



Toray IR Day
Medium-term Management Program “AP-G 2022”

Water Treatment Business

June 5, 2020

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Contents

- 1. Importance of the water treatment business**
- 2. Major issues of Toray's water treatment business in “AP-G 2022”**

1. Importance of the water treatment business

2. Major issues of Toray's water treatment business in “AP-G 2022”

Global Water Issue

Concern for global warming caused by greenhouse gases

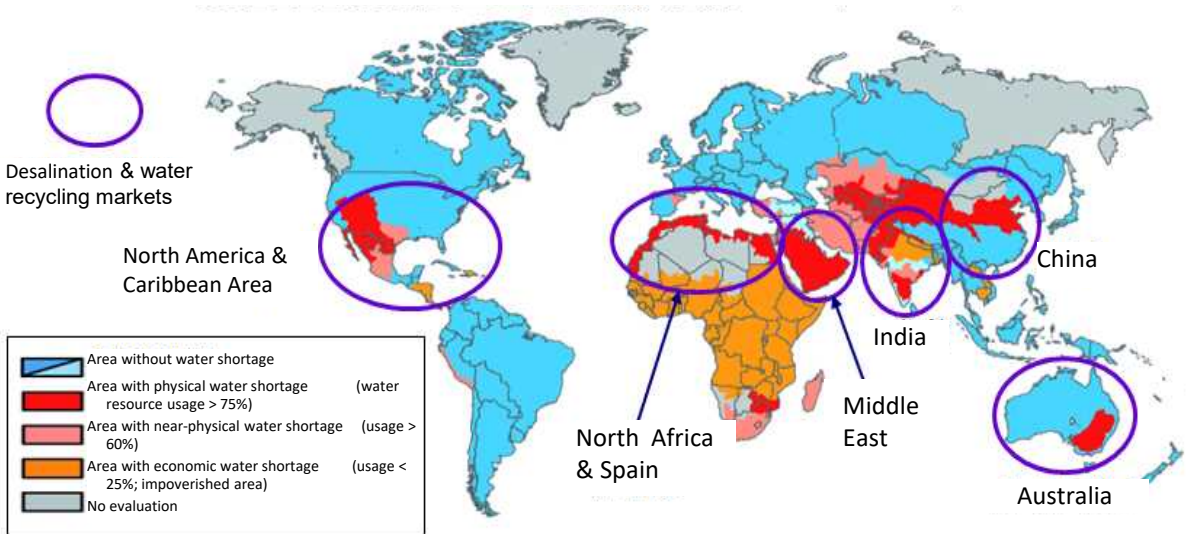


Water Issues

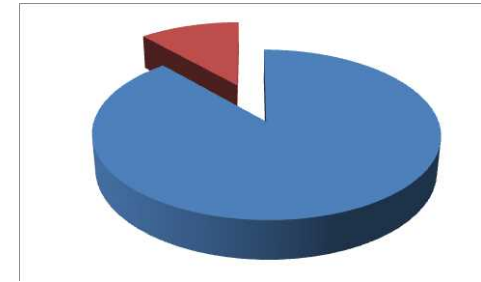
1. **Water is a global issue equal in importance as greenhouse gases.**
2. Water is a global issue which should be solved together with food and energy issues.
3. **Water is an important issue for improving human health and safety.**

Global Water Resources & Current Climate Conditions

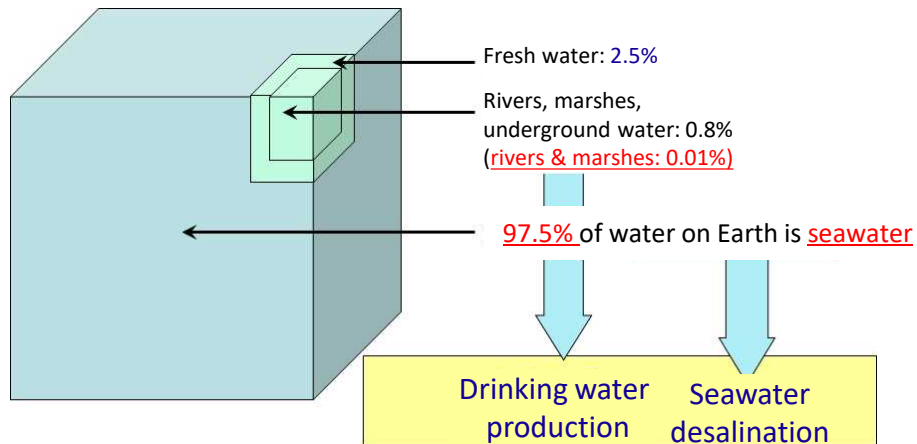
Current global water shortages (Source: IWMI Report 2006)



The 750 million out of the 7.2 billion people on Earth are lacking daily drinking and domestic water



(Source: World Water Development Report 2015)

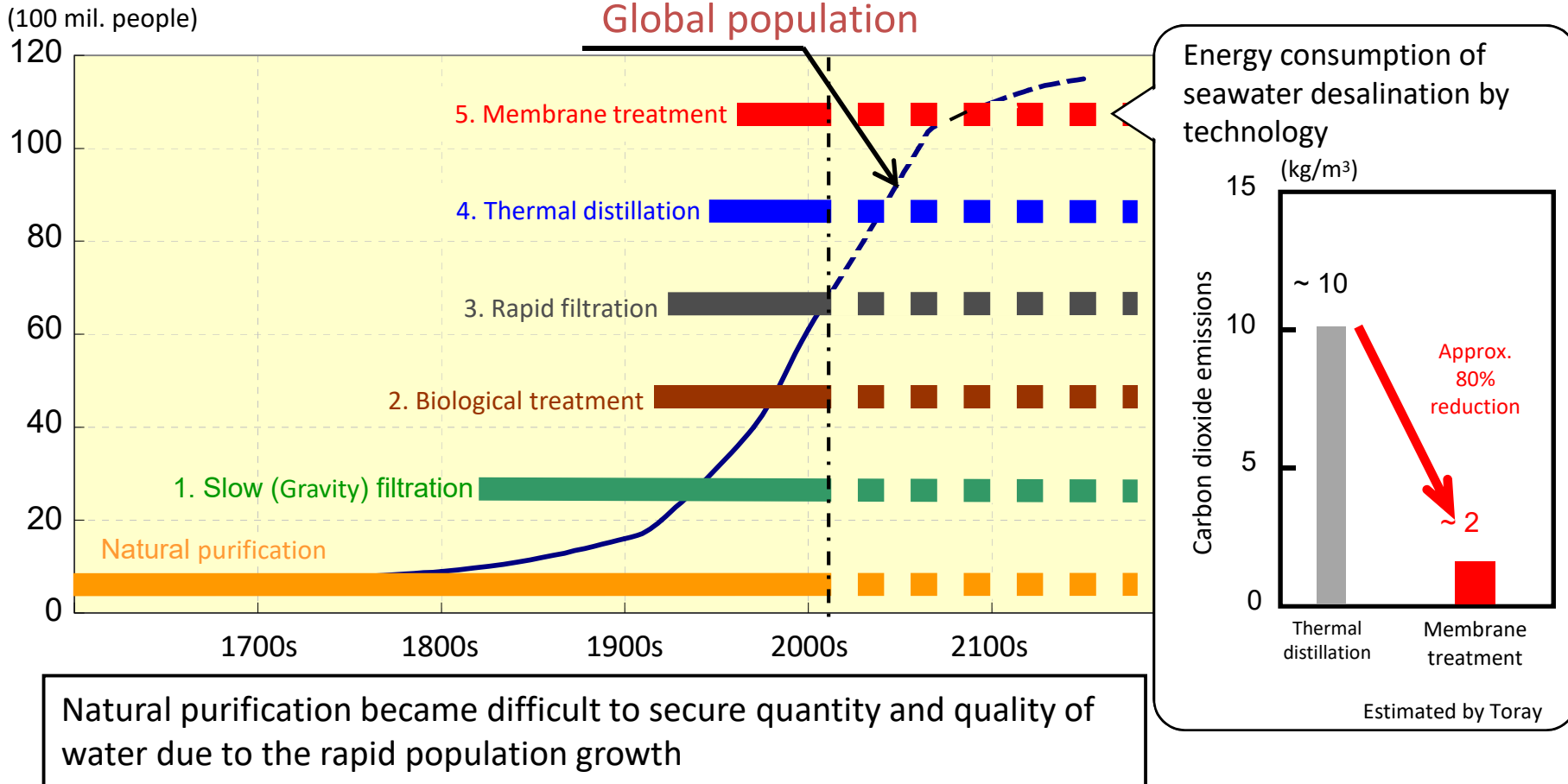


Global water shortage is getting more serious, but only 0.01% of the surface water on earth is available for humans

