TORAY
Innovation by Chemistry

TORAY IR Seminar

Toray Group's Initiatives for Water Treatment Business "Vision 2030"

March 28, 2025

Satoshi Shimoyama
Corporate Vice President,
General manager, Water Treatment & Environment Division
Toray Industries, Inc.

Contents

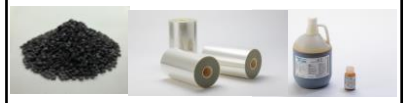
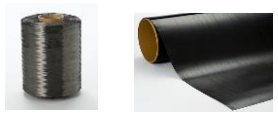
I

Overview of the Water Treatment Business

Positioning of the Water Treatment Business

FY 2024 Forecast
Announced on February 12,2025

Billion yen

Segments	Major Products	Revenue	Core Operating Income
Fiber &Textiles		1,006.0	64.0
Performance Chemicals		955.0	63.5
Carbon Fiber Composite Materials		304.0	22.0
Environment & Engineering		252.0	26.5
Life Science		55.5	0.0
Others		17.5	2.5
Adjustment			▲33.5
Total		2,590.0	145.0

Growth Business Fields Under AP-G 2025

SI Business
Sustainability Innovation Business

1. Products that accelerate measures to counter climate change
2. Products that facilitate sustainable, recycling-based use of resources and production
3. Products that help provide clean water and air and reduce environmental impact
4. Products that help deliver better medical care and hygiene for people worldwide

DI Business
Digital Innovation Business

Materials, equipment, technologies, and services that help improve convenience and productivity by supporting the widespread adoption of digital technology

Toray Group's Sustainability Vision and Water Treatment Membrane's Contribution

Toray Group Initiatives	Four Perspectives of the World as Envisioned in 2050
Toray Group's innovative technologies and advanced materials	
Accelerating measures to counter climate change	1 A net zero emissions world, where greenhouse gas emissions are completely offset by absorption
Realizing sustainable, recycling-based use of resources and production	2 A world where resources are sustainably managed
Providing clean water and air, and reducing environmental impact	3 A world with a restored natural environment, with clean water and air for everyone
Contributing to better medical care and hygiene for people worldwide	4 A world where everyone enjoys good health and hygiene

Water Treatment Membrane's Contribution

CO_2 emissions avoided by using RO membrane for seawater desalination*1

Evaporation method **336** > RO membrane method **53**

(t-CO_2/26,000m^3-water)

*1 **Figures in the circles above represent CO_2 emissions for the entire product life cycle**

Source: *Innovations for Greenhouse Gas Reductions*, Japan Chemical Industry Association (JCIA)

Expansion into fields other than water treatment

Utilize separation membrane technology developed by Toray

- High removal
- Energy-saving in use
- Stain-resistant
- High durability

[Application]

Food, Resource recovery, Gas separation

Create safe water with Water Treatment Membrane

Water Management and Prevention of Water Pollution

Toray's Positioning in the Water Treatment Industry

Positioning of Toray's membrane business in the Industry

Membrane Type	Main Use	Position in the Market
RO	• Seawater Desalination	No.1 Globally
	• Ultrapure Water • Wastewater Reuse	Leading in High Performance
NF	• Harmful Substance Elimination	Customized Support
	• Potable Water	
UF	• Pretreatment for Seawater Desalination	Superior in High Performance, High Durability
MBR	• Wastewater Treatment	Superior in High Performance, Easy Handling

Toray Group's Competitiveness

Accomplishments in Seawater Desalination
- No.1 market share globally (Significant share in the Middle East)
- Have taken a lead in localization in Saudi Arabia, the largest market

IMS* proposal:
* Integrated Membrane System
- Wide range of product lineup
- Provide the optimal solution for various water sources and applications

Localization/ Global Network
- Global integrated operation system for production, sales, and technology

"Made by Toray" at all locations, in time

35 Sales Offices
6 Production Bases
4 R&D Centers

Product Appeal / Technical Service
- RO/ Started development in the 1960s, became a pioneer in the industry
- RO/ High performance (in removal and durability) ⇒ Seamless technical services
- UF/ High durability, high anti-fouling
- MBR/ Ease of operation

◆Growth business: 10% CAGR in revenue over the last 10 years and double-digit ROIC

Growth Areas to Focus on

✓ Existing applications:
- Seawater Desalination
- Wastewater Reuse
- Ultrapure Water (for Semiconductor)

✓ New applications:
- Cooling Water (for Data Center)
- Agricultural Water

TORAY

II

Business Environment

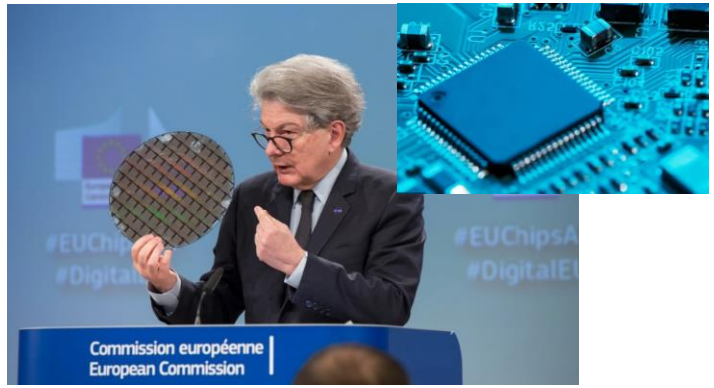
Environment Surrounding the Water Treatment Business

- Growing expectation for water treatment membranes to solve social issues due to accelerated and aggravated water shortages, in addition to heightened environmental awareness
- New business opportunities, despite the political risks of each area and country

Climate Change and Drought

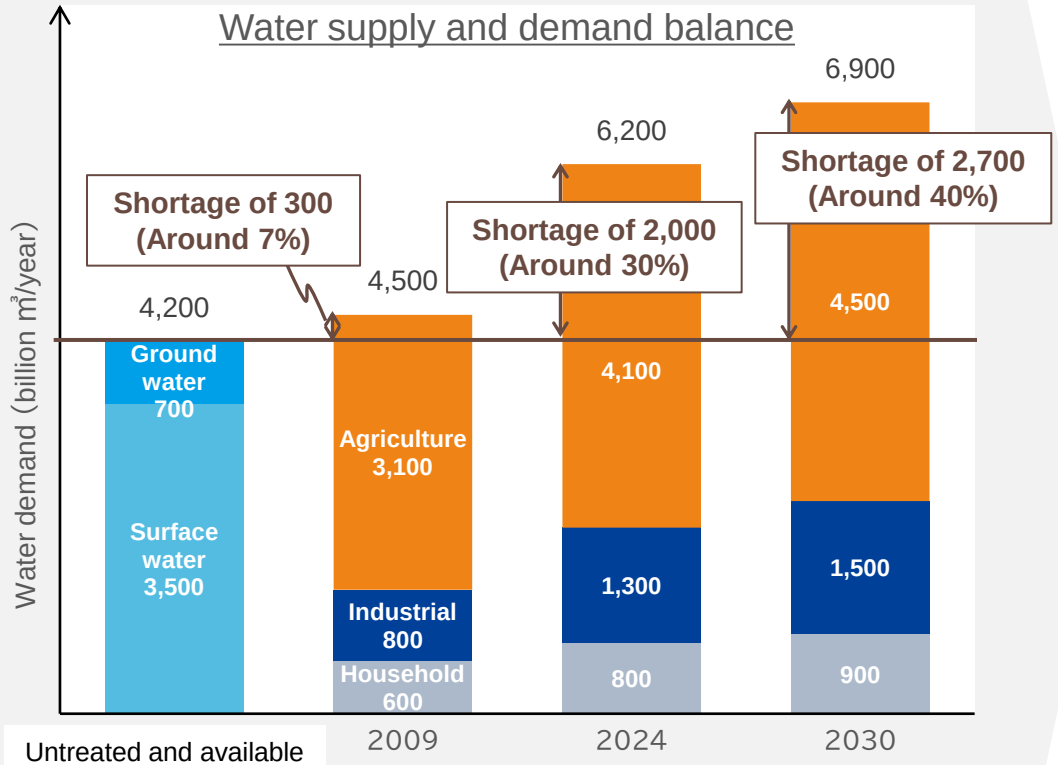
Environmental Regulation

International Affairs and Industrial Policies

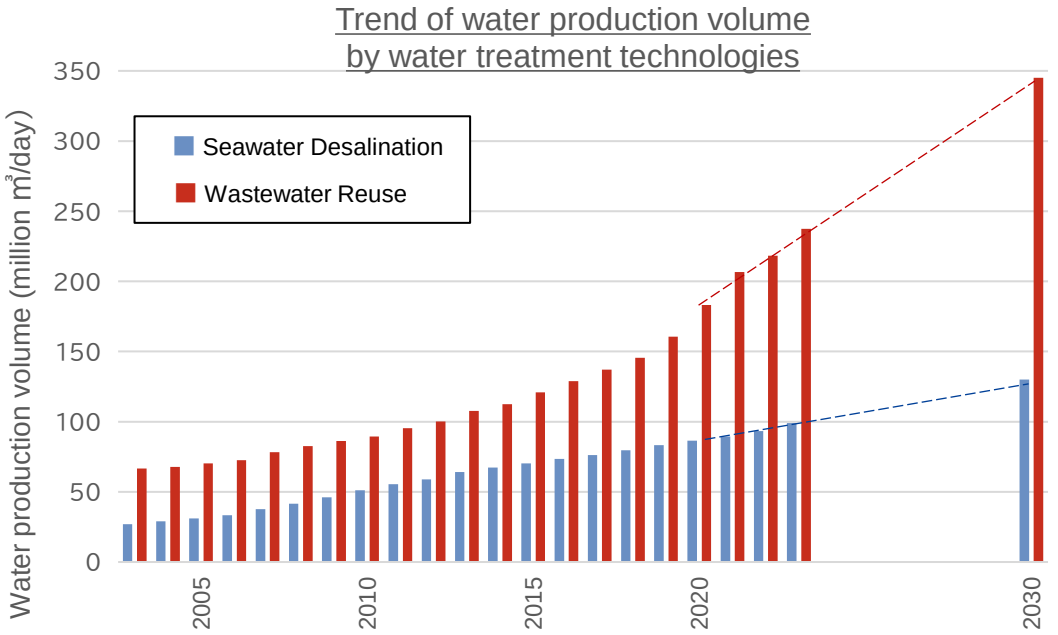


Water Treatment Membrane Demand Outlook

- By 2030, water demand is expected to rise to 140% of the world's freshwater resources
- Growth in wastewater reuse field due to the ease of water sourcing from residential and industrial areas



