'TORAY'
Innovation by Chemistry

TORAY IR Seminar

Toray Group's Initiatives for Sustainability Business

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Toray Industries, Inc.

Contents

I

Basic Approach

Corporate Philosophy and Sustainability Vision

Corporate Philosophy

Contributing to society through the creation of new value with innovative ideas, technologies and products

Corporate Missions

For our customers
To provide new value to our customers through high-quality products and superior services
For our employees
To provide meaningful work and fair opportunities
For our shareholders
To practice sincere and trustworthy management
For society
To establish ties and develop mutual trust as a responsible corporate citizen

Vision

Toray Group Sustainability Vision

(Announced in 2018)

Toray Group Sustainability Vision (Announced in 2018)

We deliver innovative technologies and advanced materials that provide real solutions to the challenges the world faces with balancing development and sustainability

Expanding Contribution to Society & Reducing Our Environmental Impact

Expanding contribution to society

- Expansion of hydrogen and cost reduction
- Larger blades for wind turbine blades
- Fuel efficiency by weight reduction
- Improving water use efficiency
- Evolution of electrification
- Expansion of recycled and biomass-based products

Expansion and cost reduction of renewable energy, hydrogen, recycled and biomass-based raw materials

Increasing economic value
+
Increasing social value

Expansion of advanced materials and environmental impact reduction technology

Reducing our environmental impact

- Conversion to clean fuels
- Utilization of renewable energy
- Process innovation
- Reduction of water usage
- Applying recycled and biomass-based raw materials
- Waste reduction

Expanding contributions to society through business and reducing our environmental impact create interactive "Virtuous Cycle of Value"

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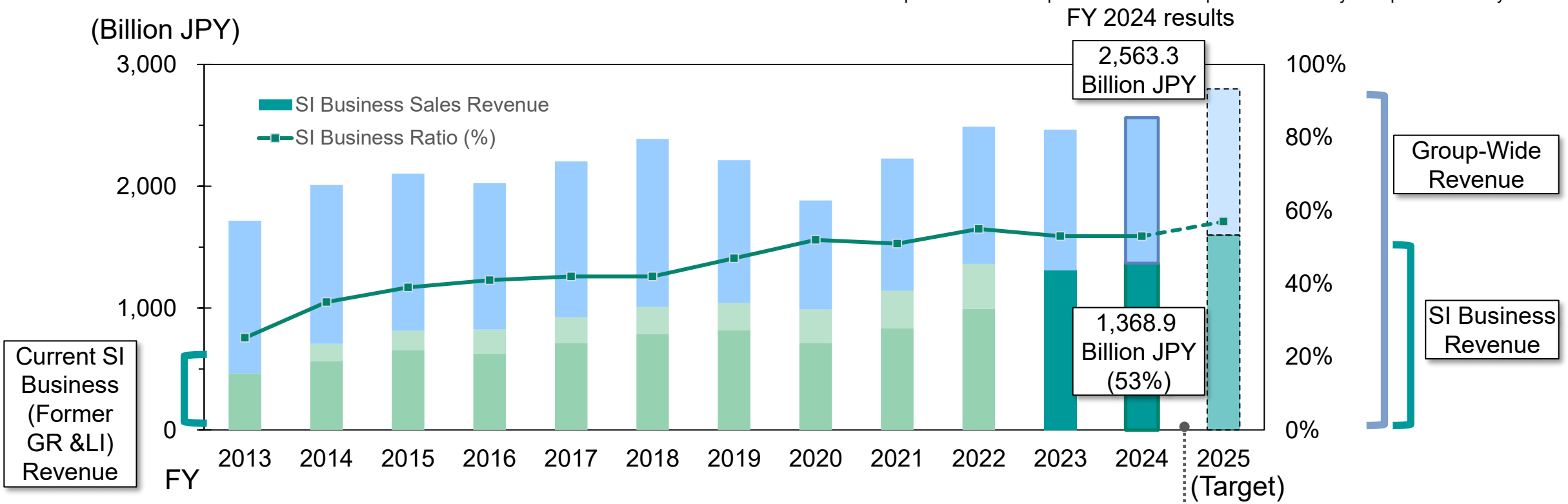
II

Sustainability-Related Business Initiatives

History of Sustainability-Related Business Expansion

Group-wide sales revenue vs Sustainability Innovation (SI) business* sales revenue (FY 2013-2025)

* Group of businesses or products that can help realize the Toray Group Sustainability Vision



Organi-zation		
	SI Strategic Planning Dept (General environmental strategy)	CSR Operations Dept (CSR Promotion, Internal & External Communication)
	Environmental Solutions Dept (Marketing)	Sustainable Technology Dept (Development)

From April 2025
Corporate Sustainability Strategic Managament Div

Steadily expanding its contribution to society,
growing to 1,368.9 billion JPY of revenue in FY 2024, which represents 53% of group-wide revenue

Overview of the Sustainability Innovation (SI) Business

Contributing to better medical care and hygiene for people

(Non-woven fabric for diapers)

(Airbag)

(Medical Filter)

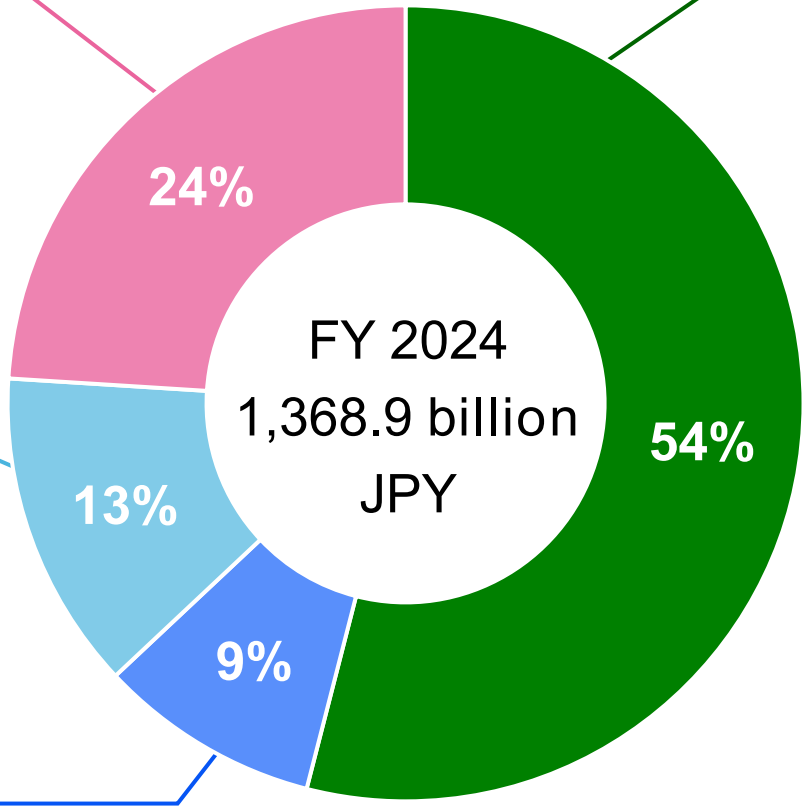
Providing clean water and air

(Water Treatment Membrane)

(Air Filter)

Promoting resource recycling

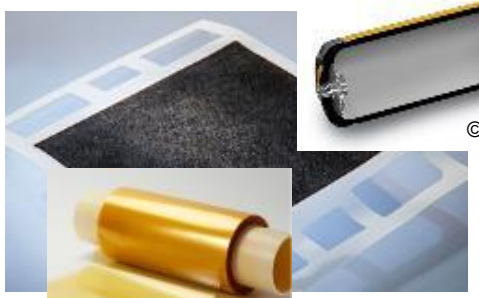
(Fibers made from recycled raw materials)



Contribution to GHG reduction

(Carbon fiber for aircrafts)

(Carbon fiber
for wind turbine blades)



(Materials for hydrogen-related components)

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III

Initiatives for Resource Recycling

Progress in Resource Recycling Initiatives and FY 2030 Targets

FY 2030 Target

Revenue target for products that facilitate sustainable, recycling-based use of resources and production

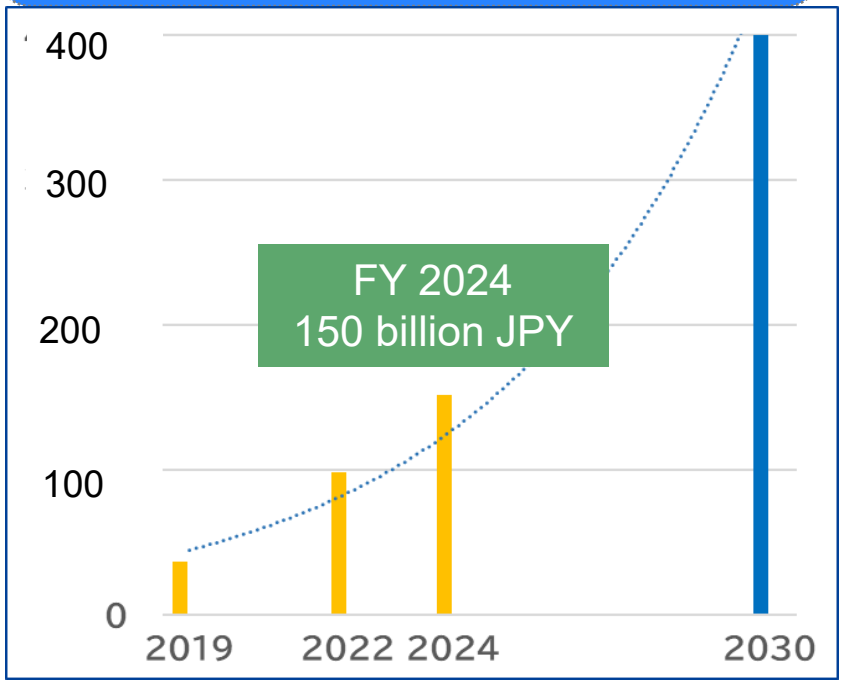
400 billion yen

Target for percentage of raw materials sourced from recycling, derived from biomass, or produced with CO_2 recycling **used in Toray core polymers** (*1)

20%

*1.PET and nylon polymers

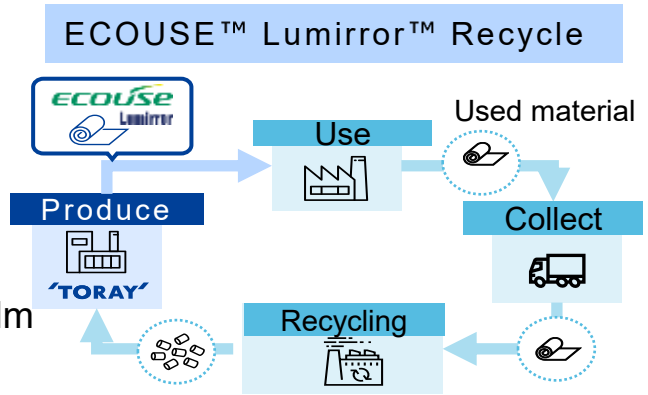
Revenue for products that facilitate sustainable, recycling-based use of resources and production (billion JPY)



Recycle

◯ Recycled Fiber &+™
In addition to polyester recycled fibers using used PET bottles, the brand expanded to nylon recycled fibers using discarded fishing nets.