Water production using water treatment membranes is gaining more attention

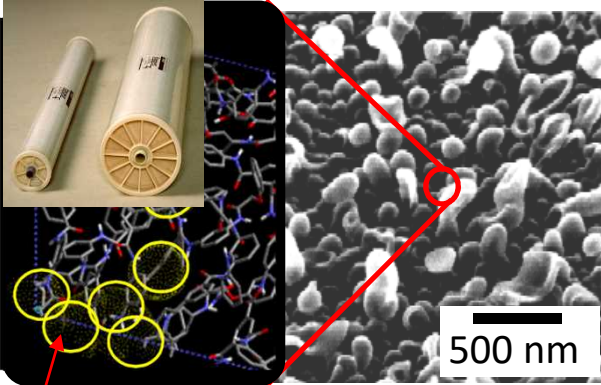
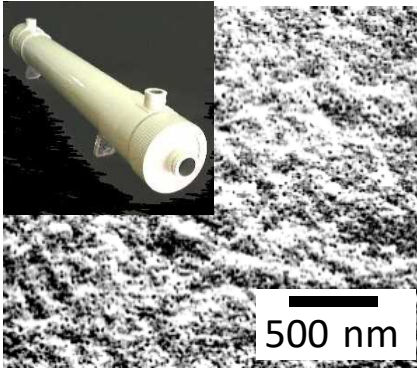
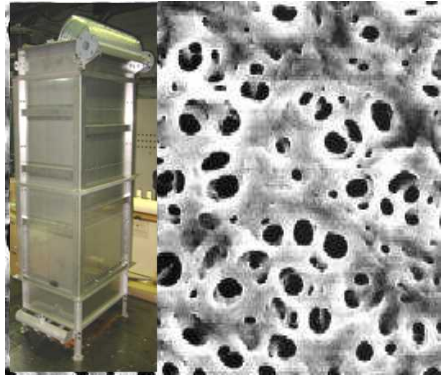
Reference: V.I.Korzoun and A.A.Sokolov: World Water Balance and Water Resources of the Earth E/Conf.70/TP127 (1997) (International Water Association Publications)

Population Growth and the Evolution of Water Treatment Technology



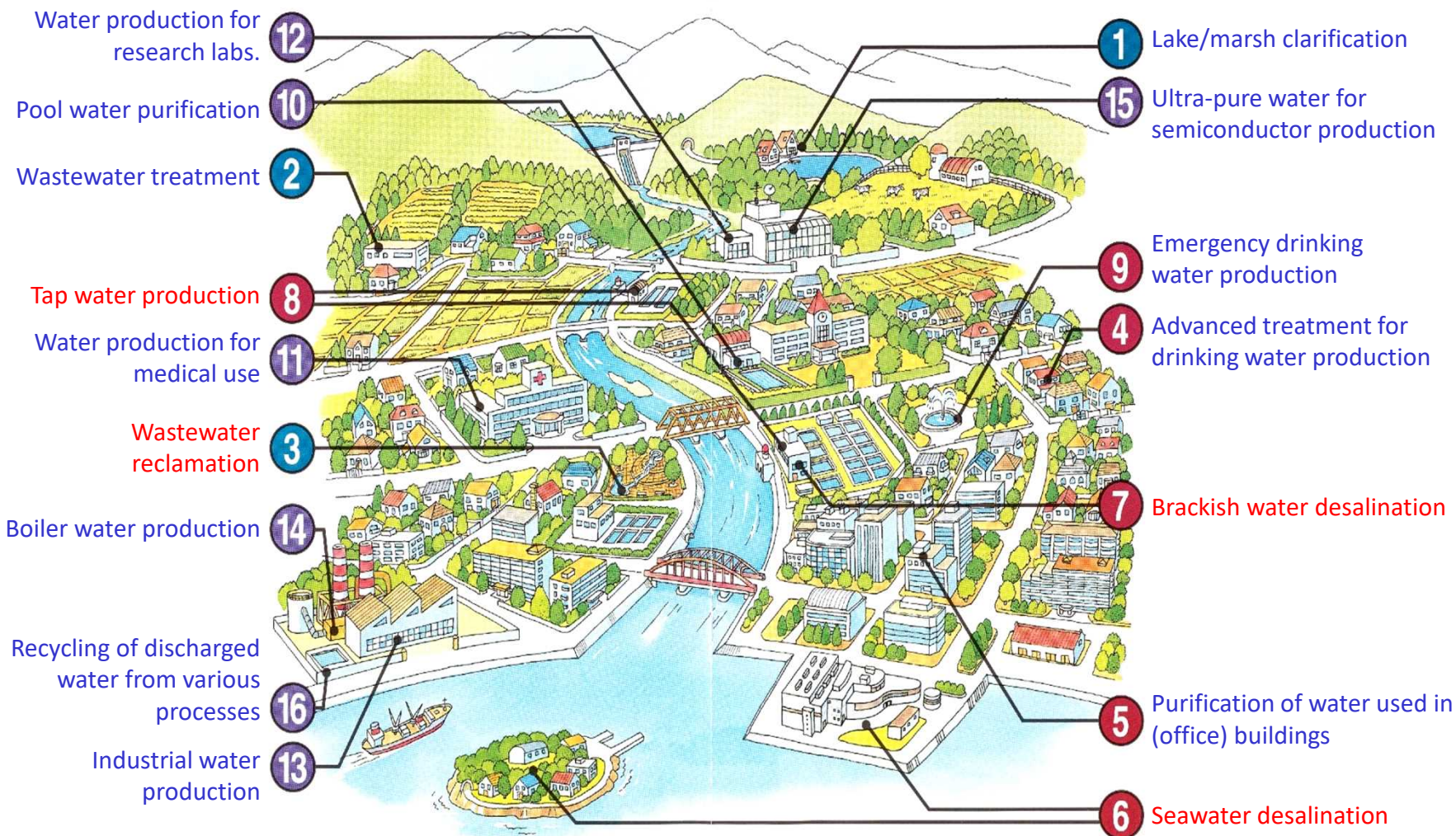
Membrane treatment technology is essential in the 21st century, enabling high quality of water, high speed and reduction of energy in the water treatment process

Function and Structure of Water Treatment Membranes

Size	1 nm	10 nm	100 nm	1000 nm
Separation targets	Ion, Low molecule weight organics High molecular weight polymers Colloids Monovalent ions Agricultural & Organic Materials Highly charged ions Viruses Coliforms Trihalomethanes Bacteria			
Types of membranes	Reverse Osmosis [RO] Nanofiltration [NF] Ultrafiltration [UF] Microfiltration [MF]			
Membrane structures	 Pore size of RO membranes (0.6~0.8 nm) 500 nm  500 nm 			
	Seawater desalination and drinking water production (removal of persistent substances)		Drinking water production (clarification and bacteria removal) and wastewater reclamation / reuse	

Toray develops, manufactures, and sells a full range of membrane products in-house.