Estimated by Toray（Ref：Charting Our Water Future, The 2030 Water Resources）



Estimated by Toray（Ref：GWI DesalData / IDRA）

Market growth rate

Up to the present: Water Desalination ≒ Wastewater Reuse

Future: Water Desalination ＜ Wastewater Reuse

Growth Business Field Outlook – Seawater Desalination (1) –

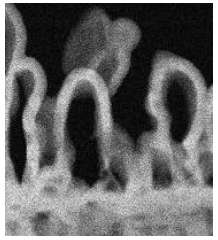
■ **Received an unparalleled track record of orders in this application, including the Taweelah project in the UAE, one of the largest seawater desalination plants in the world**
→ Achieved a position as the "de facto standard" of seawater desalination

World's Top 10 Seawater Desalination Plants Using RO Membrane

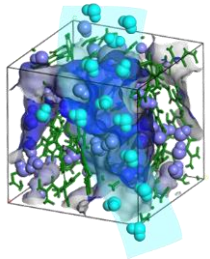
No	Country	Name of Project	Volume (ton/day)	Start Year	RO Producer
1	UAE	Taweelah IWP	909,000	2023	TORAY
2	UAE	Umm al Quwain IWP	681,818	2022	TORAY
3	Israel	Soreq 2	670,000	2024	
4	Saudi Arabia	Khobar 2 replacement SWRO	630,000	2023	
5	Israel	Soreq	624,000	2013	
6	Saudi Arabia	Shoaiba 5 (SWCC)	600,000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

- Taweelah in the UAE started commercial operation in 2024

Toray's high-performance seawater desalination RO membrane



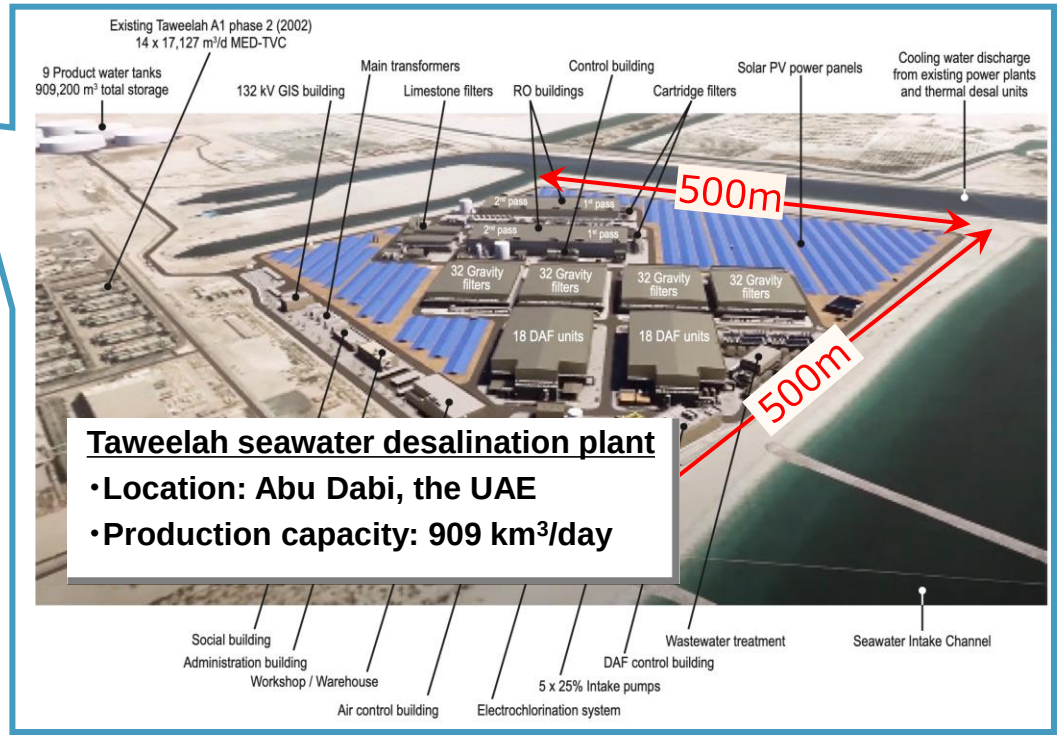
Advanced analysis technology



DX

- Developed high-performance RO membranes leveraging Toray's superior polymer technology, as well as advanced analysis technology and DX that controls the shape of folds and pore size distribution.

Realized both high removal and water production

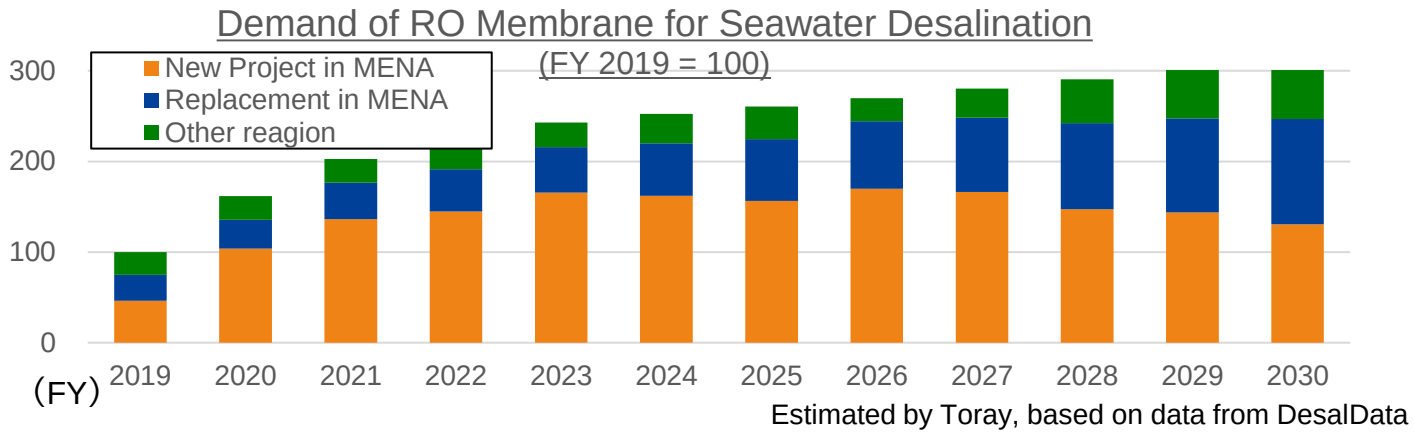


Taweelah seawater desalination plant
- **Location: Abu Dabi, the UAE**
- **Production capacity: 909 km³/day**

◆ **Achieved No. 1 market share of seawater desalination, thanks to Toray's high-quality RO membrane production in Saudi Arabia and prompt customer support**

Growth Business Field Outlook: Seawater Desalination (2)

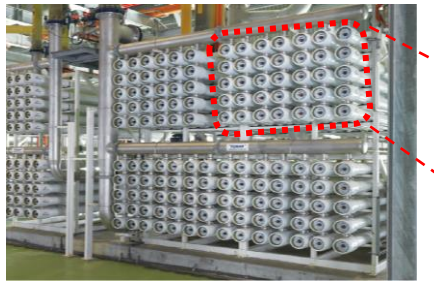
- **New seawater desalination plants are increasing outside the Middle East, particularly in North Africa**
- **The construction of new plants in the Middle East will peak out, but replacement demand is expected to increase**



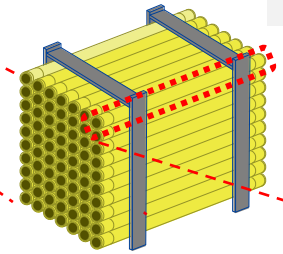
Estimated by Toray, based on data from DesalData

Steps for replacing RO membrane modules

Replace the RO membrane element periodically to maintain water quality, pressure, and other parameters at the specified levels.