◯ ECOUSE™ Lumirror™
Estabilished a recylcling scheme of used PET film by customers, collaborating with recyclers and customers.



Biomass-based

◯ 100% biomass-based Polyester fiber : Pre-marketing stage
◯ 100% biomass-based Nylon 510 fiber : Started full-fledged sales

Resource recycling business increased to 150 billion JPY in FY 2024 as well as percentage of use of recycled resources

IV

Initiatives to Reduce Environmental Impact

Driving Towards Achieving Goals (Challenge 50+ Project)

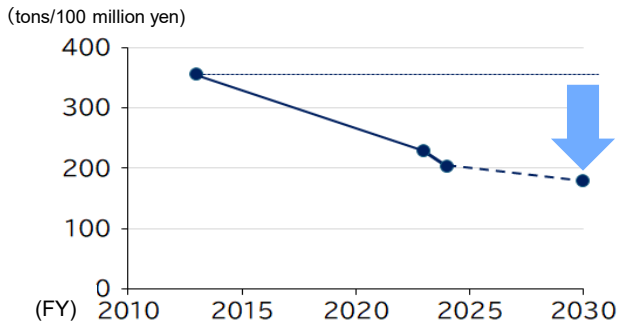
Target

Promoting initiatives to achieve the FY 2030 targets (vs FY 2013) through group-wide project

GHG Emissions Reduction

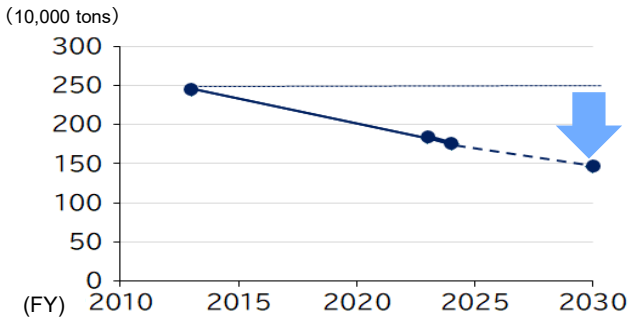
Lower GHG emissions per unit of revenue across the Toray Group by:

50% or more reduction



Lower GHG emissions of Toray Group in Japan by:

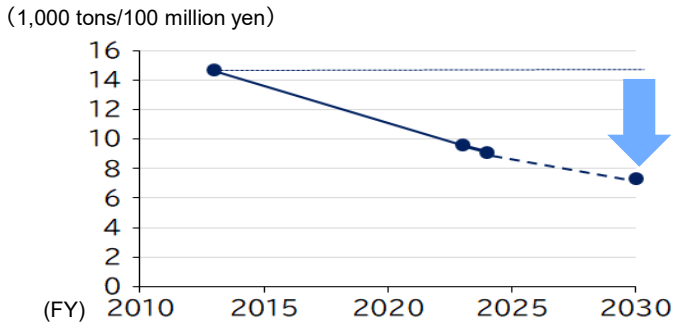
40% or more reduction



Water usage reduction

Reduce water usage per unit of revenue across the Toray Group by:

50% or more reduction



Measures

GHG Emissions Reduction

- Replacing coal-fired boilers with purchased electricity
- Fuel conversion
- Expanding use of biomass fuels
- Expanding use of renewable electricity

Water usage reduction

- More wastewater recycling using Toray water treatment technology
- Maintaining energy-saving activities
- Deploying successful improvement models across the Group

By pursuing high efficiency and high-added-value to reduce environmental impact while expanding business,
Toray sets high target of reducing GHG emissions and water consumption by 50% or more per unit of revenue

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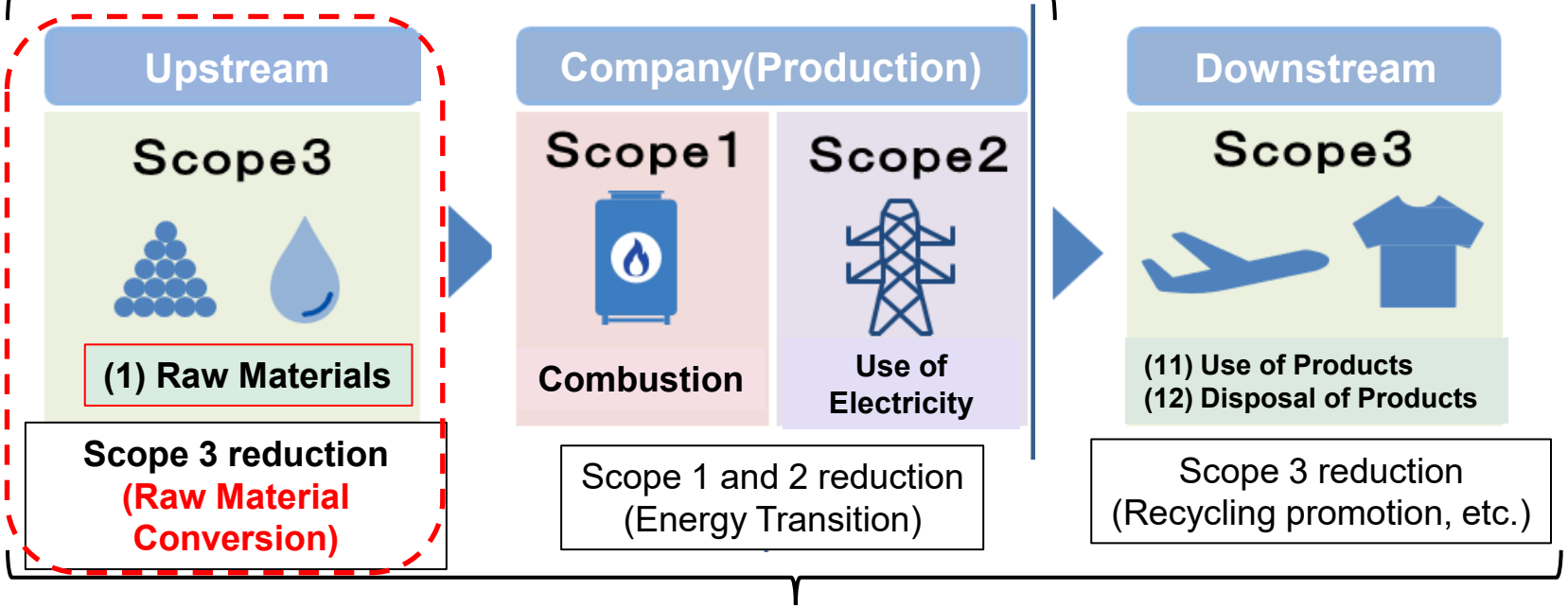
Scope 3 and Initiatives to Reduce Carbon Footprint (CFP)

- Emissions derived from purchased raw materials (Category 1) is 50% of Scope 3 (16.4 million t - CO_2) and 1.8 times of total Scope 1+2
- Conversion to low CFP raw materials is important for reducing products' CFP and for reducing GHG emissions throughout the supply chain

<Product Requirements : Low CFP>



<Corporate Social Responsibility: Reducing GHG emissions throughout the supply chain>

Promoting Category 1 reduction (raw material conversion) by collaborating with suppliers as well as reducing Scope 1 and 2 (Applying recycled and biomass-based raw materials, etc)