Applicable Fields for Water Treatment Membranes



The fields for water treatment membranes keep growing in our daily lives as well as industries

1. Importance of the water treatment business

2. Major issues of Toray's water treatment business in “AP-G 2022”

Review of “AP-G 2019” (FY 2017–2019)

Achieved steady business expansion by developing new products and strengthening technical proposals, strengthening global sales capabilities, and thoroughly strengthening our business structure

RO

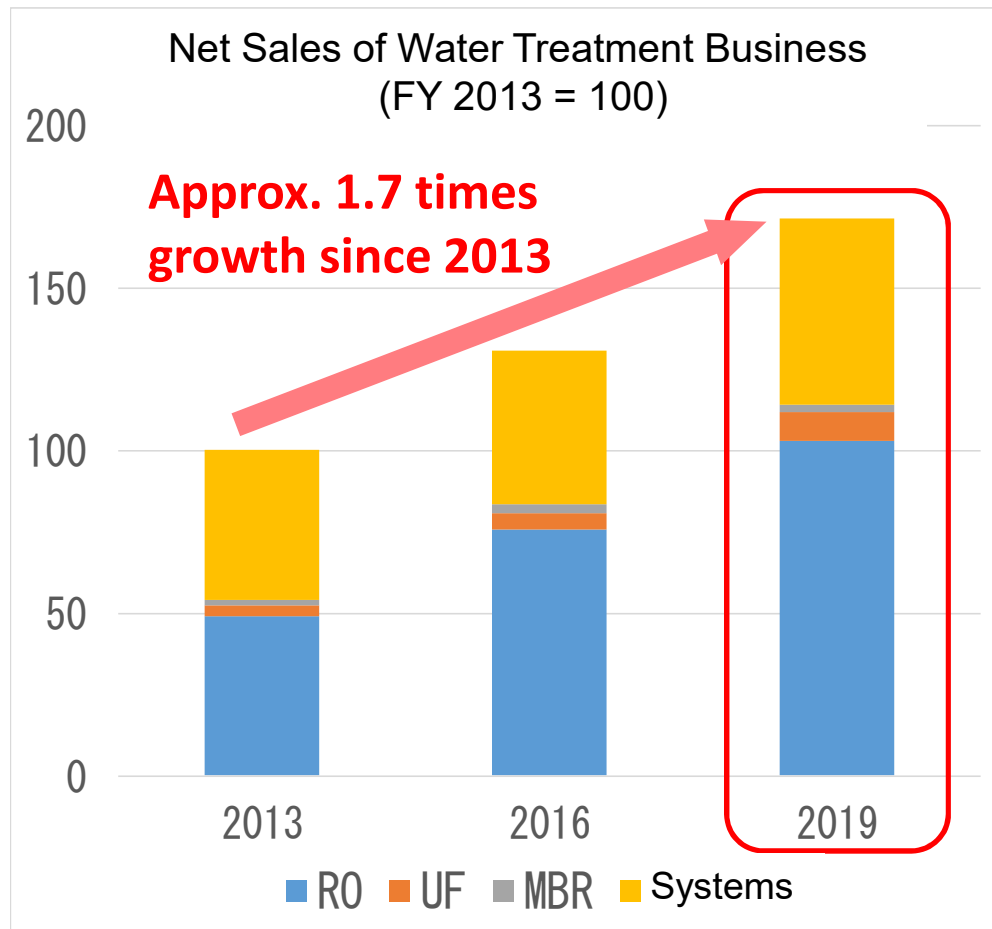
- Developed new, high-performance products
- Enhanced and expanded global sales and production capabilities
- Increased synergies by integrating production and sales activities with TAK
- Established stable production structure at TMME

UF, MBR

Developed new sales channels, launched new products to the market, and strengthened the business structure

Plant & Equipment

Strengthened the structure of the EPC business centering around Suido Kiko



Basic Policies in the Water Treatment Business in “AP-G 2022”

Further enhance the position as an “Excellent Company” in the water treatment membrane business

- To achieve overwhelming global top market share and realize highly profitable business -

Major issues

RO

- Timely **expand production capacity** and enhance **development of new product**
- Further strengthen **non-price competitiveness** and business structure
- Secure **a leading share in the global market**

UF & MBR

- Rapidly expand sales of the new products **“New Tips”** and **“NHP”** then establish the robust business foundation

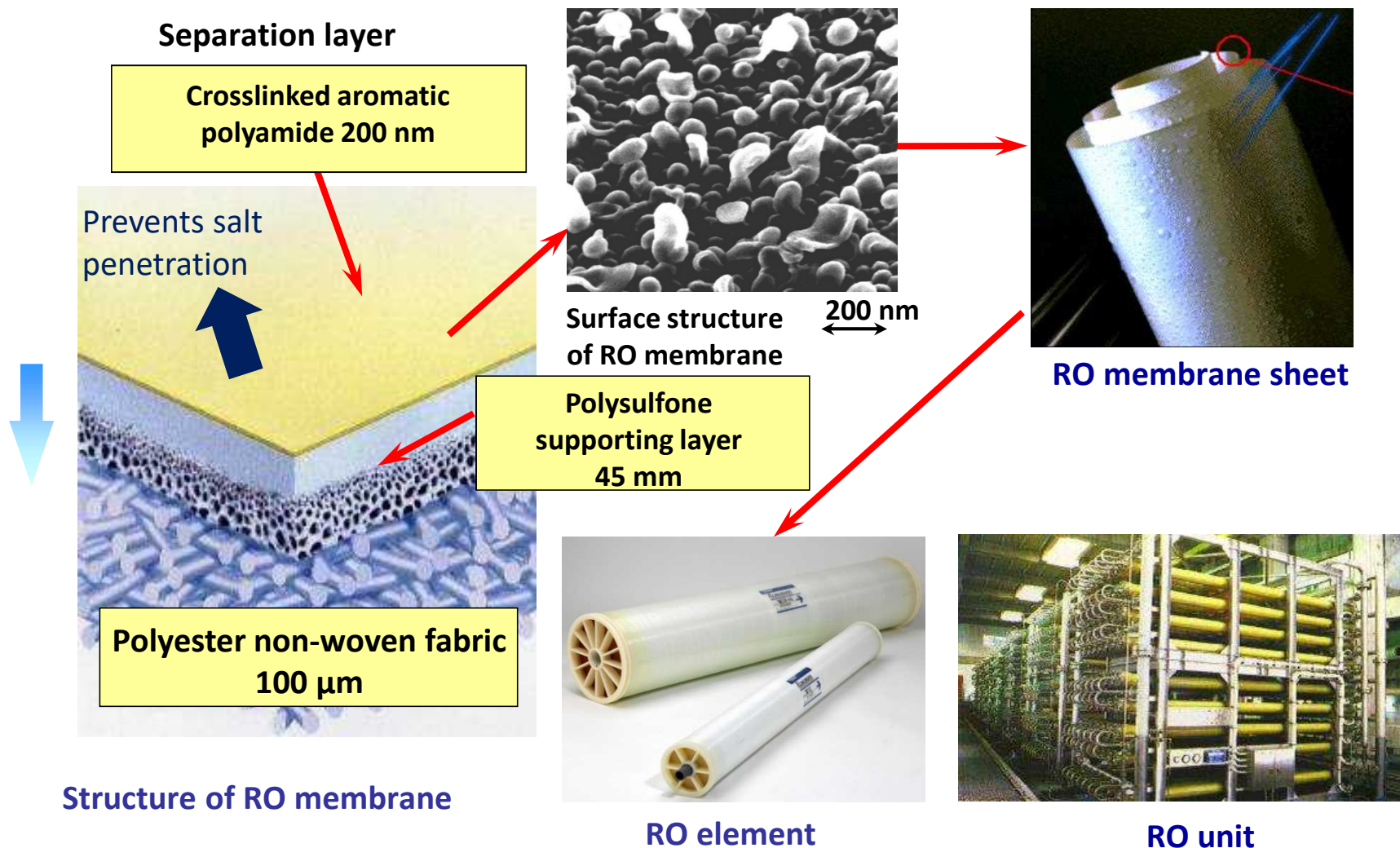
Plant & Equipment

- Strengthen profitability of the EPC business; expand the O&M business, and develop process technologies in new fields

1. RO

RO Membrane

RO membrane with three-layer composite structure is the core product of Toray's water treatment business