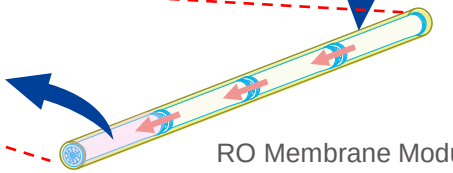


RO Membrane Plant



RO Membrane Module Unit

RO Membrane Element



RO Membrane Module

Characteristics of demand

＜New Project＞

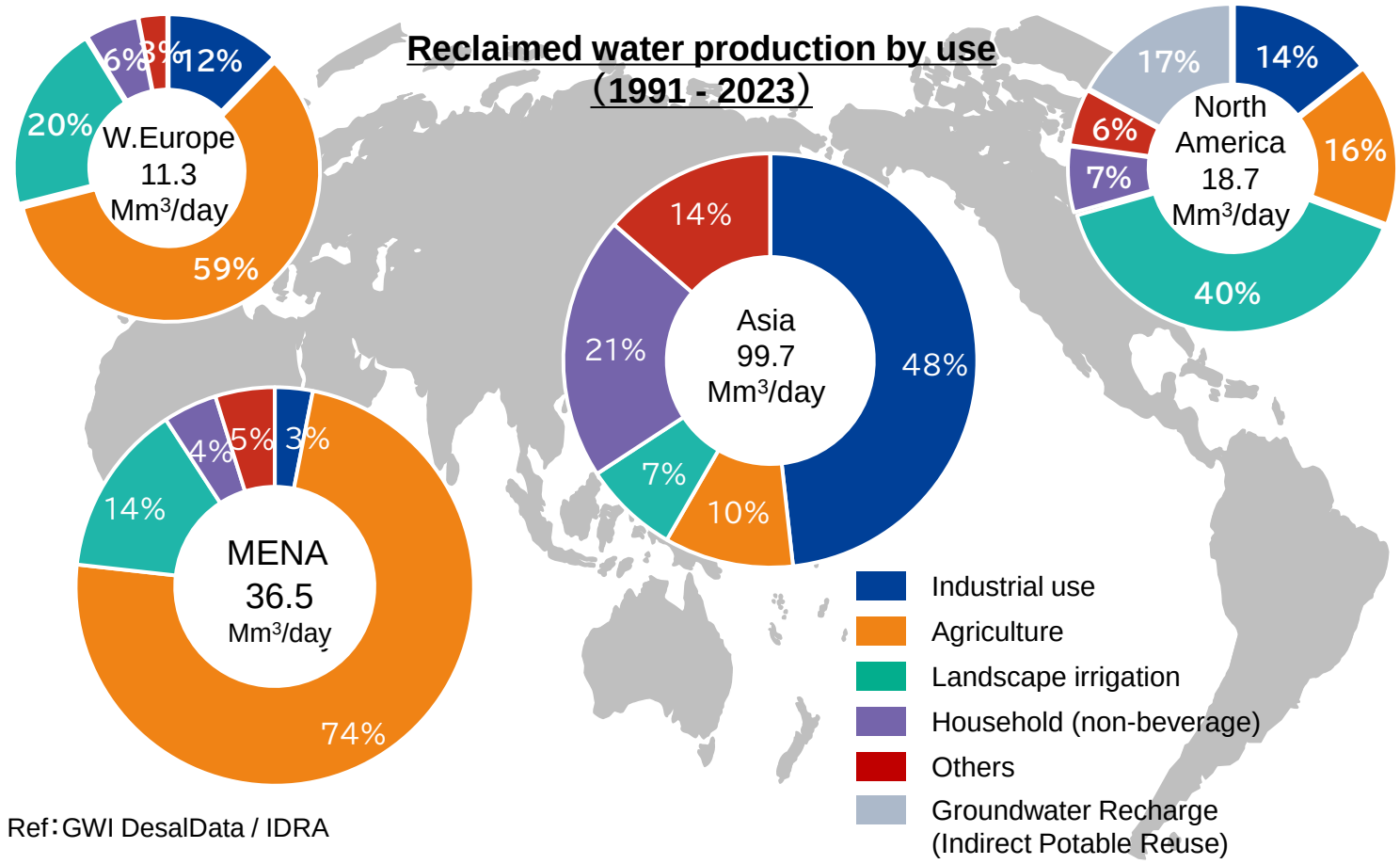
- In the Middle East, the construction of new plants will remain strong until 2027 due to replacement from the evaporation method and industrial growth
- Toray's progress in localization gave it an advantage in winning orders in Saudi Arabia, in line with Saudization, the government policy
- New projects are also increasing in other regions, such as North Africa, Australia, Asia, China, and USA.

＜Replacement＞

- There is periodic demand for the replacement of membranes
- Replacement demand increases in line with accumulated construction of new plants

Growth Business Field Outlook – Wastewater Reuse (1) –

- **Demand is growing at about 6-7% per year**
- **The use of reclaimed water varies from region to region and requires appropriate approaches for each application and water source**



Ref：GWI DesalData / IDRA

Characteristics of demand

- Easy access to water sources
- Various filtration and concentration requirements by country and region

<Expected trend>

- ✓ USA: Increase of IPR (Indirect Potable Reuse)
  Growing attention to DPR (Direct Potable Reuse)
  PFAS removal
- ✓ China: ZLD (Zero Liquid Discharge)
- ✓ India: Dyeing wastewater treatment

- The rise in awareness about the SDGs has led to the expansion of water reuse initiatives in the private sector, particularly among large companies.
  e.g. 100% reuse target at semiconductor factories

Growth Business Field Outlook – Wastewater Reuse (2) –

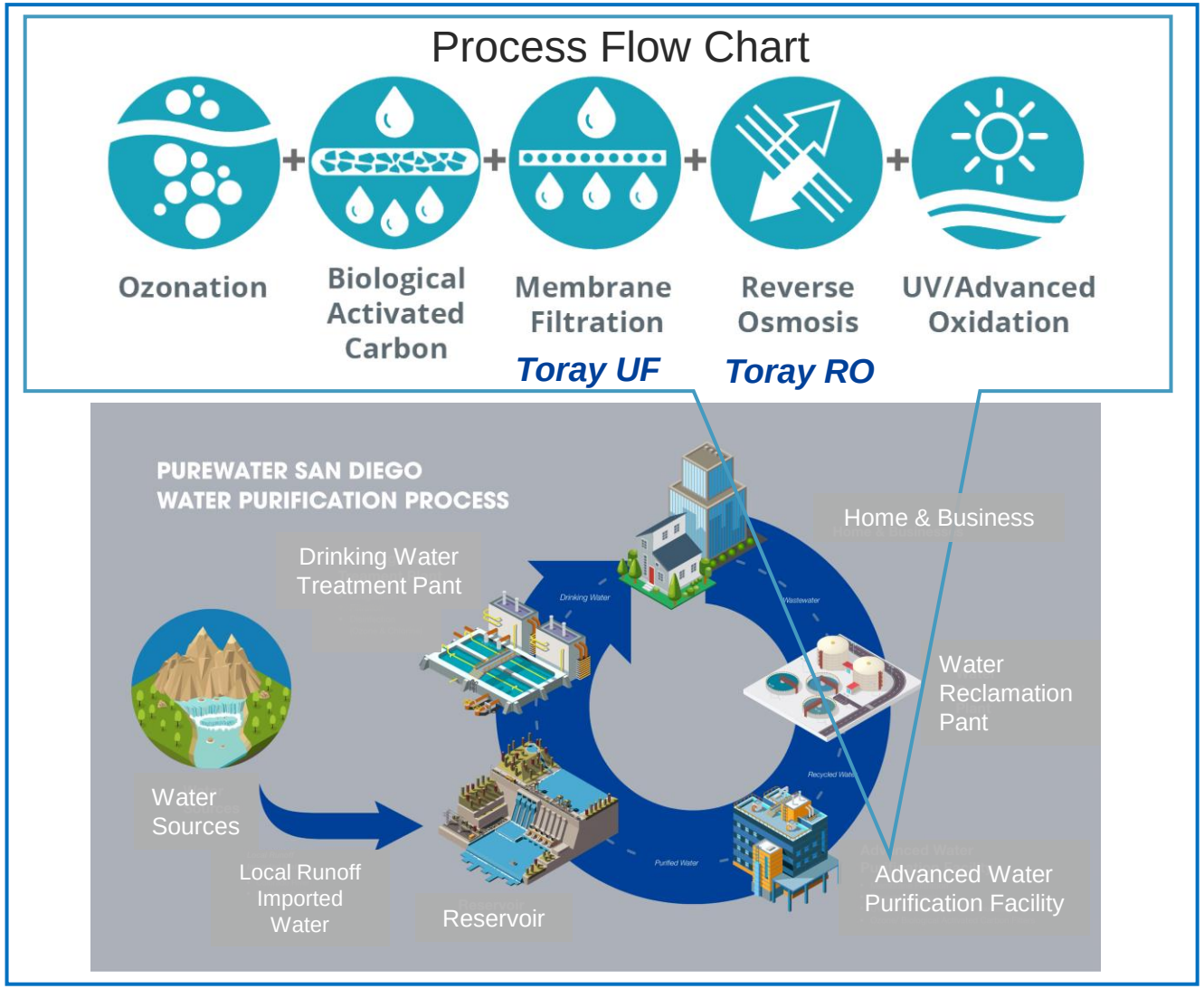
San Diego Pure Water ［California］

Production capacity: 150,000 m^3/day

Toray UF Membrane

Toray RO Membrane

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

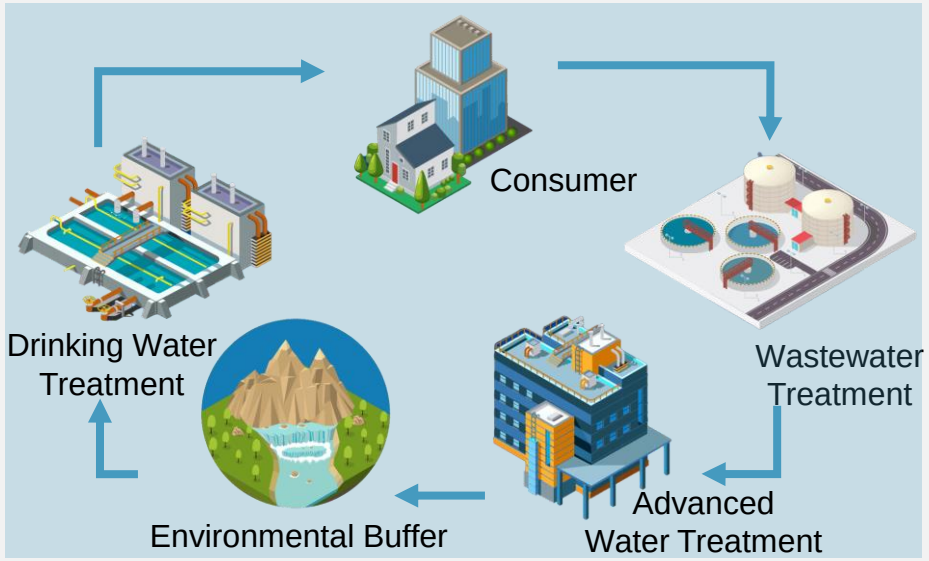


*Reference: https://www.sandiego.gov/sites/default/files/legacy/water/pdf/purewater/2014/fs_purewater.pdf