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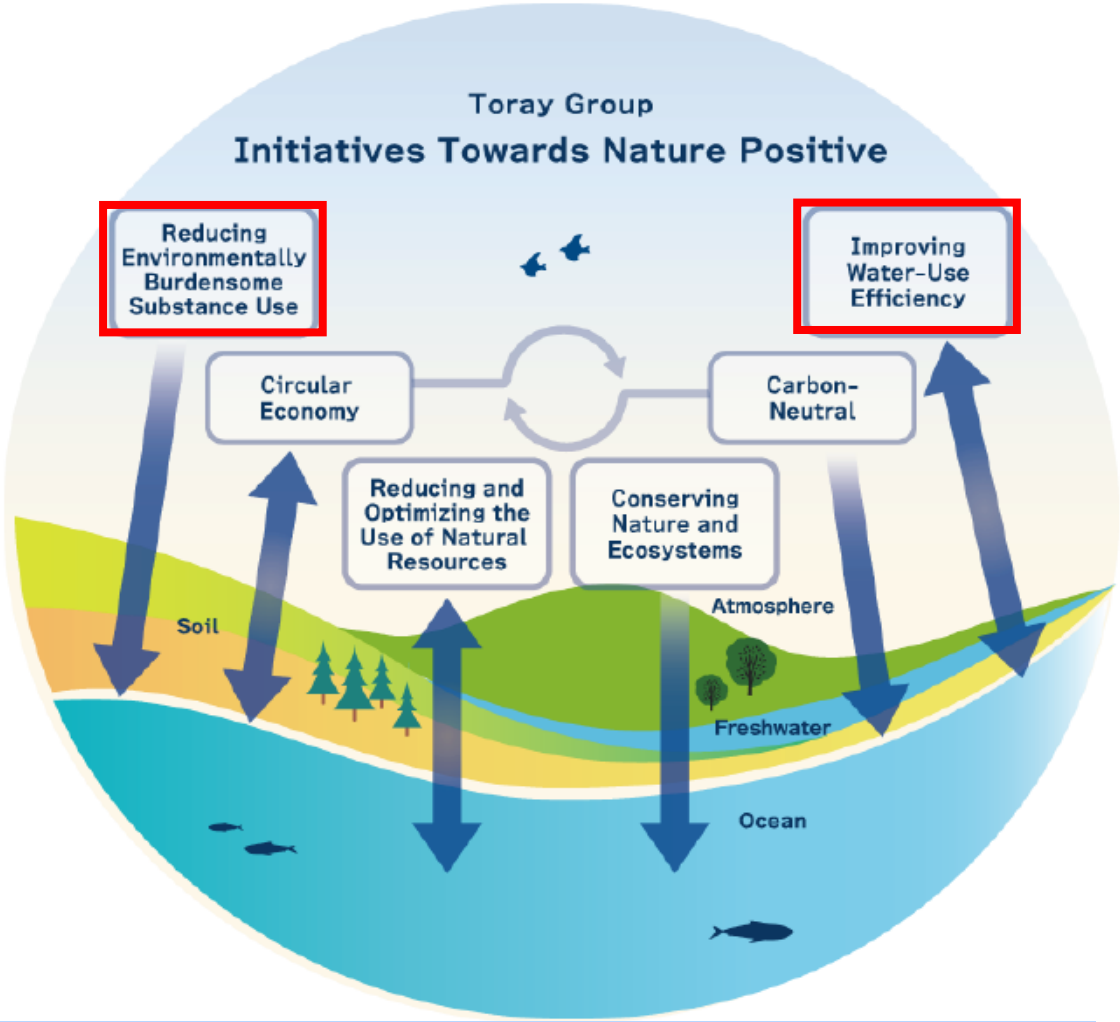
Expansion of Initiatives to Reduce Environmental Impact

Overview of Toray's activities to reduce environmental impact

- Reduction of GHG emissions (fuel conversion, renewable energy)
- Promotion of resource recycling (recycle and biomass-based materials)
- Reduction of environmentally hazardous substances (reduction of VOC emissions)
- Improving water use efficiency (reducing water usage)
- Reduction and efficiency of natural resource use (development of alternative materials)
- Nature and ecosystem conservation (ecosystem protection, greening, cleaning)

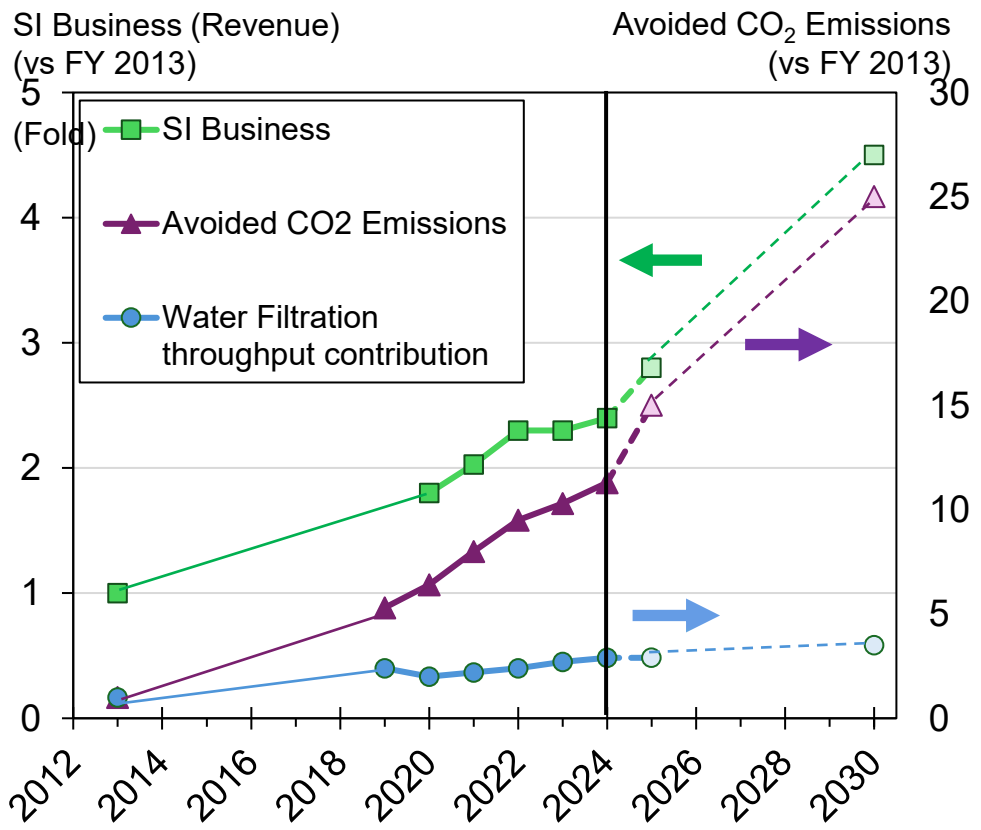
TNFD Report (December 2024)



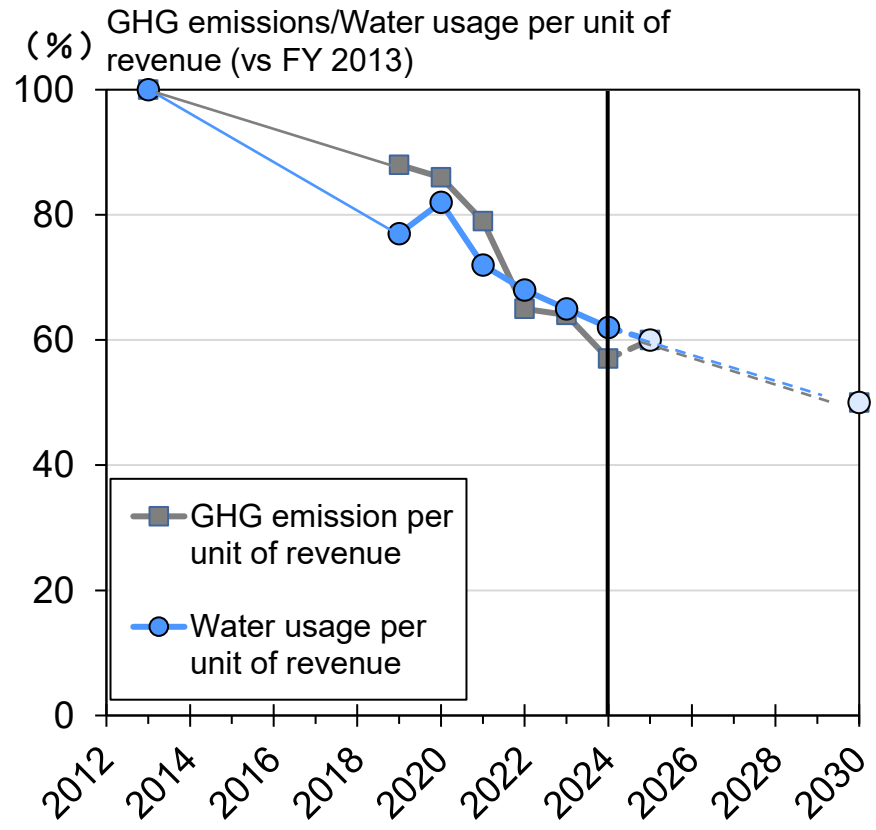
Expanding initiatives to reduce environmental impact through nature-positive (NP) initiatives for the conservation and restoration of biodiversity and natural capital