1. RO

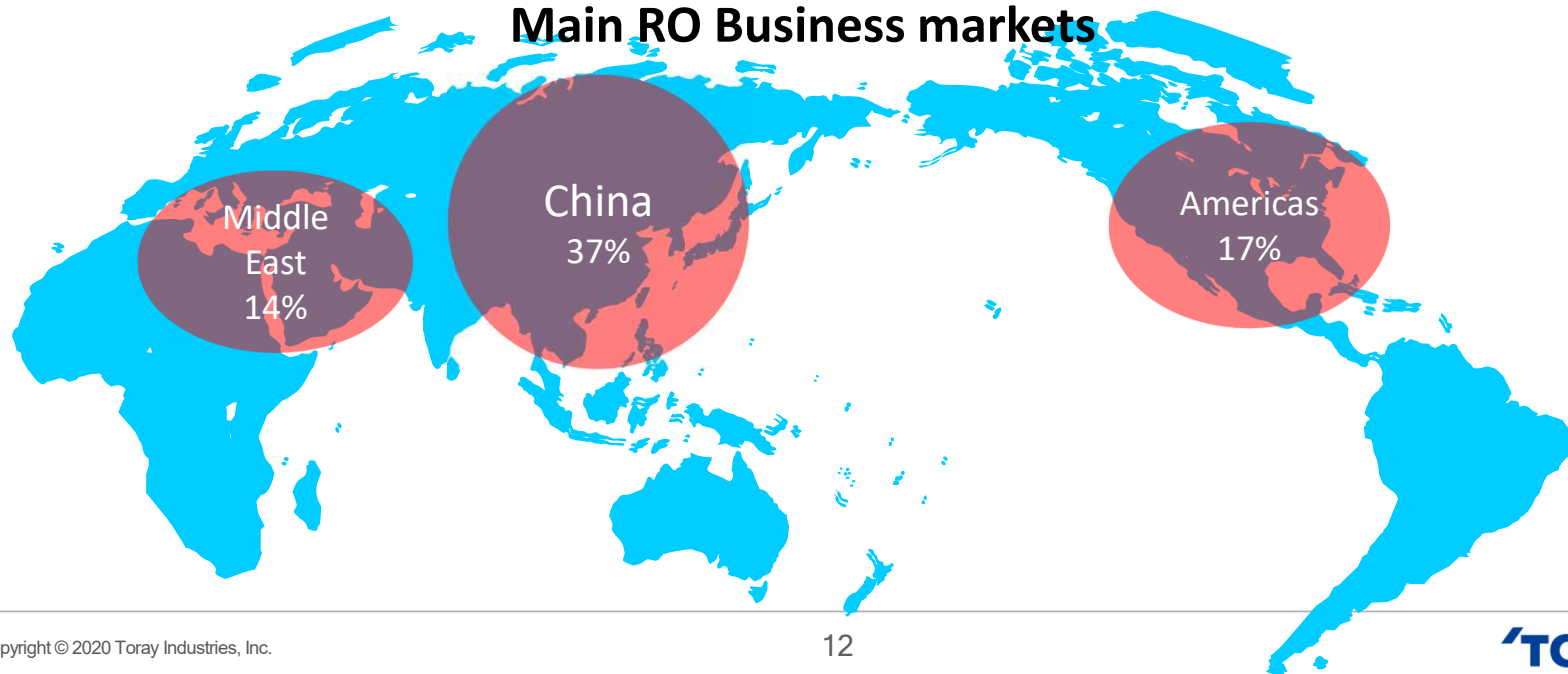
Business Environment

Forecasting **approx. 7% CAGR** based on the global water shortage and increasing concern on environment, especially in China and the Middle East

China: Increasing number of **wastewater treatment projects** due to strict environmental regulations, and increasing demand for advanced water treatment due to higher water quality standard for drinking water

Middle East: Increase in water demand due to population growth and industrial promotion measures ; switchover from thermal distillation technology to RO technology for energy efficiency, leading to an expansion in **large-scale seawater desalination projects** using RO membranes

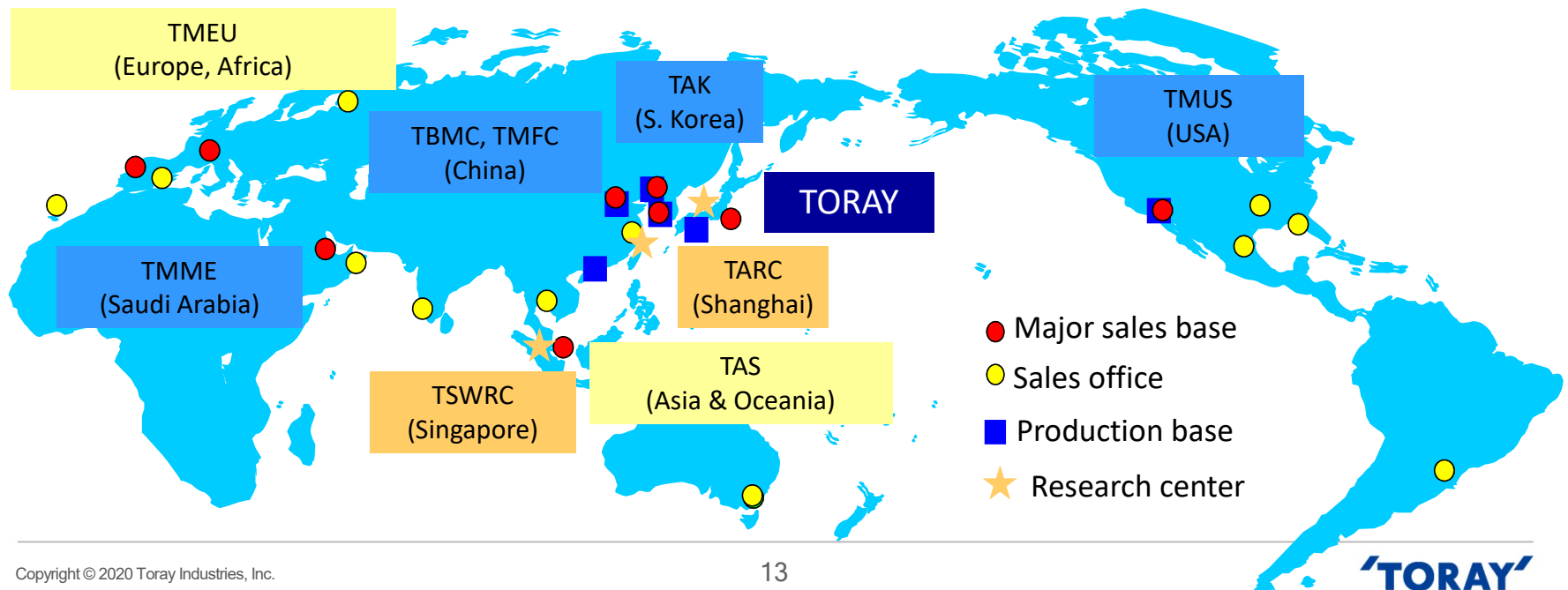
Main RO Business markets



1. RO

RO Business: Our Core Competence

1. Consolidated global operation system for production and sales (5 factories and 8 major sales offices)
2. Leading-edge R&D and new product development capability
3. Customer-oriented technical service network
4. Top level cost competitiveness in the global industry
5. Top-class global market share (between 30 - 40%)