Growth Business Field Outlook – Wastewater Reuse (3) –

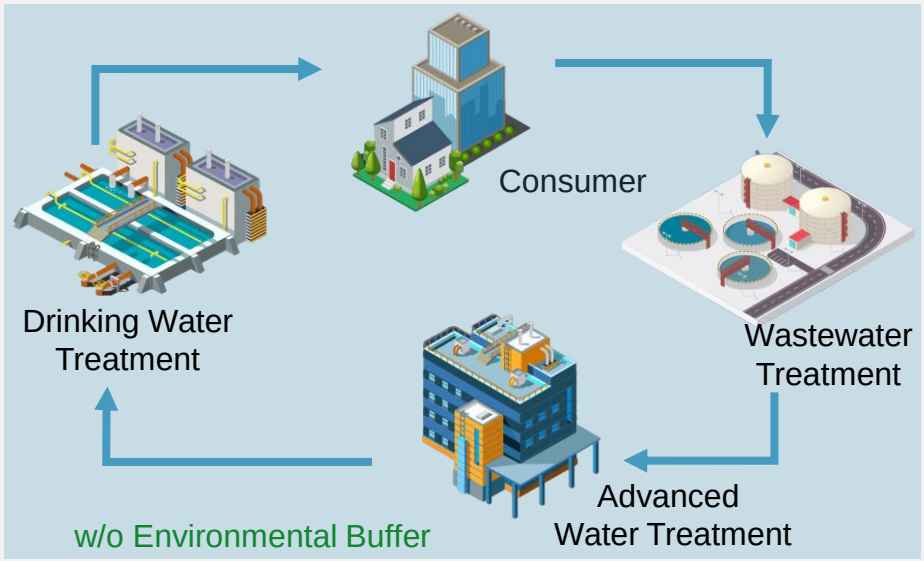
Trend in USA

IPR：Indirect Potable Reuse



- ✓ High consumer confidence due to environmental buffer
- ✓ Costly due to the need to return the water to nature (pumping)

DPR: Direct Potable Reuse



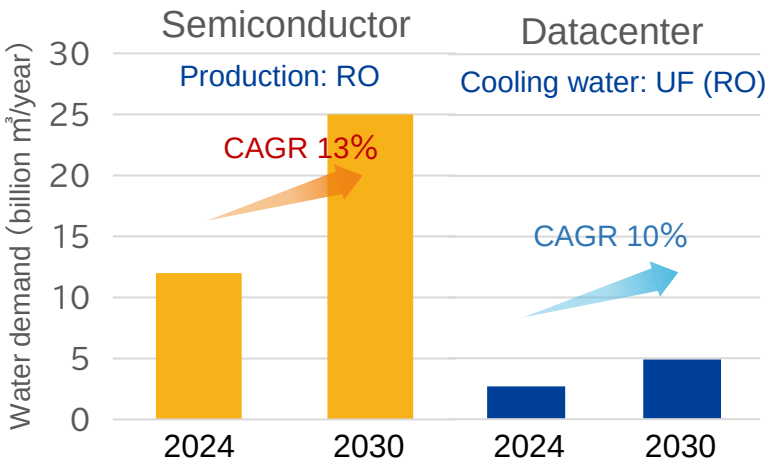
- ✓ 17% cost reduction vs. IPR by eliminating of pumping costs
- ✓ Consumer sentiment calls for increased safety in advanced water treatment

- The difficulty of water treated by wastewater reuse is increasing
  → Pretreatment with UF membrane is becoming more important
- In DPR, demand for safety (high virus filtration) is increasing

High removal UF membrane
for wastewater reuse was developed
→ To be launched in mid-2025

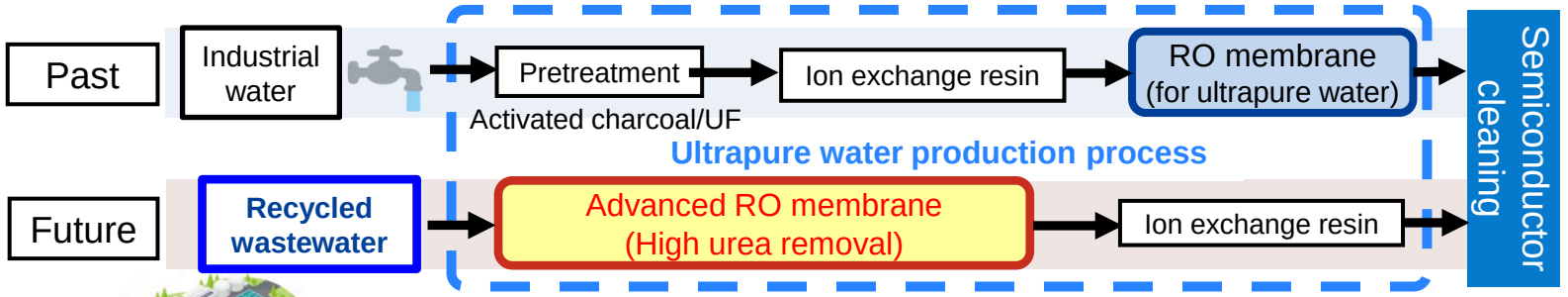
Growth Business Field Outlook: Ultrapure Water and Cooling Water
(for Semiconductor and IT Industries)

- **Water demand in these applications is growing at double-digit annual rate due to the expansion of IT equipment, EV, and AI data centers**
- **High expectations for water treatment membrane technologies due to the trend of SDGs (Recycled wastewater → ultrapure water)**



Ref: Bluefield Research

Semiconductor manufacturer, foundry	Locations of factories planned or under construction
TSMC	Japan, USA, Germany, Saudi Arabia
Samsung Electronics	USA, Korea
Intel	USA, Germany, Poland, Malaysia
Lapidus	Japan



Achieved world's highest performance in removing neutral molecules (silica, urea)

Characteristics of demand

＜Ultrapure water for semiconductors＞

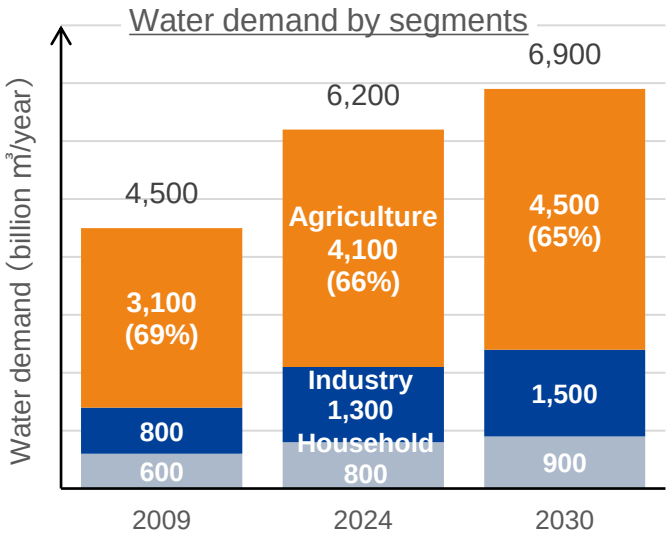
- The trend of each country constructing their own semiconductor factories was triggered by the global semiconductor shortage
  ⇒ Expected to continue due to increased geopolitical risks
- High attention on water treatment technology
  - ✓ **Improving the purity of ultrapure water (improving yields)**
  - ✓ **Fine-pitching of semiconductors**
  - ✓ **CO_2 reduction**
  - ✓ **Reuse of process water**

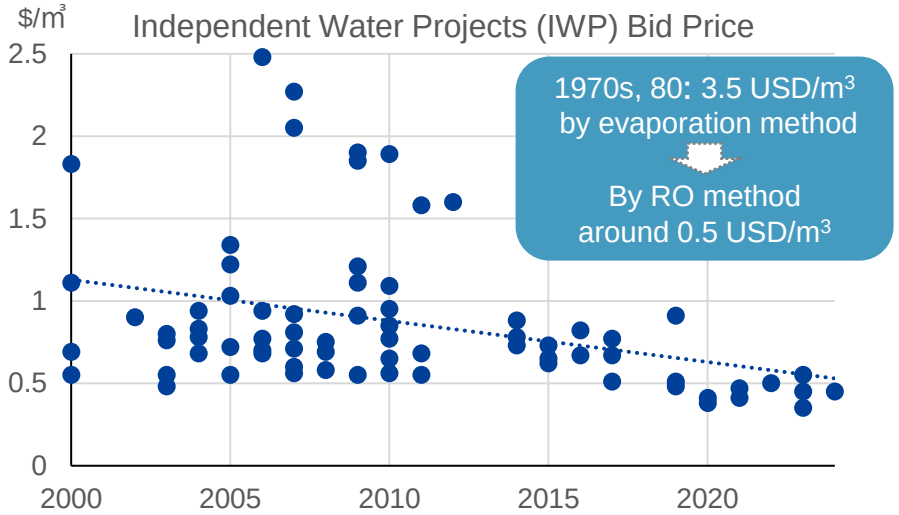
＜Cooling water for data center＞

- Construction of data center is increasing globally due to the spread of AI
  ⇒ Water use in the IT industry is growing rapidly

New Growth Business Field Outlook: Agriculture

- **Action is needed to ensure food security (agriculture), which is threatened by drought and salinity**
- **Potential to expand application of water produced by seawater desalination to agricultural use by reducing the costs of water production**





Campo De Dalías seawater desalination plant (Spain)

Due to the depletion of groundwater, seawater from the Mediterranean is being utilized as an alternative water source. Toray's RO membranes are used for desalination in agricultural and residential applications (100,000 m3/day, since 2016).