Progress Towards Our FY 2030 Target

Expanding Contribution to Society through Business Activities



Reducing environmental impact from our activities



Steadily making progress toward FY 2030 target

V

Sustainability Business Issues

- Conversion of Environmental Value to Economic Value -

Dialogue with Market / Customers and Value-Based Initiatives

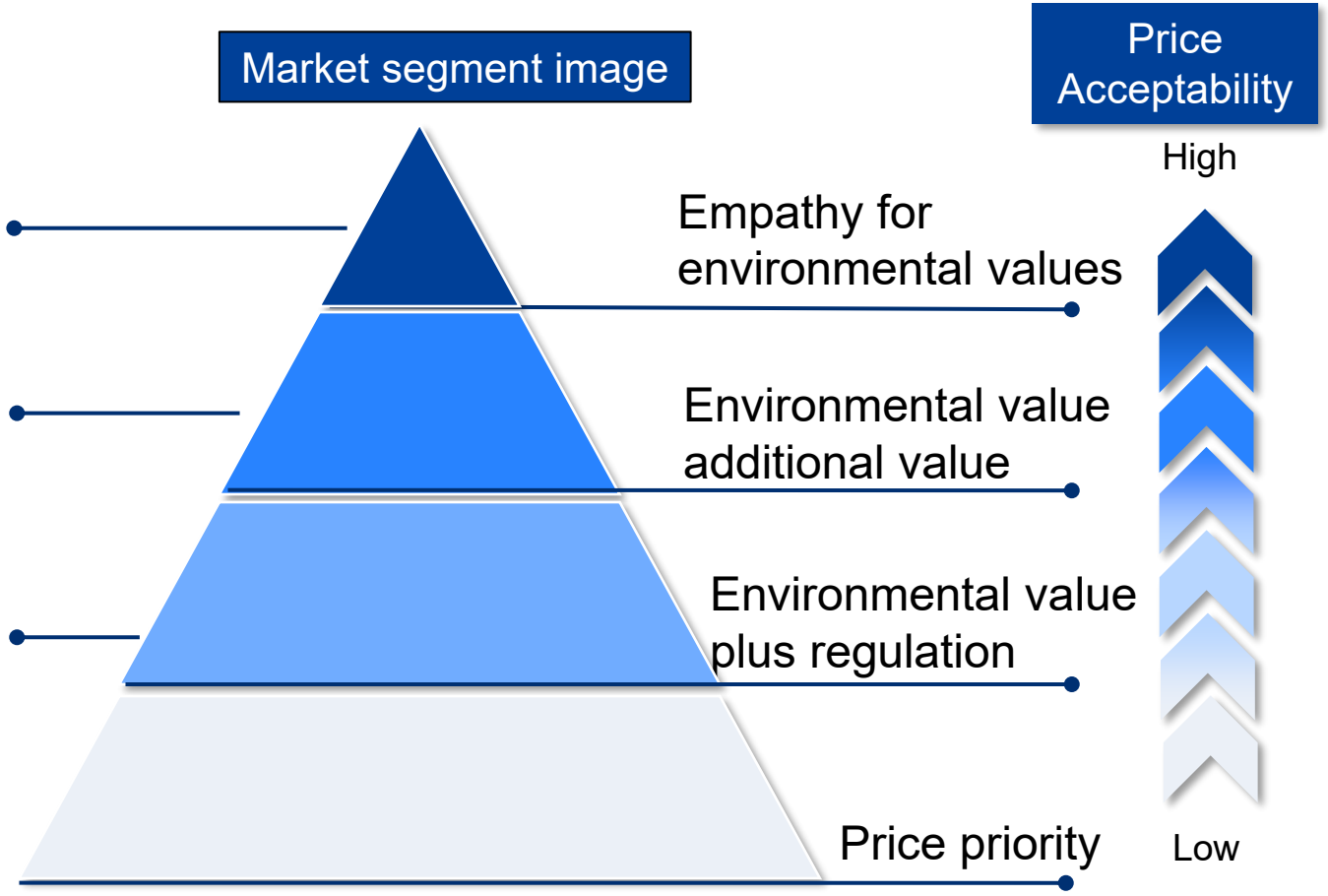
Creating system to convert environmental value into economic value = Activities to create value with customers

Market segmentation, collaboration with customers

Empathy for environmental values (sharing stories)
- Dialogue with market
- Appeal of social value
- Supply chain collaboration

Granting additional value
- Dialogue and collaboration with customers
- Innovation (internal and external)
- Promotion of additional value through collaboration

Changes in needs and market creation based on regulations and policies
- Lobbying and dialogue with government
- Value demonstration and implementation
- Mass production collaborating with customers



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V-1. Empathy for Environmental Values (Sharing Stories)

Case 1) Value Creating with Market and Customers - Challenge of 100% Biomass-Based Fiber -

100 % Biomass-based N510 fiber applied for “Tanker” collaborating with Yoshida & Co.

Members of “Tanker” project from Yoshida & Co. and Toray

Nylon 510 displayed at flagship store PORTER OMOTESANDO

Proposing new option of biomass-based raw materials

Technological capabilities to achieve physical properties equivalent to those of petroleum resources

Appealing to consumers by joint promotion

Empathy for environmental values (Sharing stories)

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V

V-2. Granting Additional Value

Case 1) Value Created with Market and Customers - &+™ Initiatives -

Launched “&+™” in 2019. By collaborating with supply chain, Toray recycled wastes to functional fibers, meeting the diverse needs of customers to create wide range of product designs (texture & functionality of clothing)

Dis-posal → Collect-ing → Pre-treatment / Recycling → Fibers (adding functionality)

Cooperation from consumer / collectors

Collaboration with recyclers

Used PET bottles

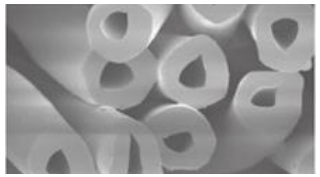
Filtering technology

Impurities removal/ Washing → Material Recycling

Discarded fishing nets (Nylon 6)

Chemical Recycling → Polymer-ization

Spinneret technology (Odd-shaped cross-section)

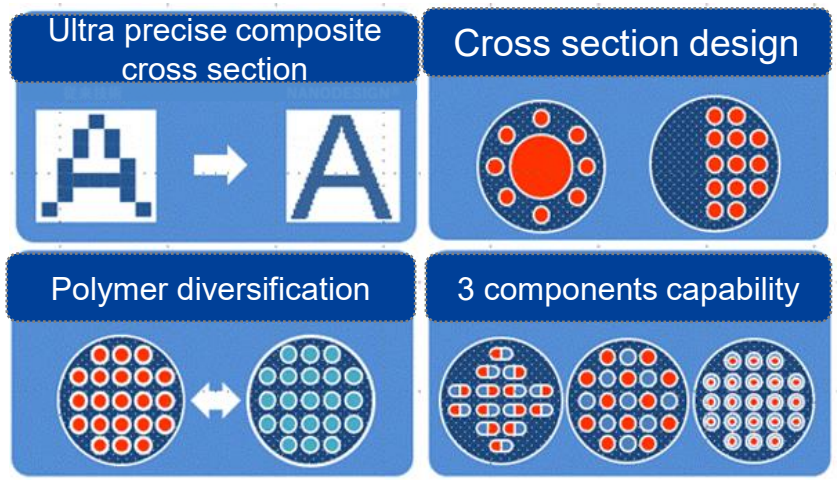


Cool in summer, warm in winter, lightweight, and moderate tension / stiffness

Insulating, lightweight, and moderate tension / stiffness

Spinning technology

Features of NANODESIGN™ Ultra precise composite spinning technology



Achieving comfort and functionality while reducing environmental impact

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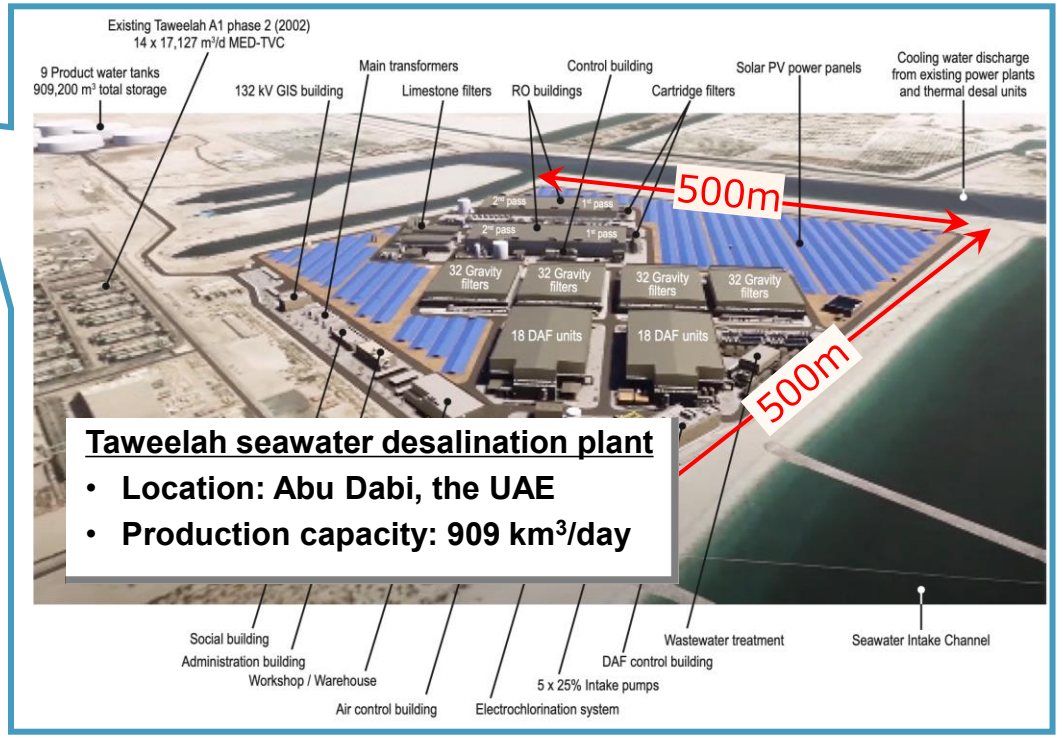
Case 2) Strengthening Customer Service by Localization
RO Membrane for Seawater Desalination Plant

- Toray has top market share in RO membrane for seawater desalination plants that contribute to solving water scarcity
- Large-scale projects are centralized in the Middle East, where high demand of seawater desalination exists
- Locally produced high-performance RO membranes in Saudi Arabia, achieved 70% of large projects by prompt customer service

World's Top 10 Seawater Desalination Plants Using RO Membrane

No	Country	Name of Project	Volume (ton/day)	Start Year	RO Producer
1	UAE	Taweelah IWP	909,000	2023	TORAY
2	UAE	Umm al Quwain IWP	681,818	2022	TORAY
3	Israel	Soreq 2	670,000	2024	
4	Saudi Arabia	Khobar 2 replacement SWRO	630,000	2023	
5	Israel	Soreq	624,000	2013	
6	Saudi Arabia	Shoaiba 5 (SWCC)	600,000	2024	TORAY
6	Saudi Arabia	Rabigh 3 IWP	600,000	2022	TORAY
6	Saudi Arabia	Shoaiba 3 Conversion Project	600,000	2025	TORAY
6	Saudi Arabia	Jubail 3a IWP	600,000	2023	TORAY
10	Saudi Arabia	Jubail 3b IWP	570,000	2024	TORAY



Achieved overwhelming results by highly performed membrane and localized prompt customer service