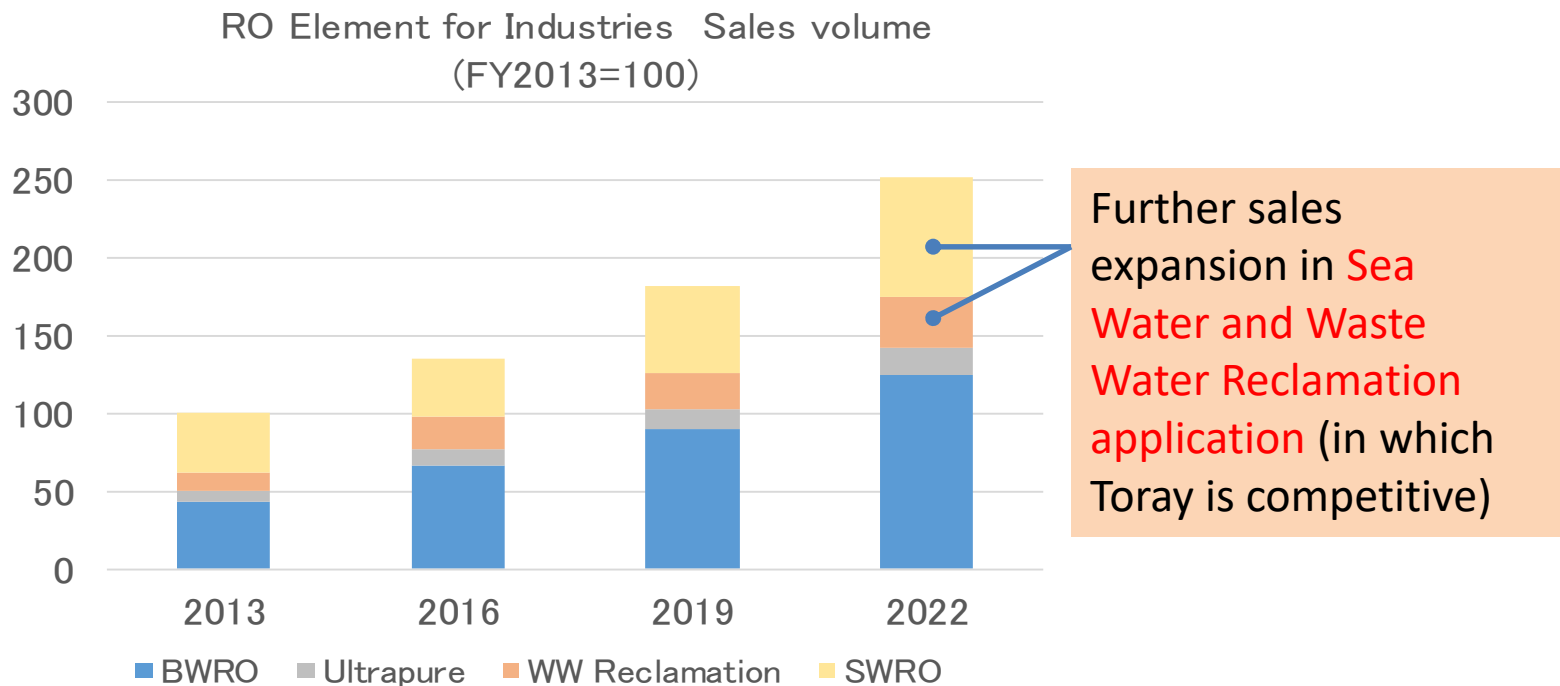


1. RO

Basic Policy for RO Business

1. Increase **production capacity by 1.6 times** (vs FY 2019) during this MTP period
2. **Accelerate new product development** that meets the regional and/or application needs
3. **Further strengthen non-price competitiveness** (proposal, tech service, quick response)
4. **Strengthen business structure**
(reduction of production cost, efficient usage of sales expense)

Acquire No. 1 in global share



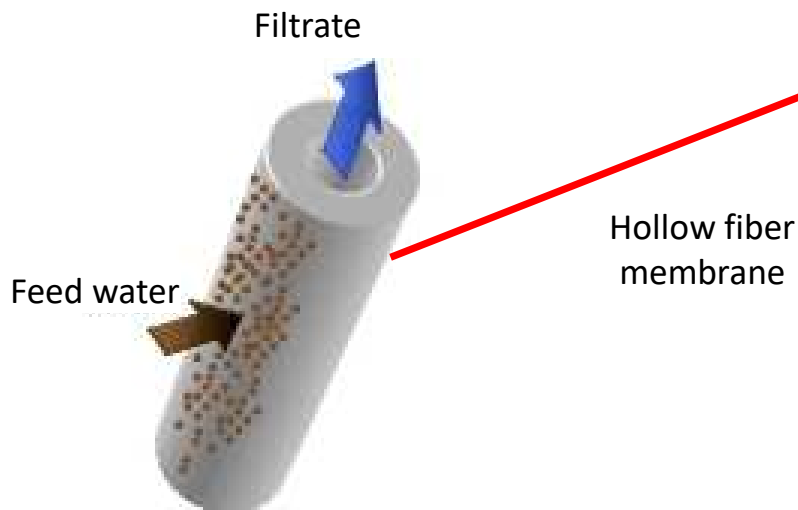
2. UF·MBR

UF

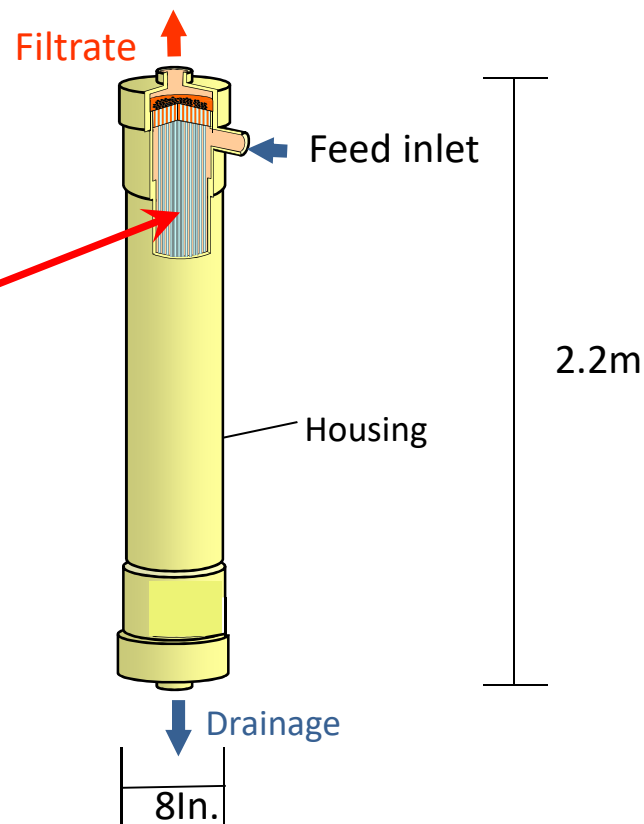
Toray's UF module applies a hollow-fiber membrane to remove suspended solids and installed in a large size module housing. It has a variety of applications, including drinking water and industrial water production, sewage/wastewater recycling, and pre-treatment for RO seawater desalination.

Filtration image of membrane

Filtration method: "Outside to inside" flow configuration is applied.



Module structure



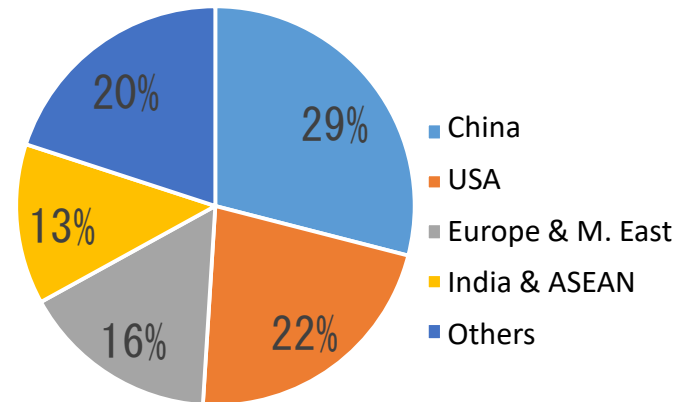
2. UF・MBR

UF Membrane Business

Forecasting approx. 10% CAGR based on the increasing demand of global wastewater reclamation

- Market size: 24 million cubic meters/day
 - Growth in India & ASEAN is expected
- Expansion of the replacement membrane market
 - Replacement membrane market to grow to approx. 30% overall

Ratio of UF membrane markets by region



Basic policy for UF business

- Promote the new product with *“New Tips”* technology
- Strengthen initiatives with partner companies in China & ASEAN
- Build advanced customer services leveraging ICT

2. UF·MBR

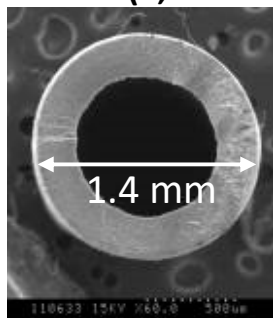
New Tips , A New UF Membrane Product

(Conventional product)

HFU-2020N

(Membrane area)

72 m²/module(9,200 fibers)



Housing

8 in. × 2.2 m

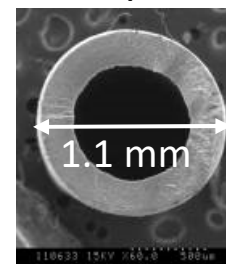


(New product)

HFUG-2020N

(Membrane area)

90 m²/module (14,400 fibers)