Characteristics of demand

- 70% of available water is used for agriculture
- Wastewater reuse is primarily used in agriculture, particularly in Western Europe and MENA regions.
- 20% of the world's farms are affected by salinity

- Requirement for desalination rate is lower than drinking water applications
- Although **cost reduction in water production** is the biggest issue, there is potential for expanding the use of water produced by seawater desalination in agriculture

III

Water Treatment Business “Vision 2030”

“Vision 2030” Basic Policies

“Vision 2030” Basic Policies

Establish position as “Leading Company” in water treatment membrane business

– Expansion to membrane solutions –

Water treatment membrane business

- Maintain / improve **high profitability** as fundamental business (source of profit)
- Solve water problems through membrane technology

  Growth Business Field to be Focused on
  - ✓ Existing Applications :
    - Seawater Desalination
    - Wastewater Reuse
    - Ultrapure Water (for Semiconductor)
  - ✓ New Applications:
    - Cooling Water (for Data Center)
    - Agricultural water

- Provide systematic integrated technical services globally

Membrane+

- Create business through **peripheral technologies** that we provide to customers as a water treatment membrane manufacturer
  1. Membrane peripheral support including chemicals
  2. O&M (Operation and Maintenance) support based on ICT (Information and Communication Technology)
- Expand applications of membrane filtration technology
  1. Filtration process by membrane for foods
  2. Recovering valuable materials such as lithium

Municipal in Japan

- Expand emerging PPP* projects
- Expand maintenance business

* PPP: Public Private Partnership
Method to promote projects in which government and private sector work together

Recycle, Reuse

- Establish cleaning and performance restoration technology
- Establish recycle (material / chemical) technology
- Establish business model

TORAY

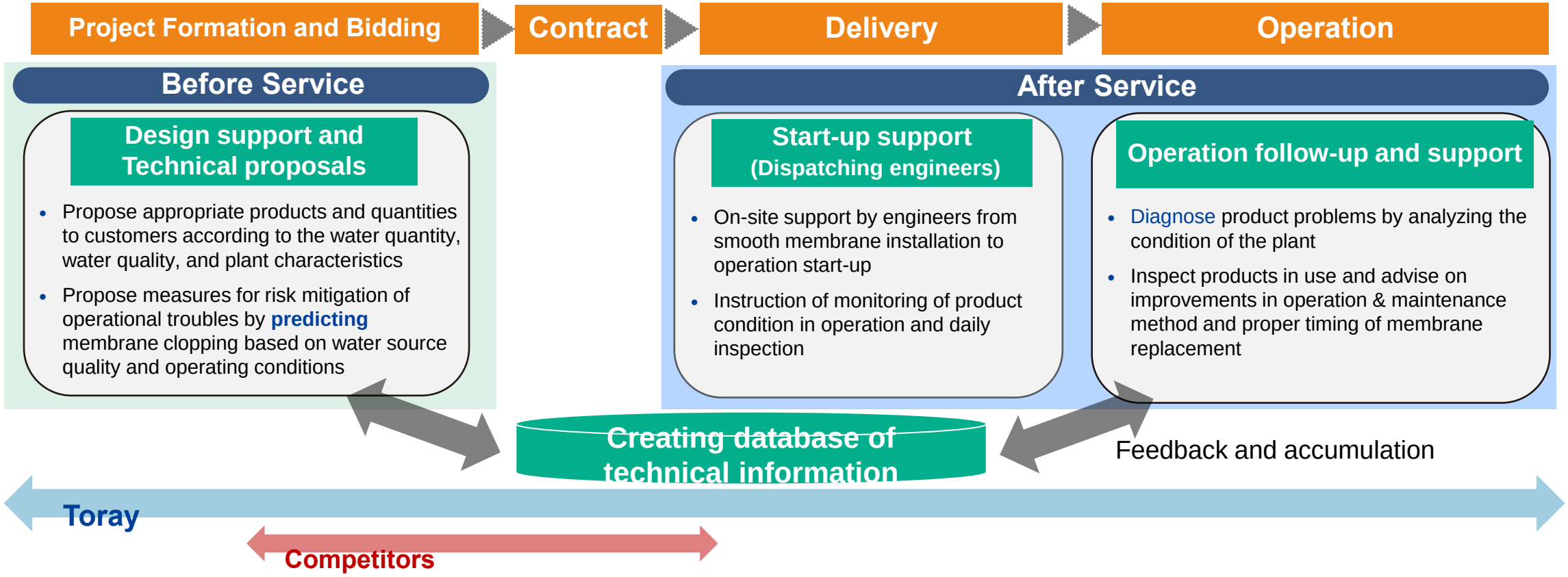
Technical Service of Toray Water Treatment Business (1)

Water treatment membrane business

- Established Toray's brand with a global technology service network and unique technical support
- GTST* provides design support, plant start-up and operation follow-up in each region
  → Through the above support from GTST, customers can benefit from improvements in performance and energy-saving by using the membranes properly

※GTST : Global Technical Service Team

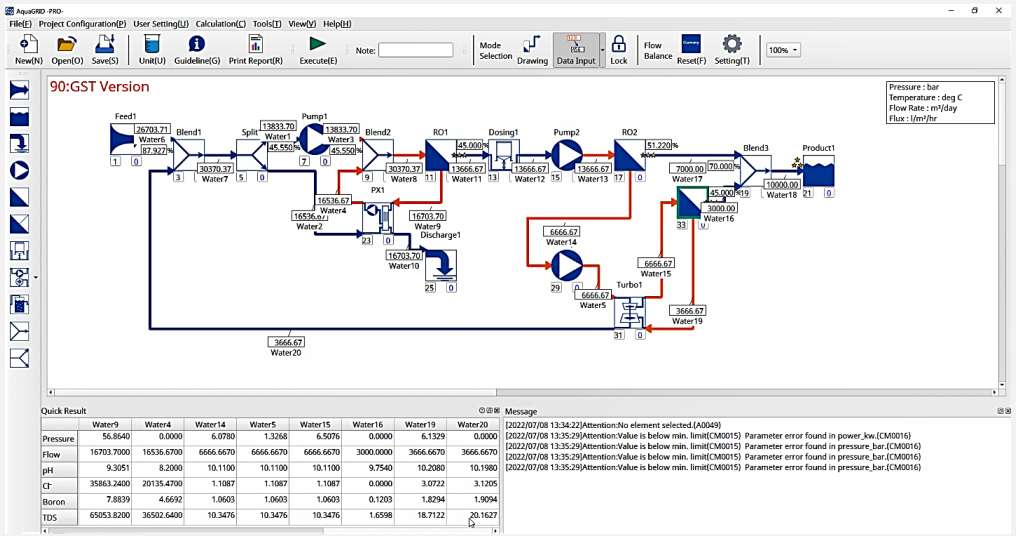
- Flow of water treatment project -



Technical Service of Toray Water Treatment Business (2)

Water treatment membrane business

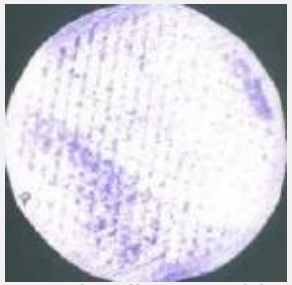
Prediction and design support



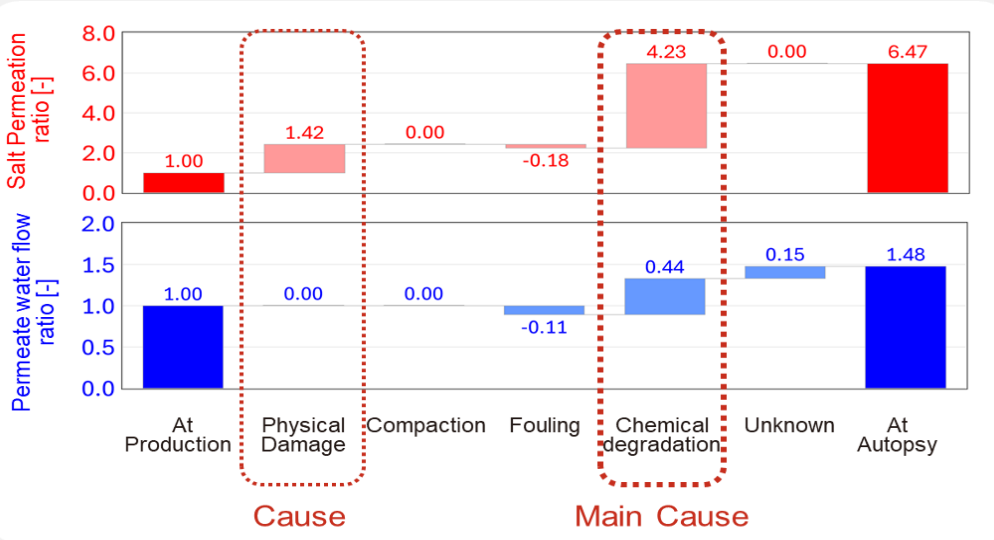
Accurate predicting technology and innovative operability to meet high level requirements

Analysis diagnosis and return inspection

Example: dirty membrane surface after use



Example: disassembled dyed membrane (Deterioration)



Advanced quantitative analytic technology

Business Expansion by Strengthening Technical Service

Water treatment membrane business

■ Develop advanced technical services globally as the basis for business expansion