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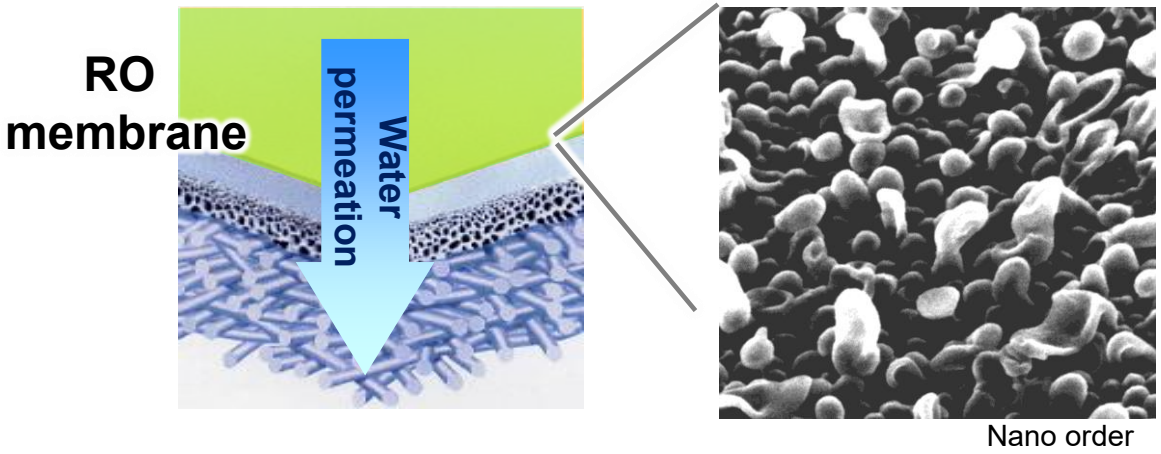
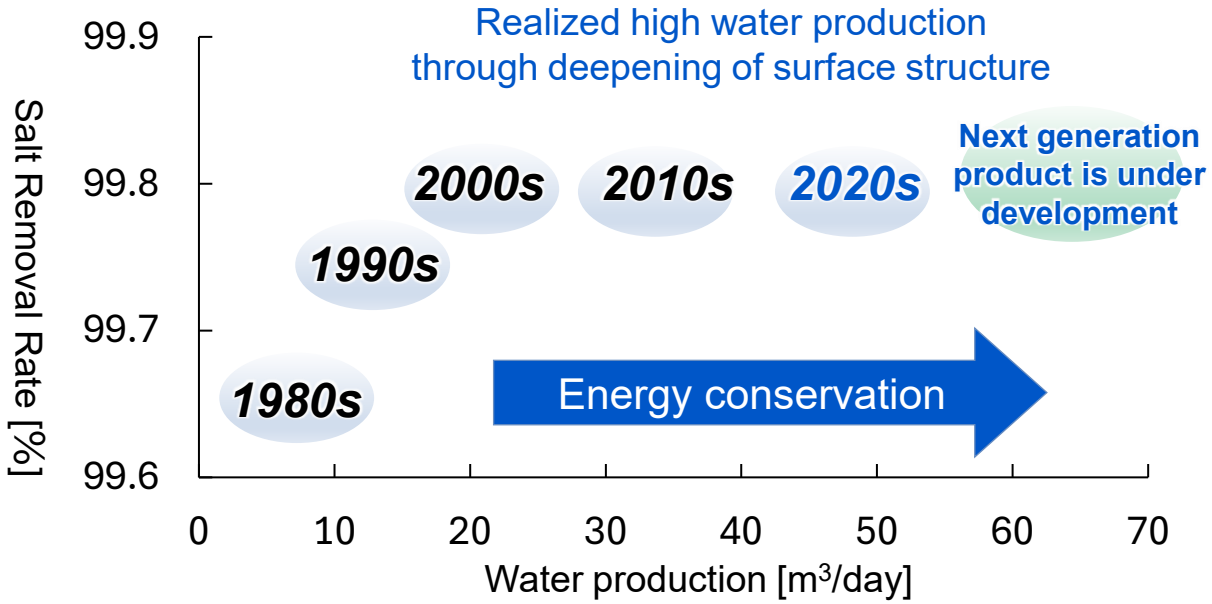
Evolution of RO Membrane

Water production

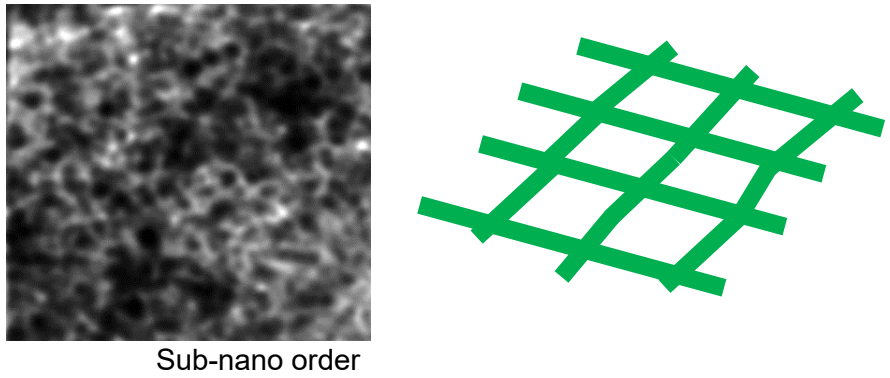
Control of surface structure (expansion of effective area)



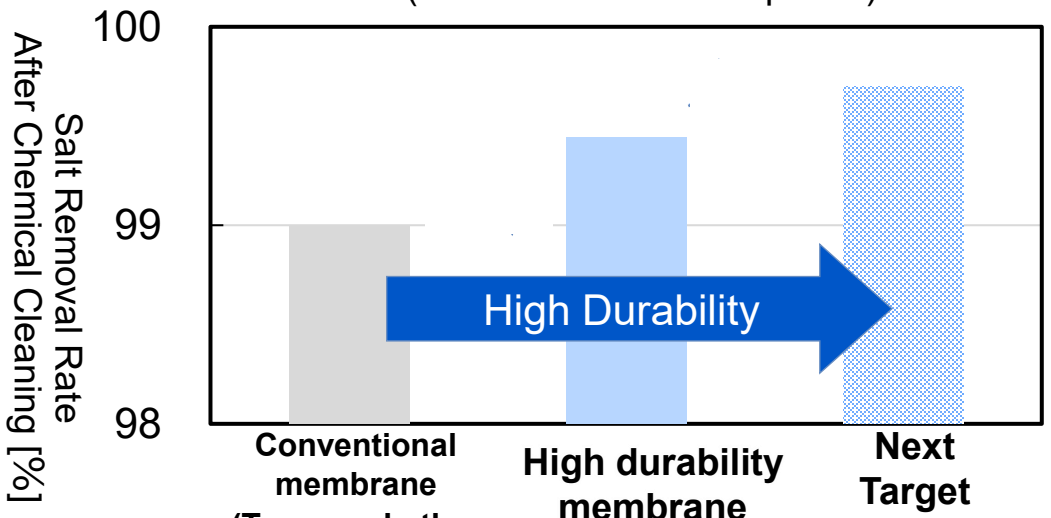


Durability

Formation of strong membrane structure (inhibition of deterioration)



Comparison of performance after repeated cleaning using acid and alkali (Test results in actual plants)



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V

V-3. Changes in Needs and Market Creation Based on Regulations and Policies

Case 1) Response to European ELV Directive Draft for Automotive Applications

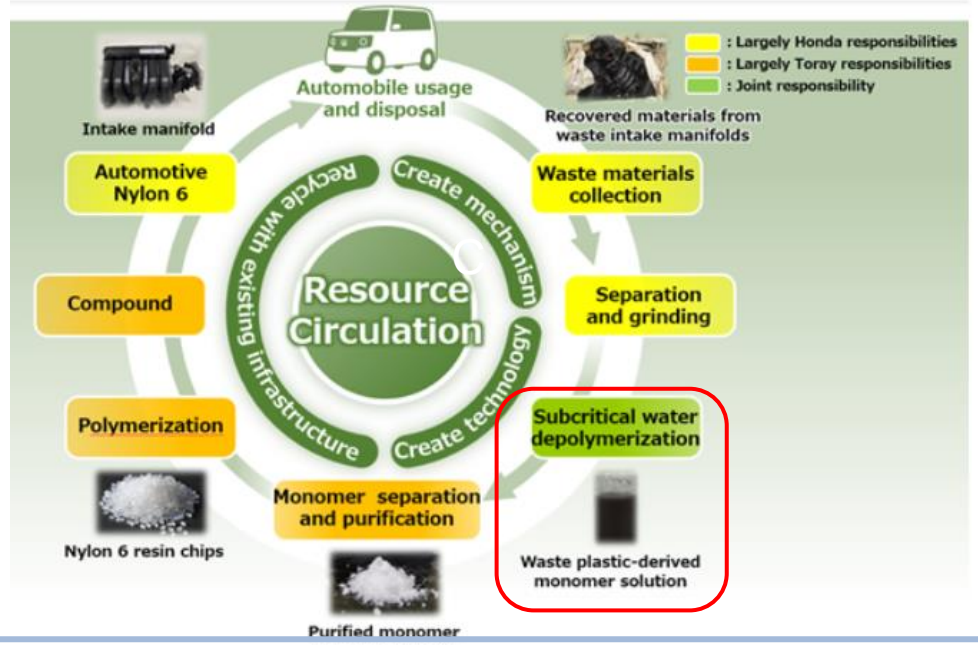
As European ELV Directive draft requires a recycling rate of 20% or more from 2031 onwards,
chemical recycling using subcritical water is under development to enable recycling of automotive parts & airbags

(Under development)