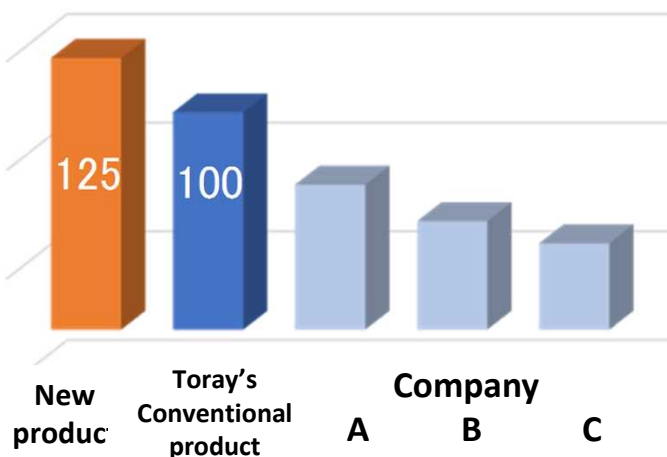
**Developed new technology: Thinner fiber
but same membrane strength**

25% more membrane area in same housing

Reduction of piping works and footprint

Expecting to save 10% of EPC cost

Total water production volume
per module life
(Toray's conventional product = 100)

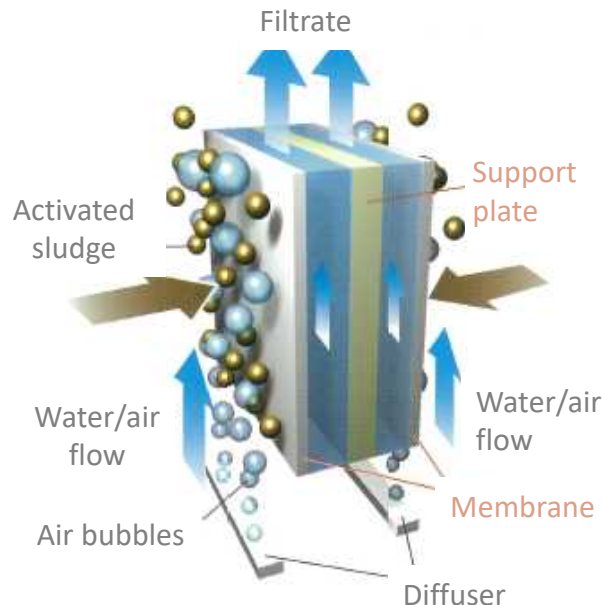


2. UF-MBR

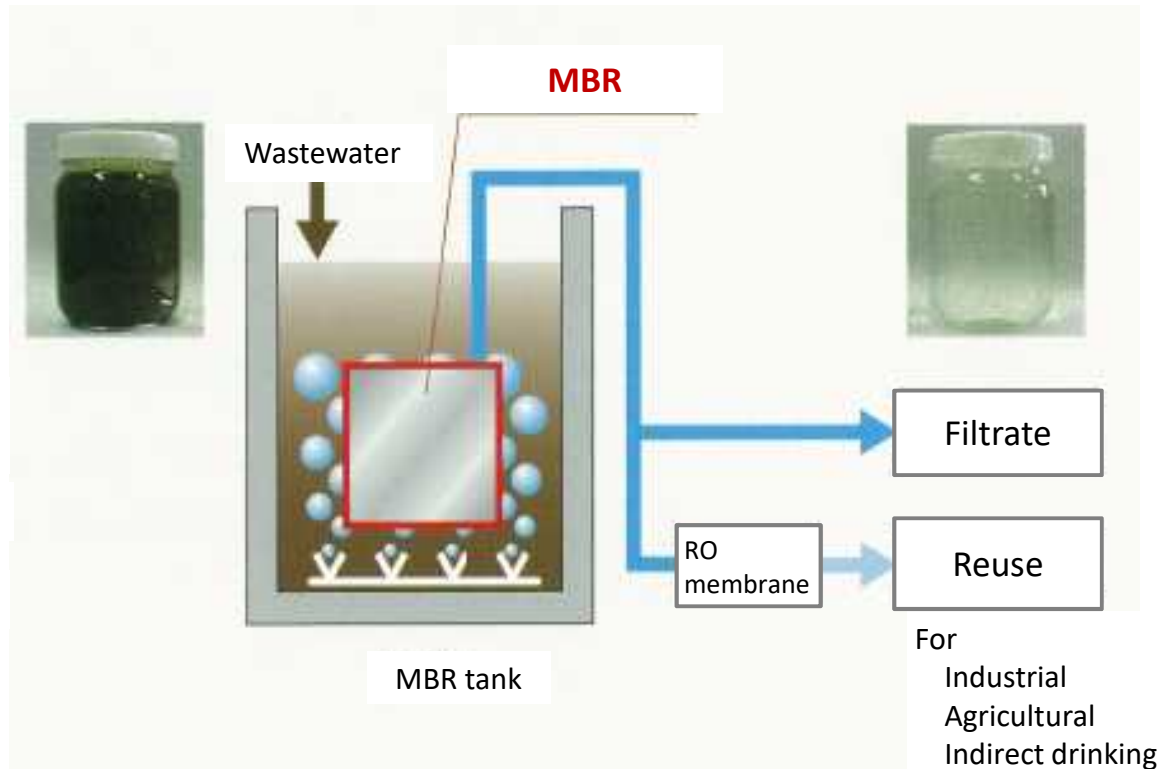
MBR Membrane Module

Toray developed a submerged type membrane module for the membrane bioreactor (MBR) process, which is an advanced process for sewage/wastewater treatment. It is being increasingly applied in the wastewater recycling thanks to its high permeability and durability.

Function of membrane element



Filtering process



2. UF・MBR

MBR Business

Expecting approx. 10% CAGR by the global water shortage and more stringent environmental regulations.

■ Market scale

Global market scale

: 7.9 million cubic meters/day (fiscal 2019)

Major markets

: China, U.S.A.

followed by Europe, Middle East, Republic of Korea
India, ASEAN, Central & South America

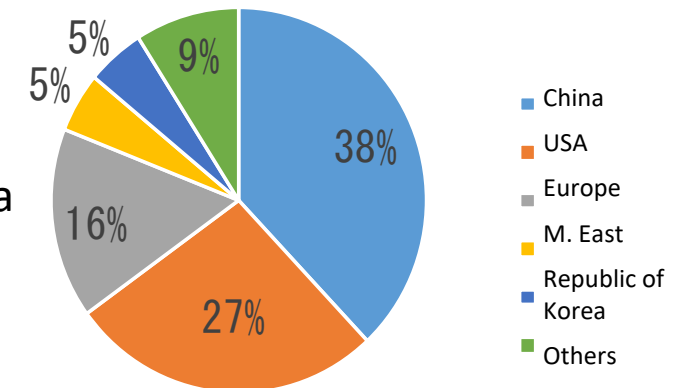
: Growth is expected due to economic development

■ Main applications

Increasing use in sewage/wastewater recycling

Membrane replacement expected to grow to 1/4 the total market

Ratio of MBR markets by region



Basic policy for MBR business

- Expand sales of new product **NHP** by pushing price and technical advantages
- **Strengthen collaboration with partner OEMs** in China, Americas, India and ASEAN countries
- **Firmly capture growing replacement market** (utilizing ICT)

2. UF·MBR

NHP, New MBR Product



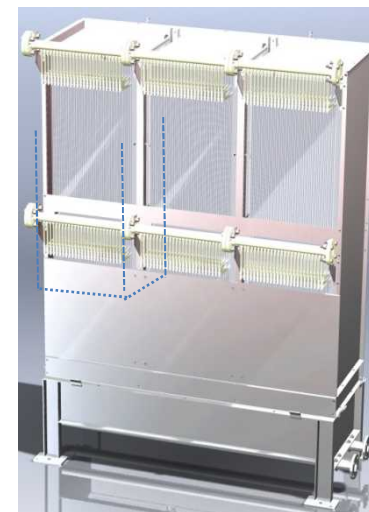
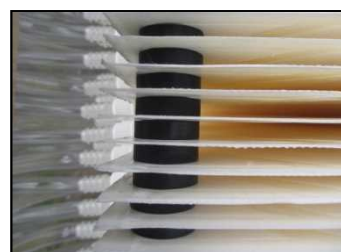
(Conventional product)

TMR140-100S
Membrane area:
140 m²
Weight: 700 kg



(New product)