What is required for membrane manufacturers

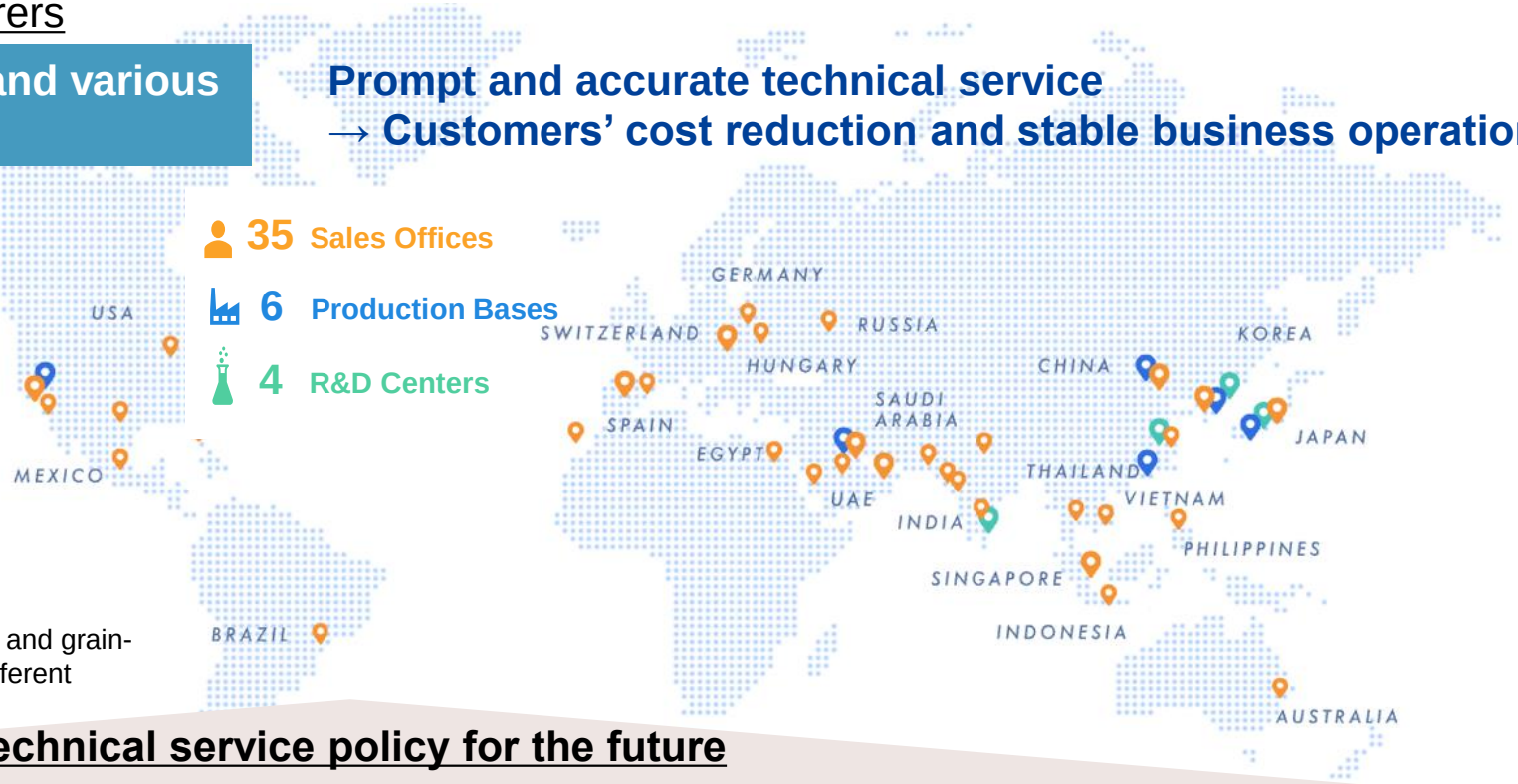
Responses to types of water sources and various "water qualities" by region

Prompt and accurate technical service
→ Customers' cost reduction and stable business operation

The Arabic Sea and the Pacific Ocean have different salinities and temperatures

Food factories and electronic component factories have different impurities

Meat-centric Western countries and grain-centric Asian countries have different metabolites



Technical service policy for the future

Functionality Enhancement in every region

- Strengthen technical responsiveness to regional needs by establishing returns inspection spot and R&D center at each location

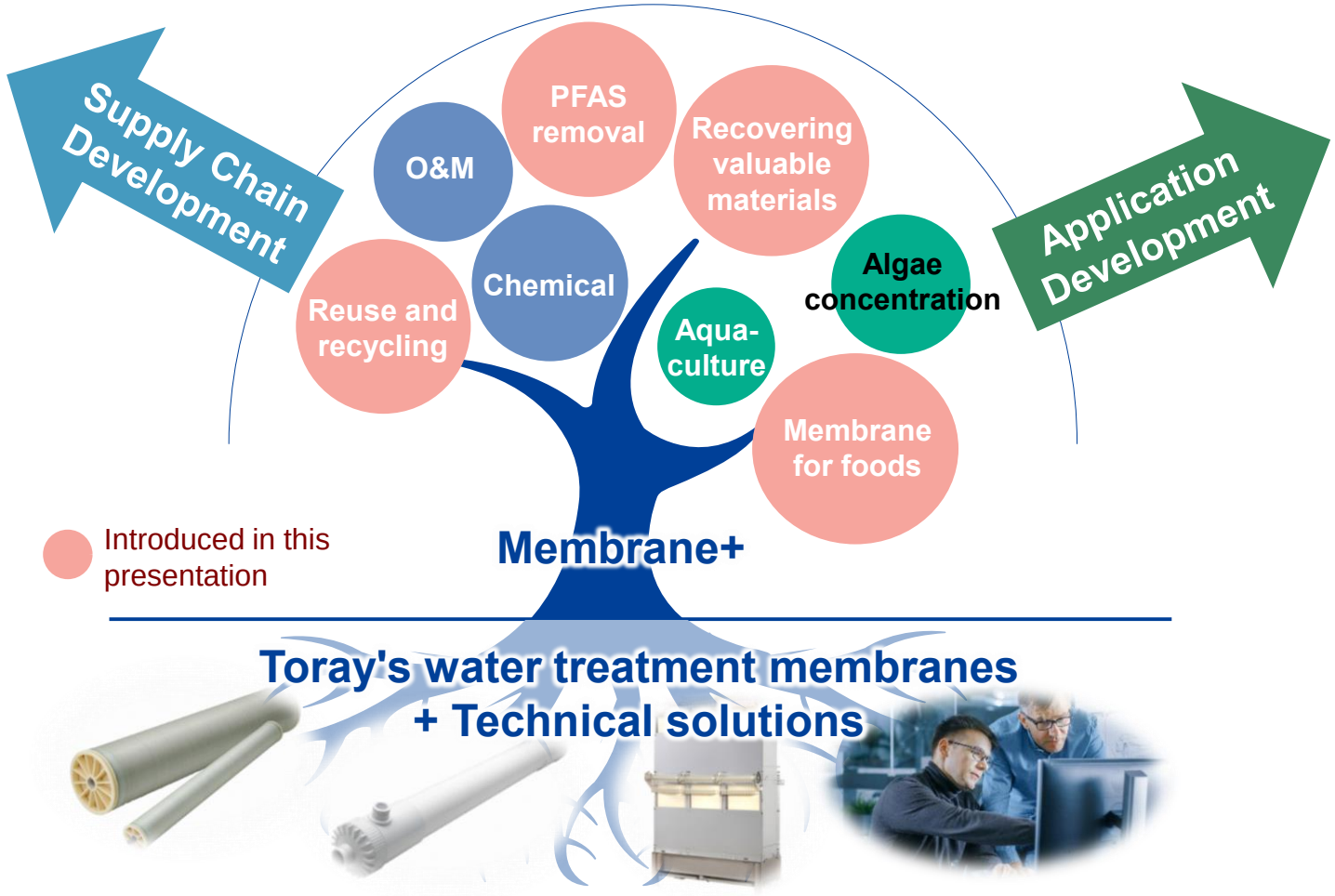
Streamlining and standardization of technology services

- Utilizing DX and AI technologies to provide top-level technical services without variances among locations

TORAY

Business Expansion by Membrane+ (1): Future Vision

- Develop a solution-based business by leveraging peripheral technology and utilizing membrane process expertise
- Promote application development by expanding the target of filtration



Target of Membrane+ business

- Business based on membrane peripheral technology, which is provided to customers from membrane manufacturer
- In existing water treatment applications, aim to expand in areas where collaboration is possible, such as providing process support, which leads to increased value for customers, as well as peripheral technologies
- Promote the development of new applications utilizing membrane separation technology. Create a new business offering packaging proposals

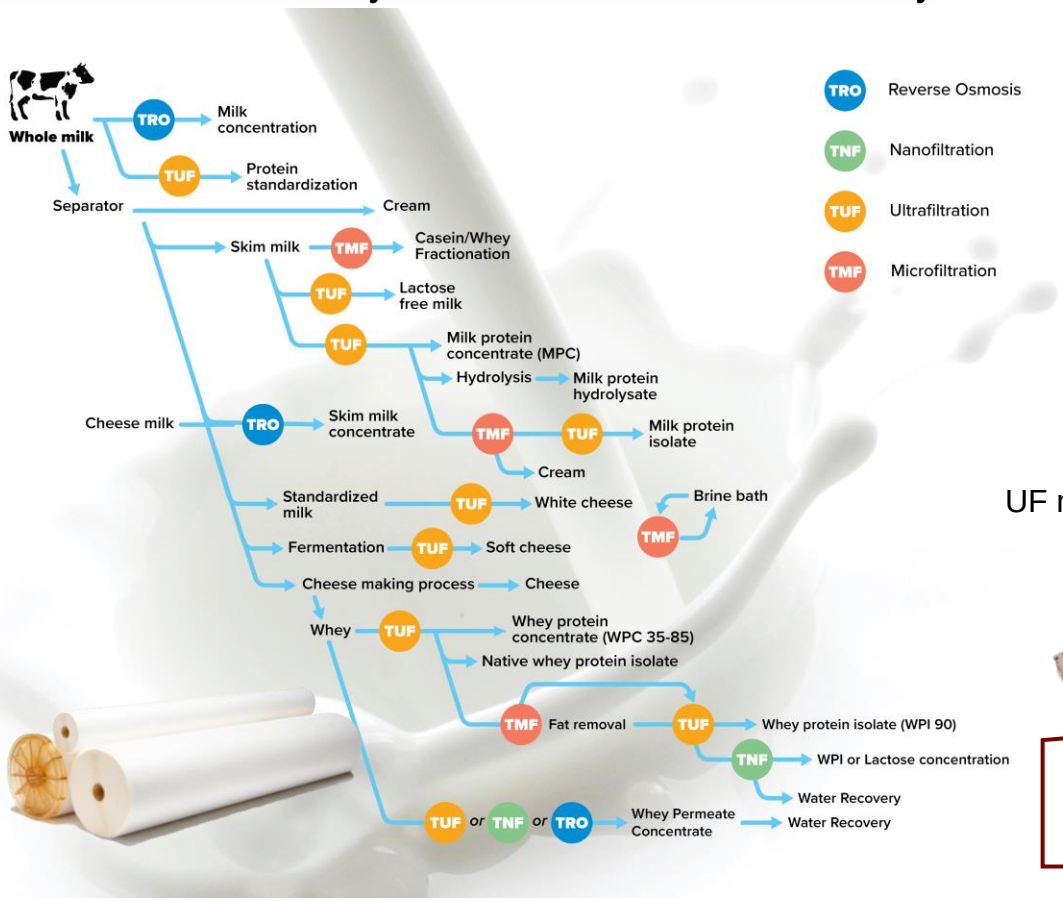
TORAY

Business Expansion by Membrane+ (2): Membrane for Foods

Membrane+

- Food applications have long been one of the largest application of UF / MF membranes
- High potential demand is expected due to new needs, such as heat shrink and thermal sterilization