Automotive resin parts (Nylon 6) chemical recycling

Joint demonstration with Honda from 2023

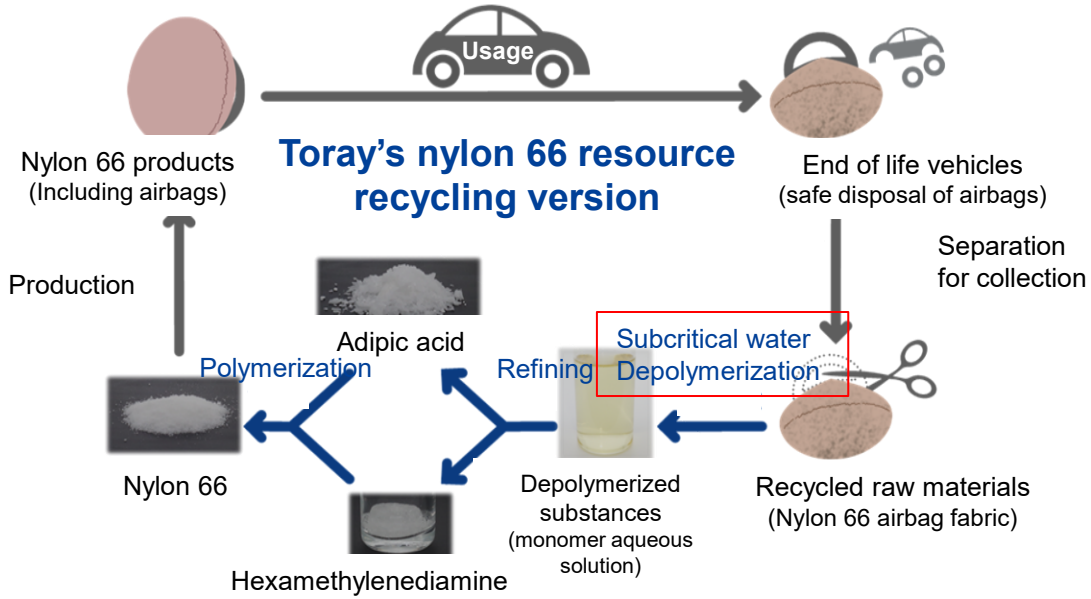
Framework for chemical recycling technology validation



(Under development)

Airbag（Nylon 66) chemical recycling

Succeeded in extracting and repolymerizing
adipic acid and hexamethylenediamine



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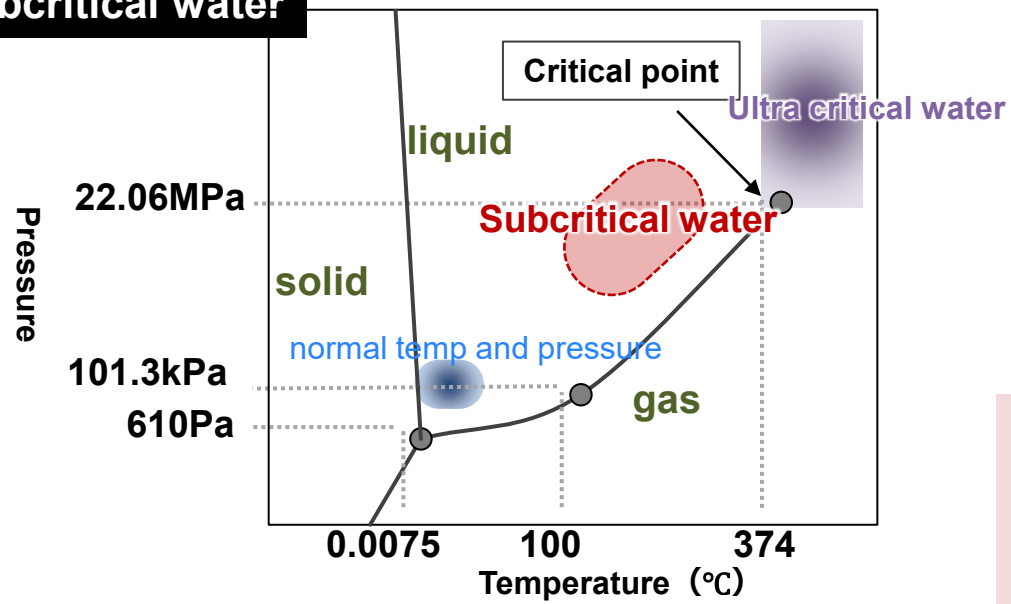
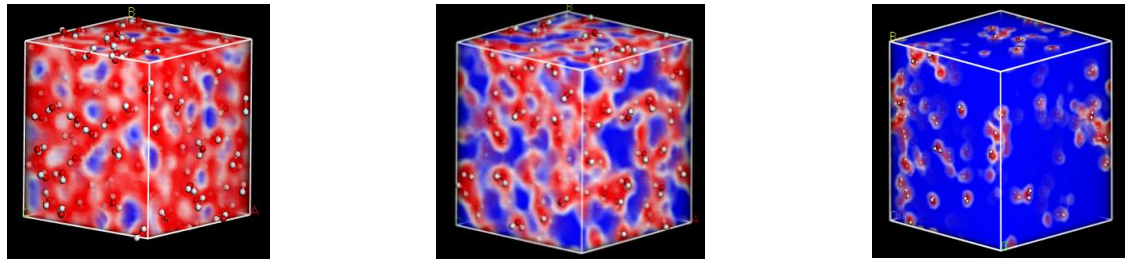
Nylon Chemical Recycled Technology Using Subcritical Water

Subcritical water

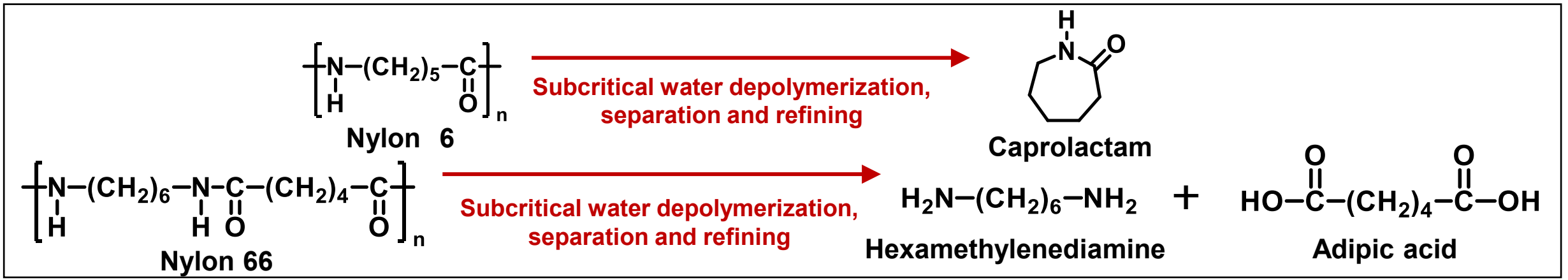


Normal temperature and pressure (0.1MPa, 27℃)	Subcritical water (25MPa, 327℃)	Ultra critical water (25MPa, 427℃)



low — Hydrogen bond density — High

- High molecular mobility (high diffusion velocity, low viscosity)
  →High permeability into polymers
- Low dielectric constant(same as to organics solvents)
  →High polymer solubility
- High ion product ([H^+][OH^-]) → High hydrolysis power



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Case 2) Creation of New Markets Initiatives for Hydrogen (1)

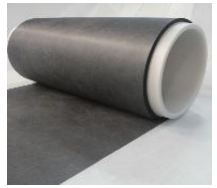
- European and Chinese governments are leading and supporting the creation of the hydrogen market, but market environment changes due to the U.S. policy shifts
- Toray is globally promoting various items such as diaphragms for alkaline and Carbon paper for electrodes

	Status	Water electrolysis		Fuel cell
		Alkaline	PEM	PEM
Europe	Industrial development was led by government, but there are issues such as high costs and strict requirements including novelty	◎ (High Performance)	◎	△
China	• Promoting social implementation focusing on alkaline water electrolysis • Commencing hybrid use with PEM type water electrolysis • FCVs are specialized for long-distance heavy-duty commercial uses	◎ (Larger-size)	△	○
United States	• Project stagnation due to the policy shift • Shift to blue hydrogen	–	△	○
Japan and Korea	• Market expansion stagnates even though development is leading • Renewable energy costs are an issue	△	△	◎ (High performance)
India	Promoting the industrialization of hydrogen and ammonia	△	–	–

◎Top runner, ○ mass production, △ small production

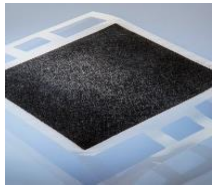
Toray's hydrogen-related components

Diaphragms for alkaline



Carbon paper / Gas diffusion layer for electrode

Carbon fiber for tanks



Catalyst-coated membrane Membrane electrode assembly

Sub-gasket film

Electrolyte membrane

Entering supply chain with various items,
assessing market and technology trends from multiple perspectives to build a dominant position

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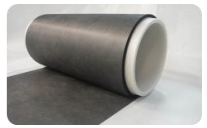
Case 2) Creation of New Markets　Initiatives for Hydrogen (2)
Strengths of Hydrogen-Related Components

Products

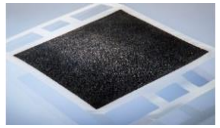
Carbon fiber

Carbon paper
/ Gas diffusion layer



Hydrocarbon electrolyte membrane

Catalyst-coated membrane/ Membrane electrode assembly



Connecting proprietary technologies and strengths to customer value

- Have an excellent track record in high performance & stable quality
- Global production & technical support system

- Design excellent strength, conductivity, and gas permeability
- Impurity-free, high surface quality

- Polymer & membrane structure design & control
- Excellent gas barrier & proton conductivity performance

- Catalyst layer design & control
- Pursuing ultimate reduction in catalyst quantity

Customers' value

High-pressure hydrogen gas tank

- Lightweight
- High-pressured
- Reliability

Fuel cell systems

(stationary and mobile)

- Improved fuel efficiency
- High-output
- Safety
- High-durability

© Toyota Motor Corp.

