under consideration

Collaboration with users

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