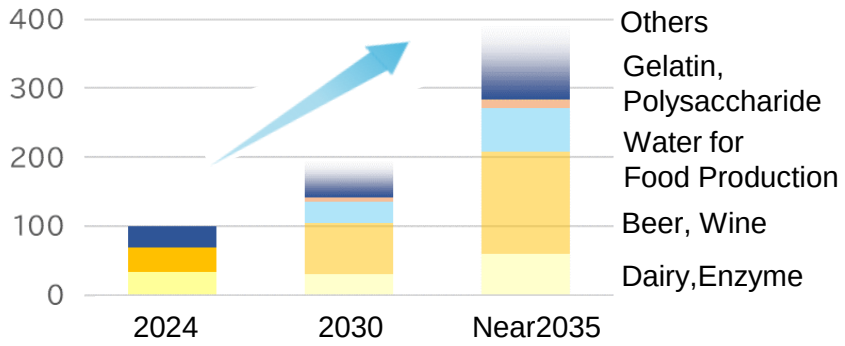
Contribution of Toray's membrane in food industry



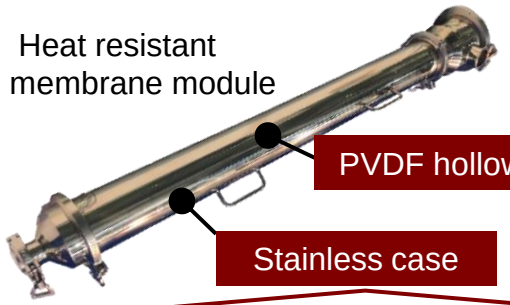
Changes in market trend

- Rising demand for carbon neutral (CN)
- Energy prices soaring and hovering at a high level
- Growing demand for safety and quality

Demand Forecast (2024=100)

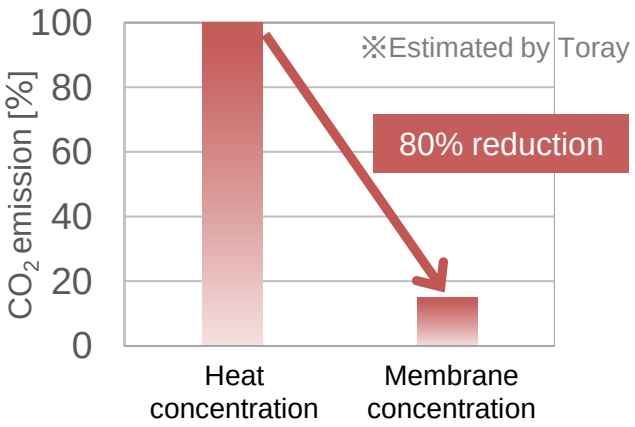


Heat resistant UF membrane module



Established membrane concentration technology by developing heat-resistant membrane and structural components

Advantages of using membrane separation technology

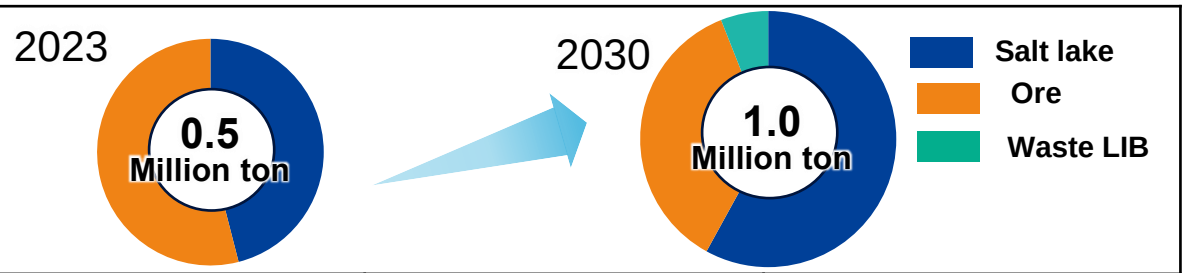


TORAY

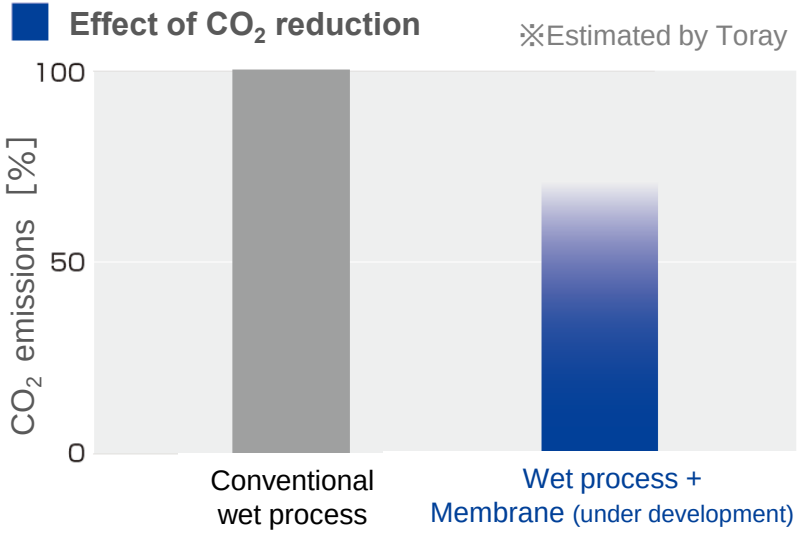
Business Expansion by Membrane+ (3) :
Recovering valuable materials (Recovery of Lithium)

Membrane+

- **Supply from salt lakes and waste LIBs is increasing from a circular economy and environmental impact perspective**
- **The usage of membranes is on the rise as conventional methods have issues in efficiency for salt lakes and waste LIB**

Source of carbonic acid Li			
Process of carbonic acid Li production and recovery	**Ore** Mining & beneficiation ↓ Melt extraction by ultra-high temperature (high CO_2 emissions) ↓ Acid leaching ↓ Purification & crystallization	**Salt lake** Pumping salt lake water ↓ Solar evaporation and concentration (about 1 year) ↓ Purification & crystallization	**Waste LIB** Incineration, crushing and sorting ↓ Black mass ↓ Acid leaching ↓ Extraction, purification crystallization Li-ion
Issues	High environmental impact	Low productivity	Low recovery
Costs	High	Low	High

Advantage of membrane separation technology



Achieved by developing acid-resistant, high-Li selective NF membrane

Process utilizing separation membrane

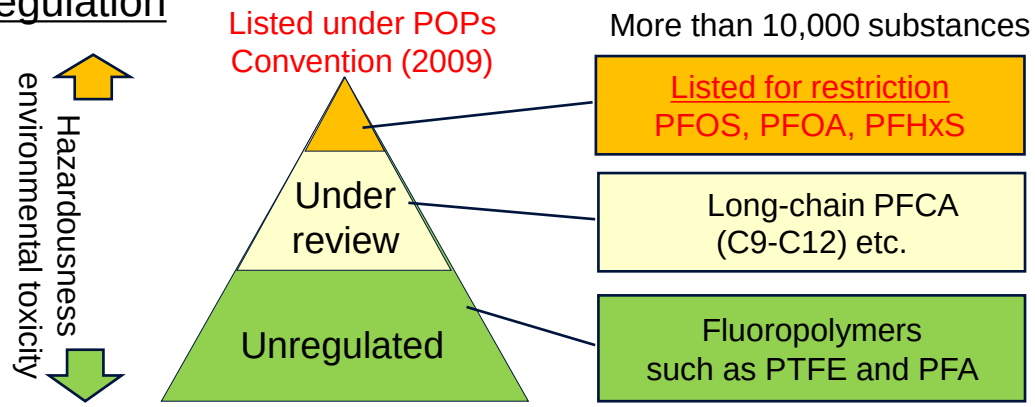
TORAY

Responding to Environmental Issues
– Contribution of Water Treatment Membrane for PFAS removal –

Membrane+

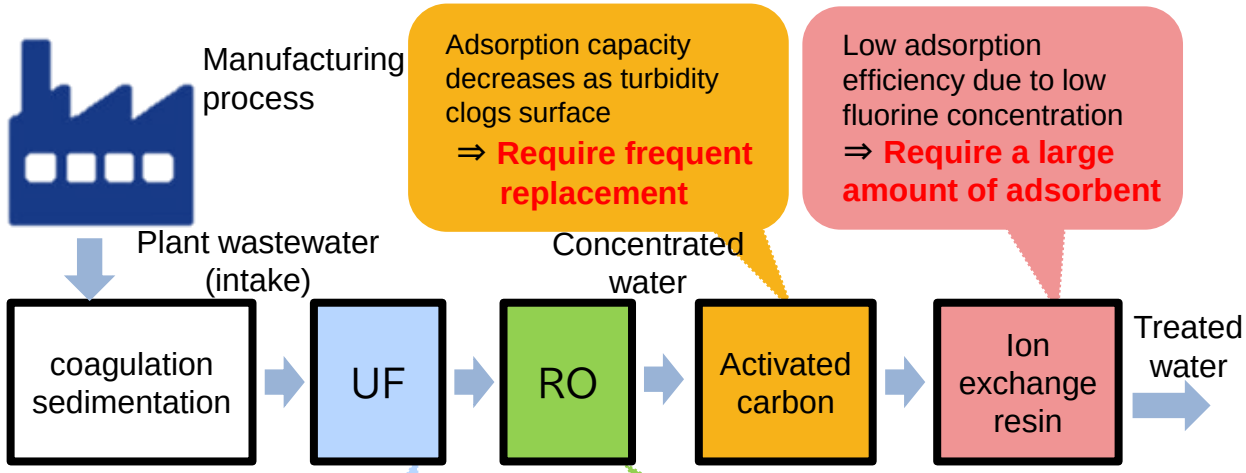
- Expect increased demand for water requiring PFAS filtration due to strengthened regulations
- PFAS removal is optimized with a combination of multiple technologies
- Build an efficient process using UF and RO membranes