Water electrolysis system

- Energy-saving
- Hydrogen generation capacity
- Precious metal saving
- High-durability

© Siemens Energy

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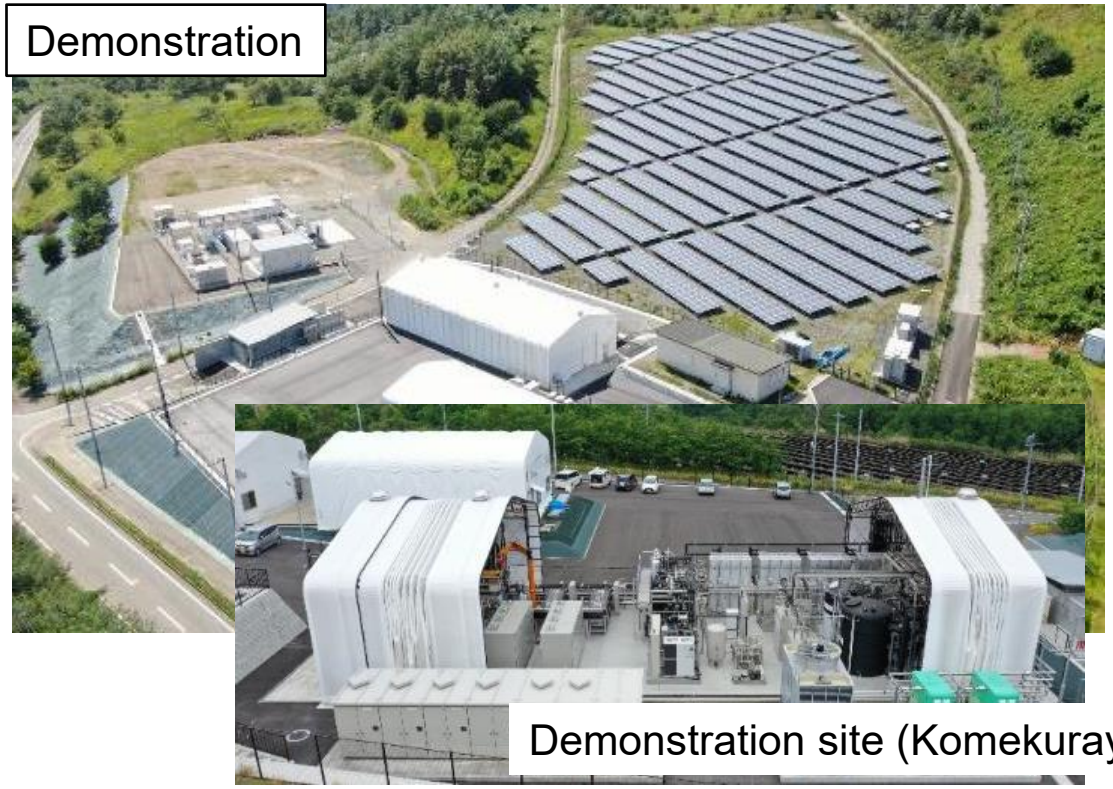
Case 2-2) Creation of New Markets　Initiatives for Hydrogen (3) Collaboration with Government / Supply Chain

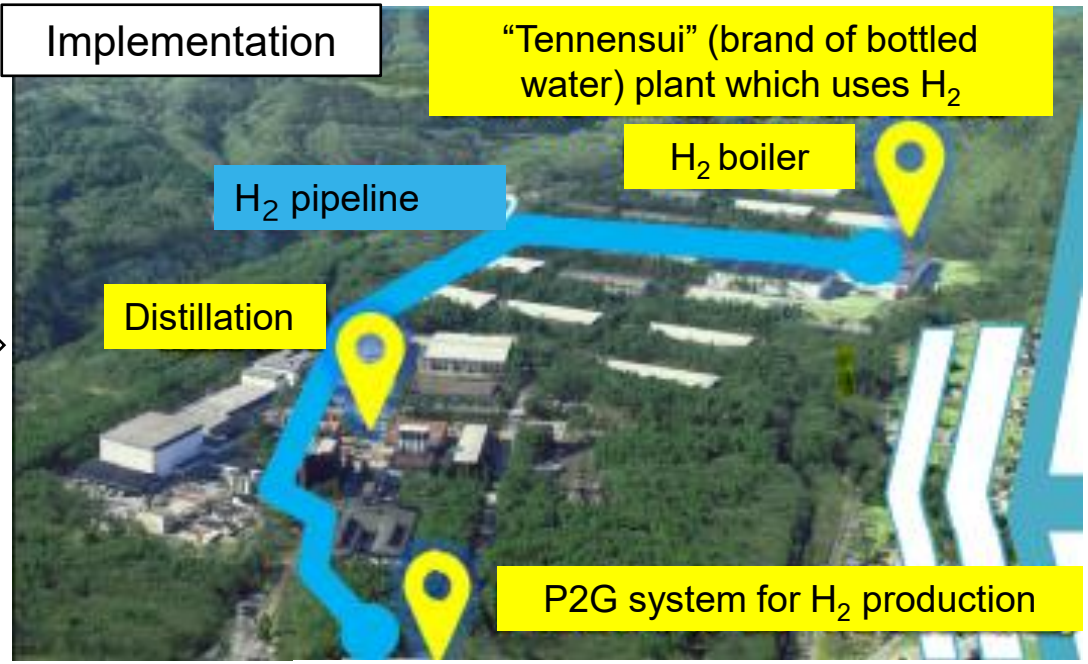
- To demonstrate the value of newly developed electrolyte membranes, Toray, Yamanashi Pref. and TEPCO established Yamanashi Hydrogen Company
- Working with water electrolyzer manufacturers (Siemens Energy, Kanadevia) to socially implement from demonstration phase

Demonstration



Demonstration site (Komekurayama, Yamanashi Pref.)

Implementation



Japan’s largest 16MW water electrolyzer adjacent to Suntory Hakushu Plant

Demonstrated advantage of electrolyte membranes in collaboration with government and supply chain
Led to mass production of electrolyte membranes & implemented to water electrolyzers using Toray’s electrolyte membranes

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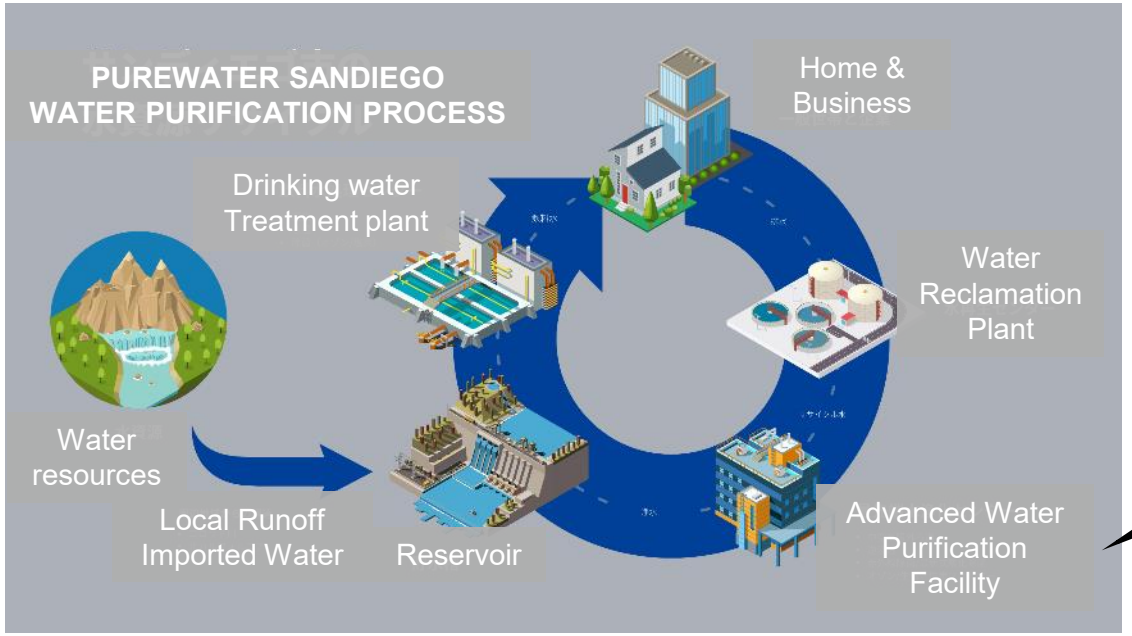
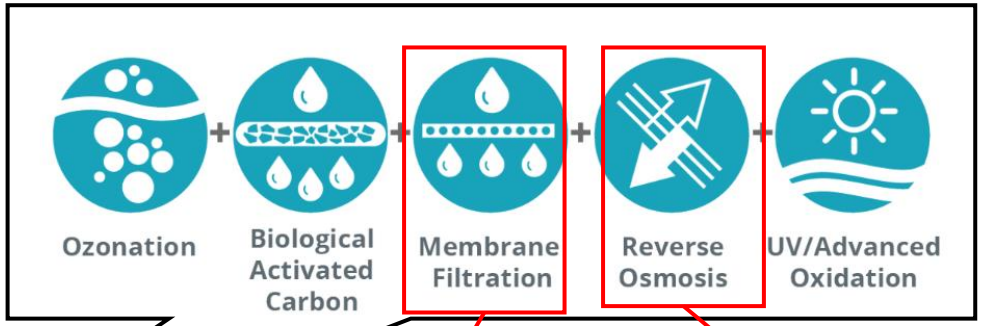
Case 3) Creating New Markets in Cooperation with Government
Wastewater Reuse

- The city of San Diego, facing water scarcity, aims to provide nearly half of the city's water demand through sewage recycling by 2035
- Integrated Membrane System using Toray's highly durable UF membrane and low fouling RO membrane provides low cost and safety in water production
- Received the order after six years of pilot testing for high reliability in durability and stable operation



*Reference: https://www.sandiego.gov/sites/default/files/legacy/water/pdf/purewater/2014/fs_purewater.pdf