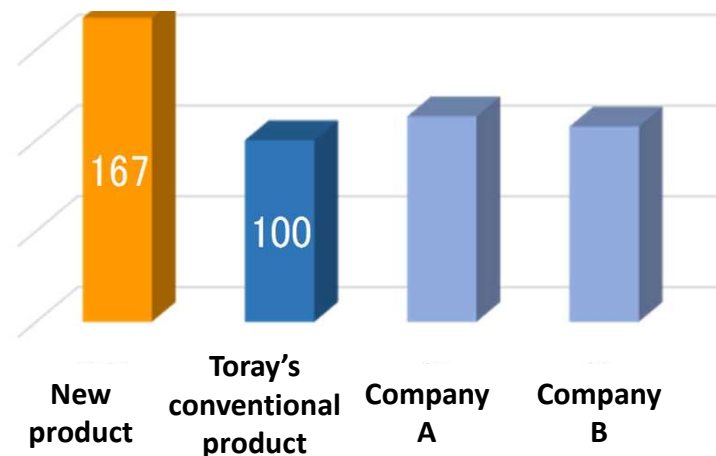
NHP210-300S
Membrane area:
210 m²
Weight: 300 kg



Developed new technology: Thinner element but maintaining robustness

- **1.5 times more membrane area** in the same size module → **Space saving**
- Less air scouring for membrane cleaning → **Energy reduction by 30%**
- Less module weight → **Less shipping cost, easier handling on-site**

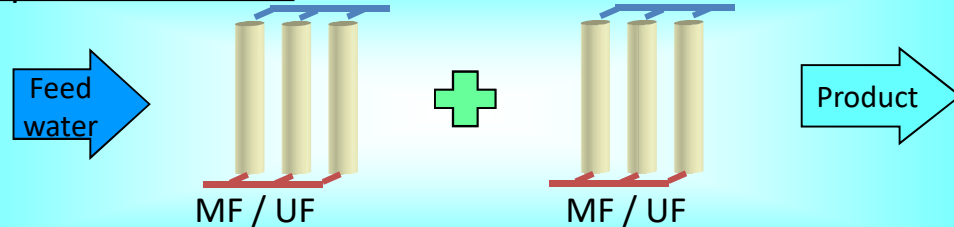
Membrane area per foot print
(Toray's conventional product = 100)



IMS (Integrated Membrane System)

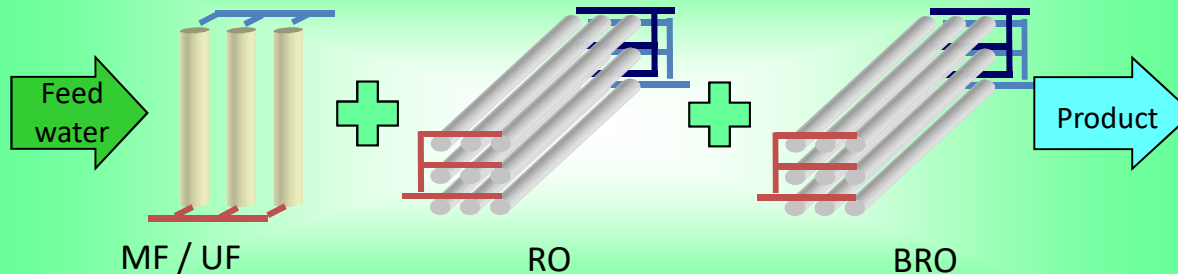
I. Water purification field

E.g.: Japan 88,000 m³/d



II. Seawater desalination field

E.g.: Japan 3,000 m³/d

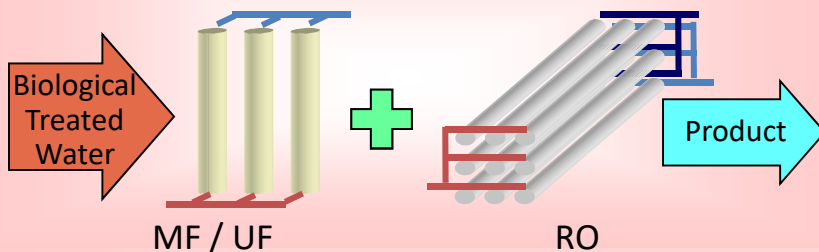


All membrane types
are developed in
house

Toray can propose excellent
performance with lower cost
by optimizing system design
for different water sources