PFAS regulation



	Drinking water	Environmental water	Remarks
WHO	PFOS：100ng/L PFOA：100ng/L	–	Provisional target
USA	PFOS：4ng/L PFOA：4ng/L	PFOS：40ng/L PFOA：60ng/L	EPA NPDWR
EU	PFAS total：500ng/L PFOS, PFOA, PFHxS ：100ng/L	–	ECHA Drinking Water Directive
JAPAN	PFOS+PFOA ：50ng/L	PFOS+PFOA ：50ng/L	MOE Provisional target

Fluorine removal process



- Help stable operation in response to changes in raw water quality
- Reduce RO Membrane operating costs

- Capable of filtering various PFAS with high removal rates over time
- Combined use with activated carbon and ion exchange resins reduces these loads
- The establishment of a low-cost treatment method for concentrated and absorbed PFAS is required

◆ Toray can provide process design, membranes and chemicals

TORAY

Response to Circular Economy
- Initiatives for Recycle and Reuse -

Recycle, Reuse

■ **Promote the establishment of cleaning and performance restoration technology as well as business model studies**

The number of used elements is increasing over the years as the RO membrane market expands

Corporate responsibility for the environment requires the reuse of these elements

New RO element

Seawater / brine water desalination plant

Currently discarded

Used elements

Reuse plant

Reuse element

Non-reusable elements

Utilization as raw plastic material, etc.

Recycle plant

Potential solution for projects and applications where water production costs are issues

Discourage emerging manufacturers entering the low-end market

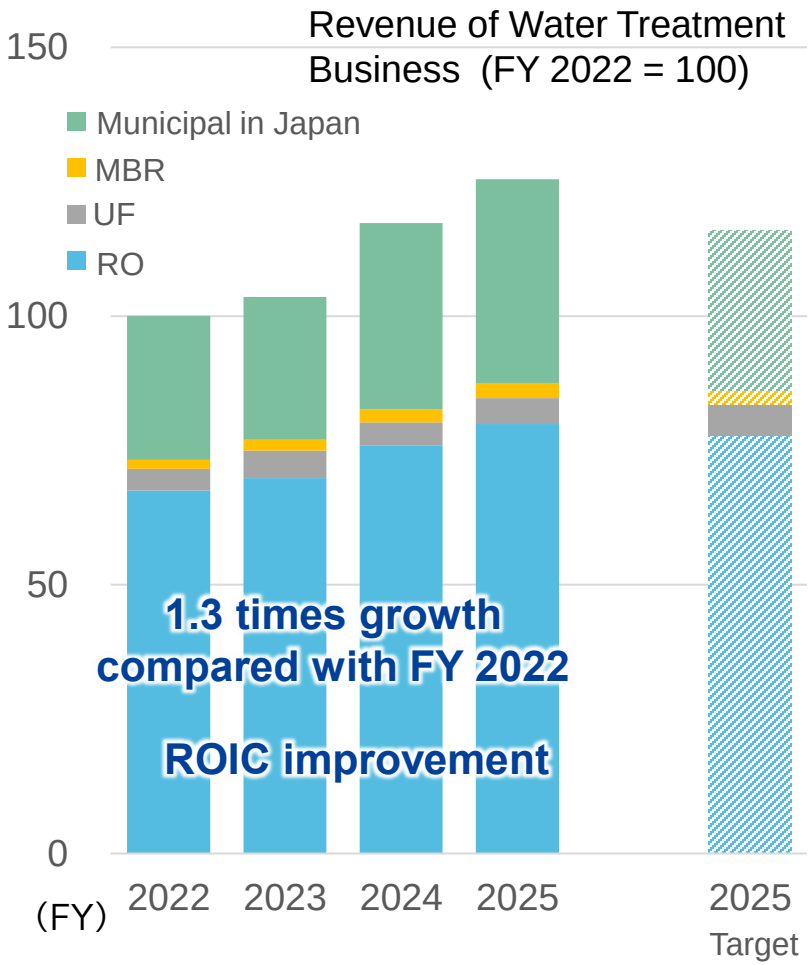
TORAY

Progress of AP-G 2025 (FY 2023 – 2025)

■ Exceeding the AP-G 2025 target through steady expansion in growth fields and regions

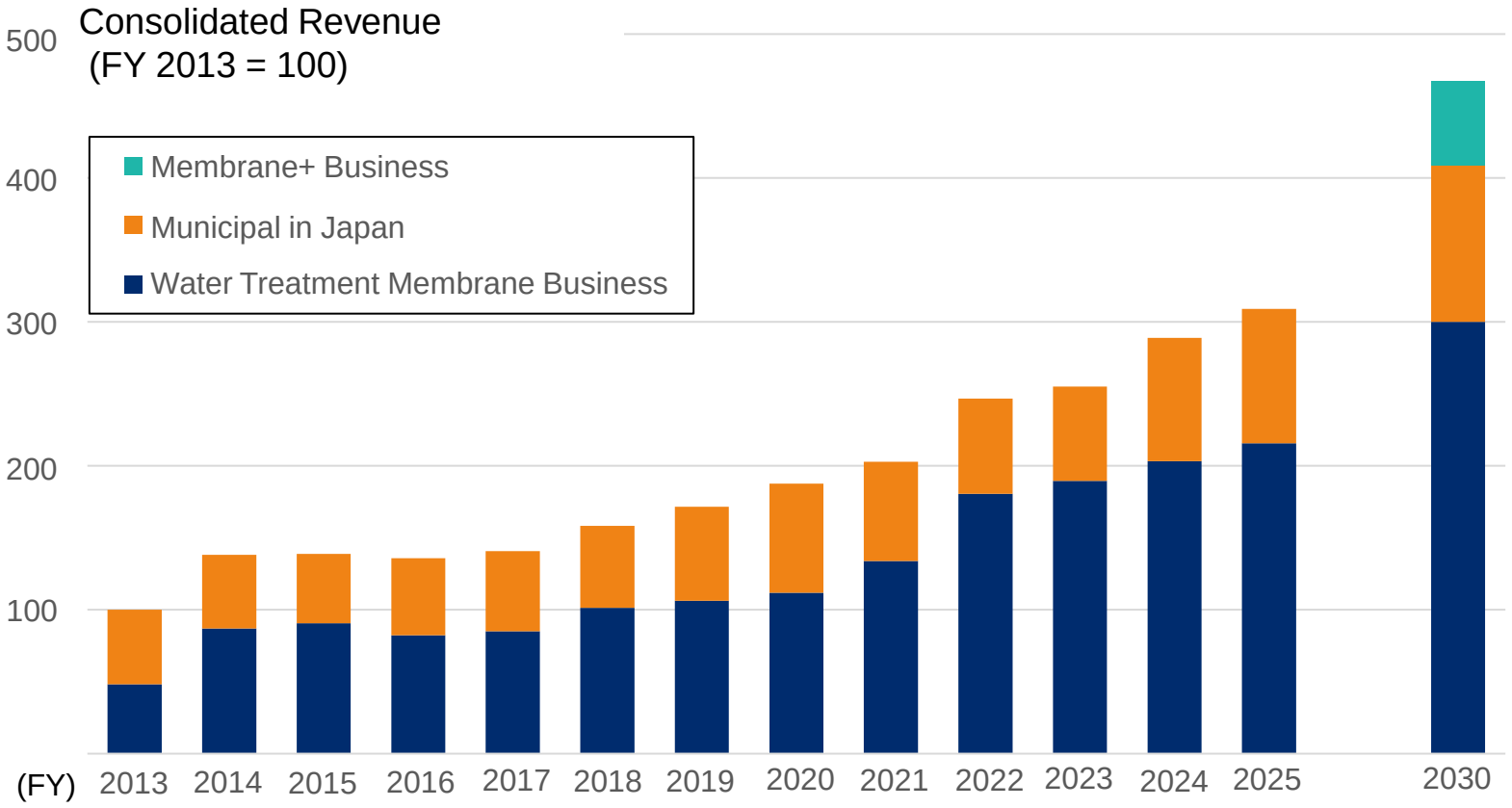
Project AP-G 2025 Basic Policies
Strengthening the business foundation as a "Leading Company" in the water treatment membrane business
- Expanding market share and securing profitability -

	Progress
RO	■ Develop high-added-value products and expand sales in targeted applications Ultrapure water: Increased adoption of high silica removal products at major semiconductor manufacturers Seawater Desalination: In addition to promoting further localization, strengthening to capture replacement demand ■ Establish global supply chain as planned, including expansion of existing production capacity ■ Establish and expand integrated technical services globally
UF/MBR	■ Improve profitability by shifting to wastewater reuse application and high-end markets ■ Strengthen business structure through collaboration with partners
Municipal in Japan	■ Strengthen maintenance business for public demand



Performance Target for FY 2030

■ Promote new business development, in addition to continued growth and improvement in profitability of the existing water treatment membrane business



CAGR (2025 - 2030)

Membrane+ Business	New
Municipal in Japan	2%
Water Treatment Membrane Business	7%

Keep / Improve Double-digit ROIC

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.

Innovation by Chemistry

TORAY