Toray UF membrane

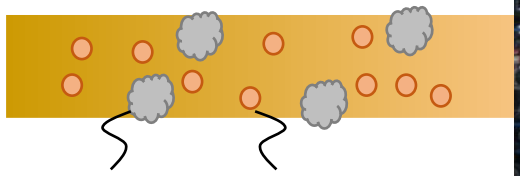
Toray RO membrane

Demonstrate reliability collaborating with government
Achieved results in the expanding wastewater reuse market

TORAY

UF Membrane for Wastewater, Evolution of RO Membrane

Wastewater



Suspended solids

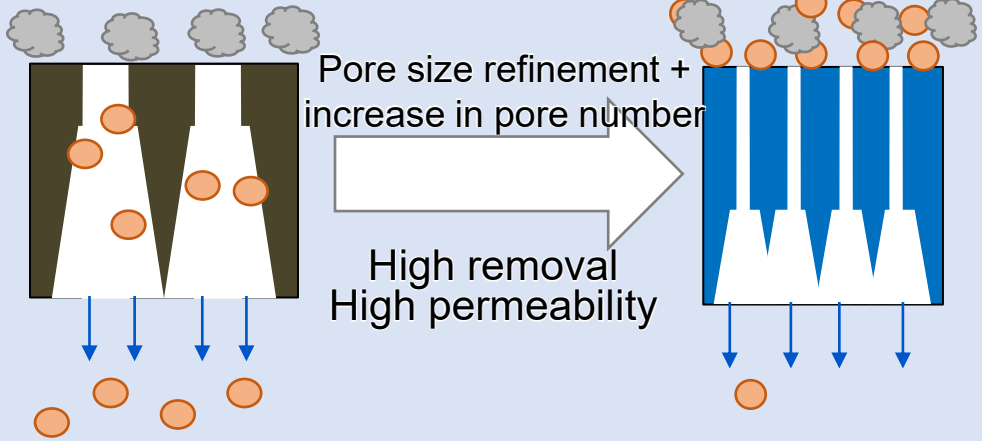
Bio-polymers

UF Membranes

RO Membranes

Potable, industrial and agricultural water, etc.

<Conventional> <High removal UF>

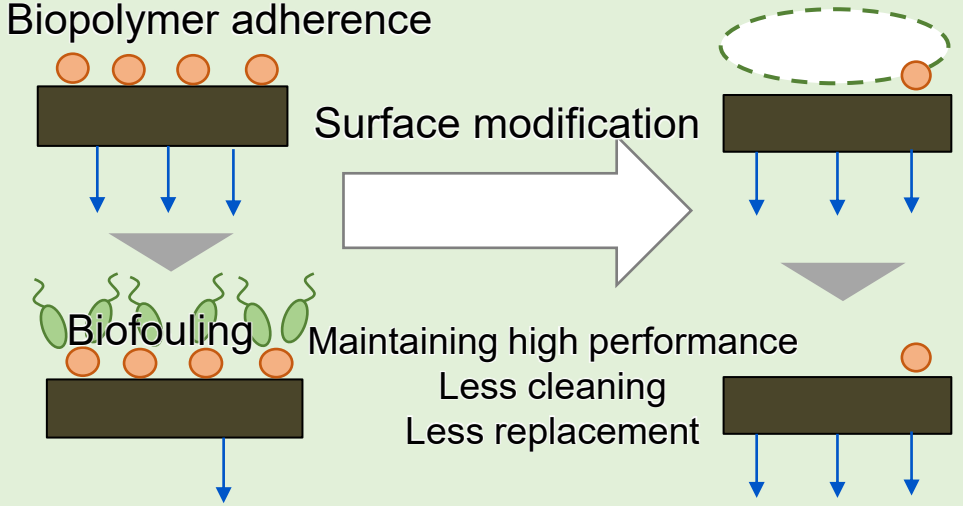


Removal of Biopolymer

50-75%

90%

<Conventional> <Low biofouling RO>



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Case 4) Research and Technology Development for Procurement of Biomass-Based Raw Materials

Building a new supply chain for biomass-based raw material procurement through collaboration with Toray's elemental technology and upstream companies

Biomass

Saccharification	Conversion and refinement	Polymerization and polymer processes
 Non-edible biomass (Cellulose)	Cellulosic Sugar	Biochemicals	Fiber & textiles, Films, Resins

Technology development + Collaborating with upstream companies

Process development / mass production

Under development

Membrane-integrated saccharification process

A processing technology that realizes cost reduction through energy-saving and recycling by applying water treatment membranes for the biomass saccharification process.


Biomass


MF UF NF RO
Membranes


Cellulosic Sugar

Under development

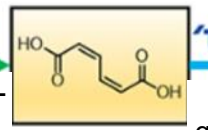
Conversion and refinement process of cellulosic sugar to biochemicals

- Toray and PTTGC* began mass production technology study to establish a supply system for non-edible biomass-based nylon raw materials
- Integration of PTTGC's fermentation technology and Toray's hydrogenation process

*Major petrochemical company headquartered in Thailand

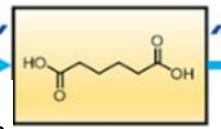

Cellulosic Sugar

Fermen-tation



Muconic Acid

Hydro-genation



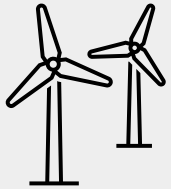
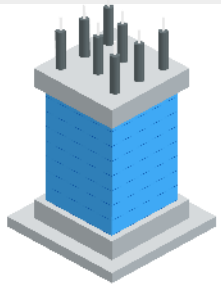
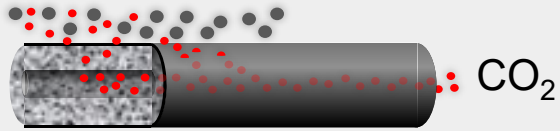
Bio-based Adipic acid


Bio-based Nylon 66

VI

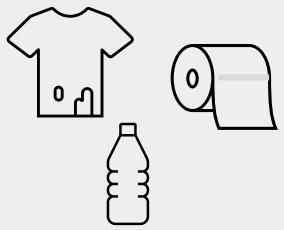
By 2030, and onwards

Innovation Supporting a Sustainable Society (**GHG** Emissions Reduction)

Method	Initiatives	Toray's product	2030	2040	2050
GHG Emissions Reduction					
Larger wind power generation	 Lightweight / high-strength wind turbine blades	Large tow carbon fiber	Main electricity source		
			Onshore / Offshore (Bottom-fixed)		
			Offshore (Floating)		
Transition to hydrogen	 High-efficiency water electrolysis	Electrolyte membrane CPs/GDLs for electrodes Diaphragms Carbon fiber for tanks	Full-fledged market expansion		
			Alkaline type		
			PEM type		
CO_2 removal for CCS	 Improved performance of CO_2 separation	Gas separation membrane	Blue hydrogen		
			Amin absorption method		
			Membrane separation method		

Innovation Supporting a Sustainable Society (Resource Recycling & Nature Positive)

Method	Initiatives	Toray's innovation	2030	2040	2050
Resource Recycling	Promoting Recycling	Separation & refining technology High-functionality Subcritical water depolymerization Hydrogen bacteria	Material recycling	Chemical recycling	Carbon Recycling(CO_2 resource utilization)
	Use of non-edible biomass-based raw materials	Membrane-integrated saccharification process	Independent from fossil fuel resources		
Nature Positive	Increasing water efficiency	High-performance water treatment membrane	Expansion of water reuse market		



Expansion of recycling targets

Efficiency improvement of biochemical processes

Expansion of applications
Improvement of water production / durability

Toward a “truly sustainable company”

Changes in policies and regulations

- U.S. policy shifts
- Changes in EU environmental policies & regulations
- Economic bloc formation (Economic security / Industrial development measures)
- Stricter environmental requirements & disclosure obligations

Market changes

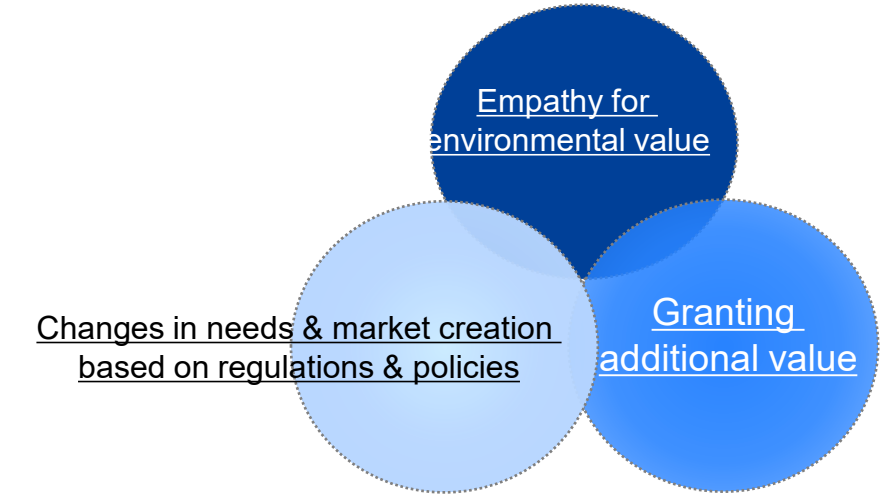
- Delays in shift to EVs in Europe, U.S. and Japan / Expansion of Chinese EV market
- Delays in expansion of hydrogen market
- Expansion of recycling needs
- Emergence of procurement risks

Strategy of Sustainable-Related Business Flexibly Responding to Changes in Society & markets

- Marketing with customer
- Establishment of supply chain based on global trend
- Continuous technology innovation
- Reducing our environmental impact
- Comprehensive assessment of risks & opportunities

Response to disclosure (Accuracy and Efficiency)

Conversion of Environmental Value to Economic Value



Balancing Economic Value & Social Value

Promoting realistic sustainability initiatives to create value with customers

TORAY

Materials Change Our Lives

'TORAY'

Innovation by Chemistry

For Sustainable Growth

Descriptions of predicted business results, projections, and business contained in this material are based on predictive forecasts of the future business environment made at the present time.

The material in this presentation is not a guarantee of the Company’s future business performance.