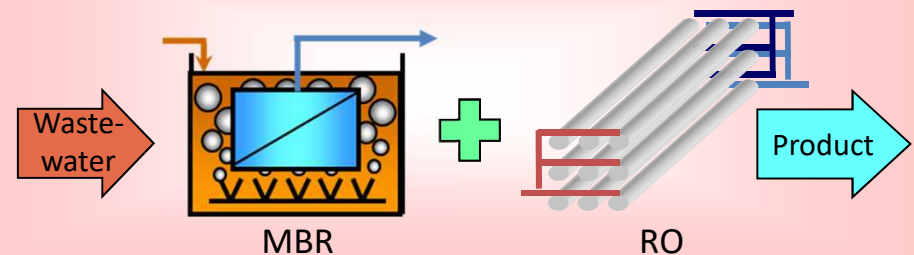
III. Wastewater reclamation field -1

E.g.: Kuwait 320,000 m³/d
Singapore 228,000 m³/d



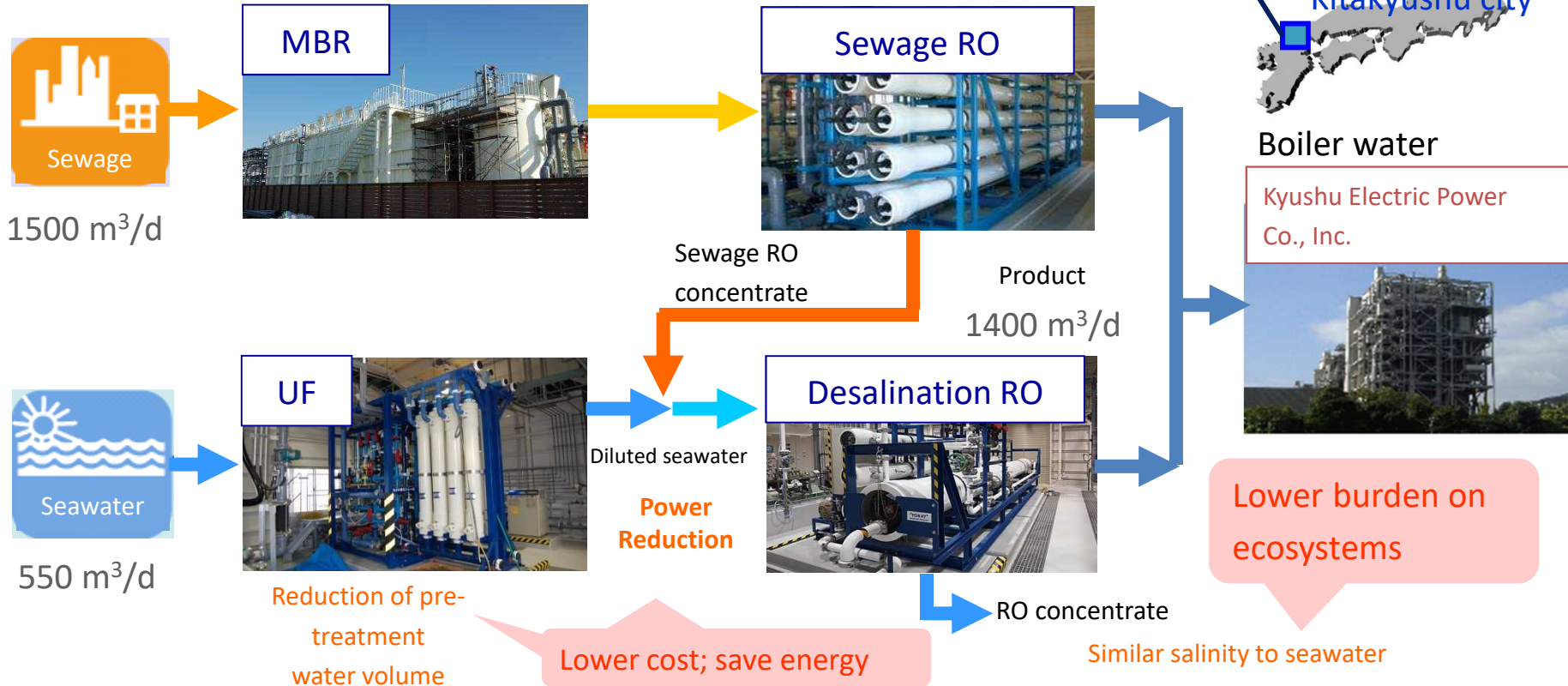
III. Wastewater reclamation field -2

E.g.: India 11,000 m³/d



MBR: Membrane Bioreactor

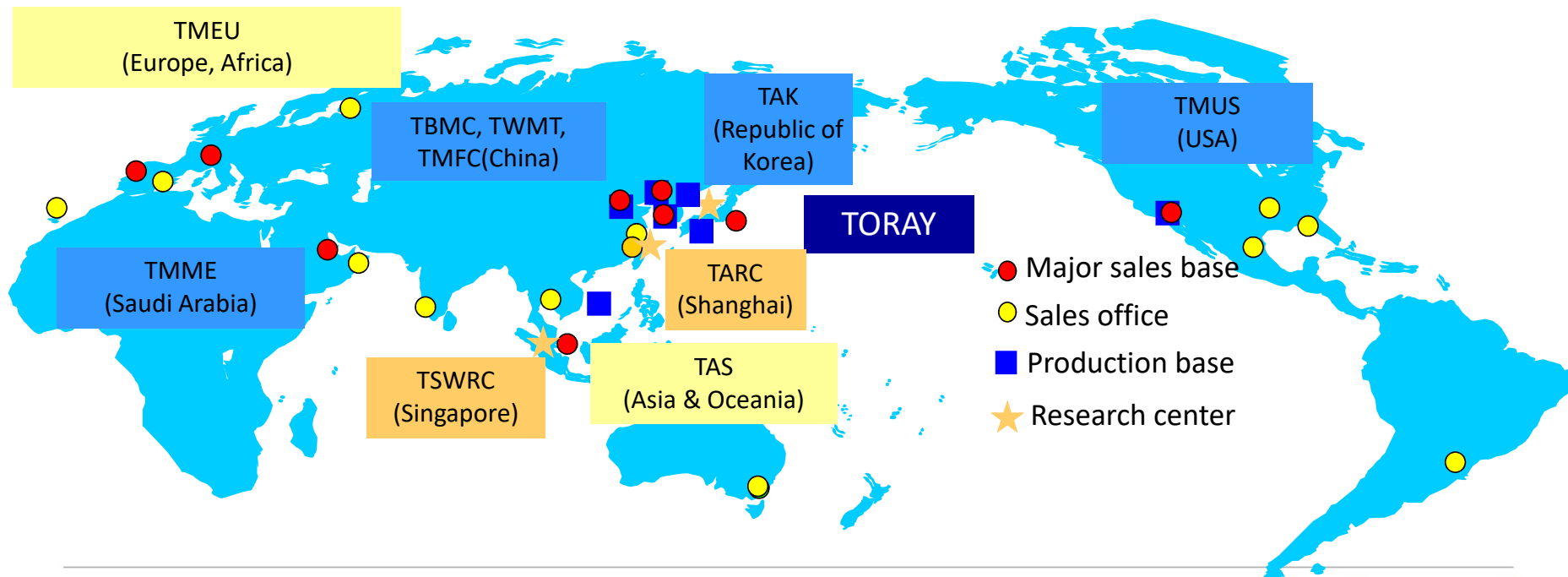
IMS Example (sewage/wastewater recycling + seawater desalination hybrid system)



Seawater desalination system is upgraded to
(1) less energy and lower cost, and (2) less environmental impact
by diluting seawater with sewage RO concentrate

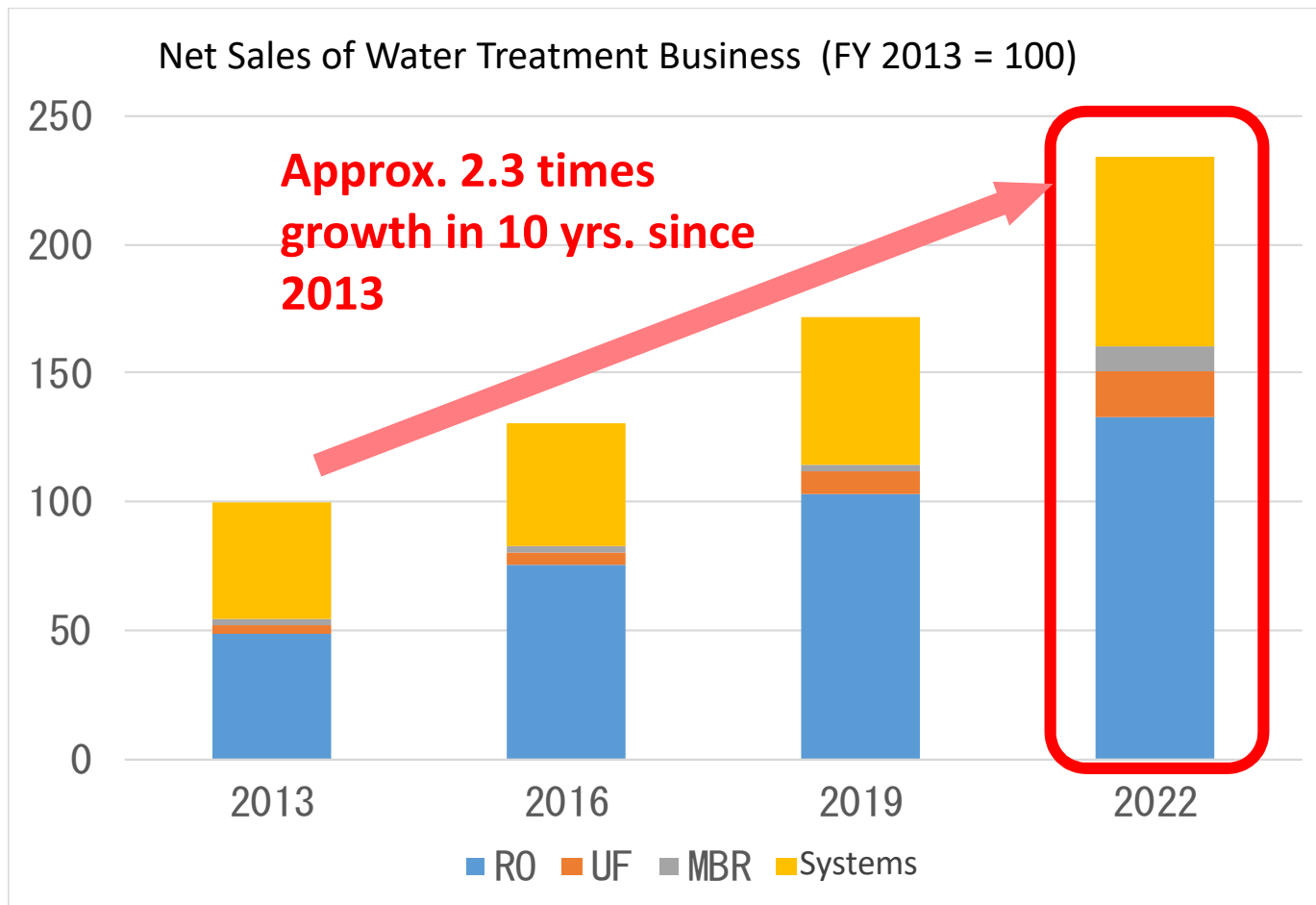
Business Expansion Leveraging our Strengths

1. Expand UF and MBR business utilizing RO global sales network
2. Propose total solution (IMS) with **broad product portfolio**
3. Stabilize supply of high quality products that meet regional needs through the **global production network**
4. Provide timely customer support through the **global technical service network**



Business Plan for the Water Treatment Business

In order to become an “Excellent Company” in the water treatment business, proceed to expand with a full line of products, focusing on our mainstay RO membranes



Descriptions of predicted business results, projections, and business plans 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.

'TORAY'

Innovation by Chemistry