



Toray's Engagement in Environmental Issues

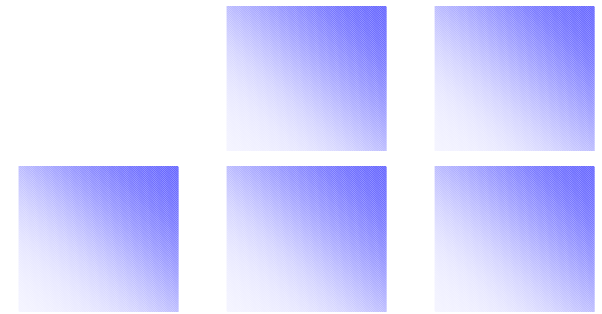
Toray Industries, Inc.

Executive Vice President & Representative Director

Hiroaki Kobayashi

Managing Director

Akihiro Nikkaku



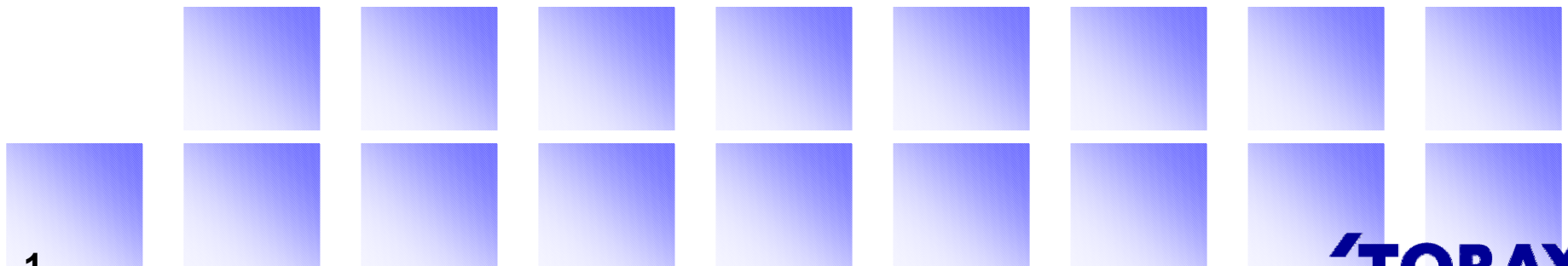
◆ Summary

Executive Vice President & Representative Director
Hiroaki Kobayashi

◆ Outline and Strategies of Water Treatment Businesses

Managing Director

Akihiro Nikkaku

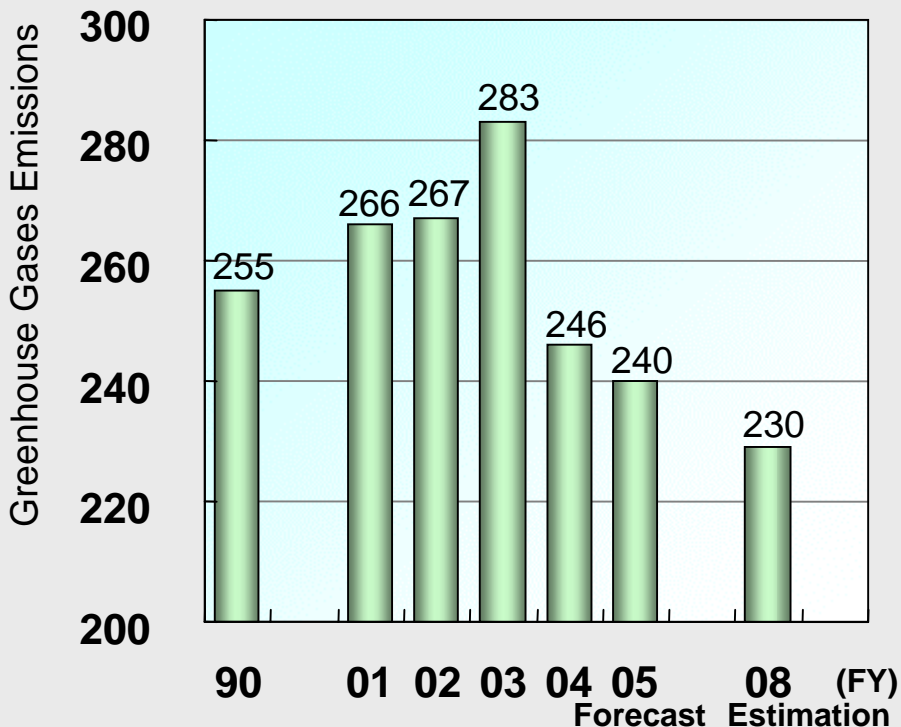


Global Warming Control-conscious Businesses

Greenhouse Gases Reduction Measures

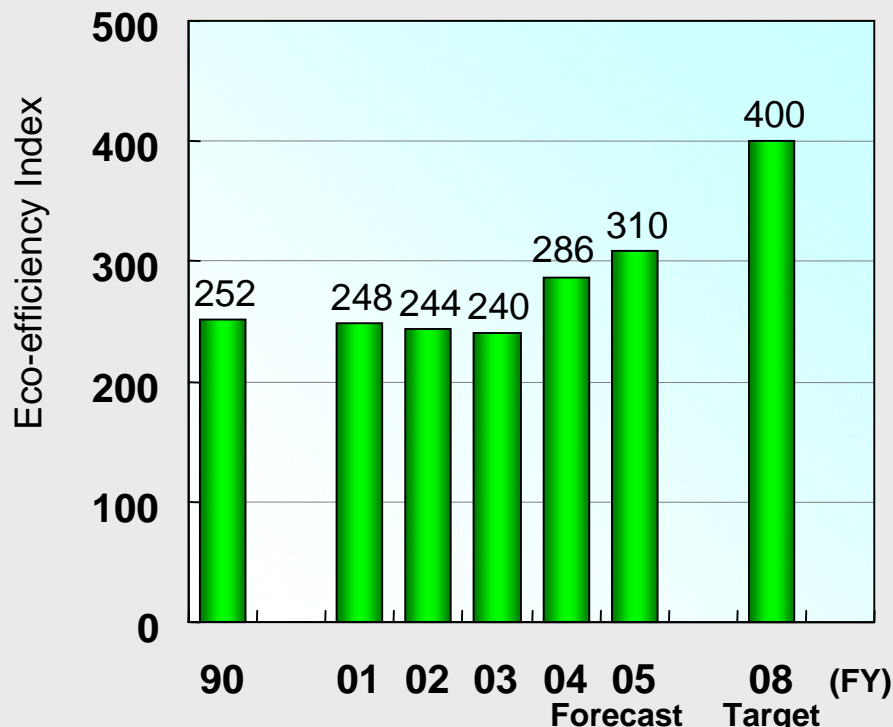
1. Natural Gas Cogeneration Facilities
2. Conversion of Boiler Fuel

(10,000 tons-CO₂ conversion/yr)



$$\text{Toray Group Eco-efficiency Index} = \frac{\text{Net Sales}}{\text{Greenhouse Gases Emissions}}$$

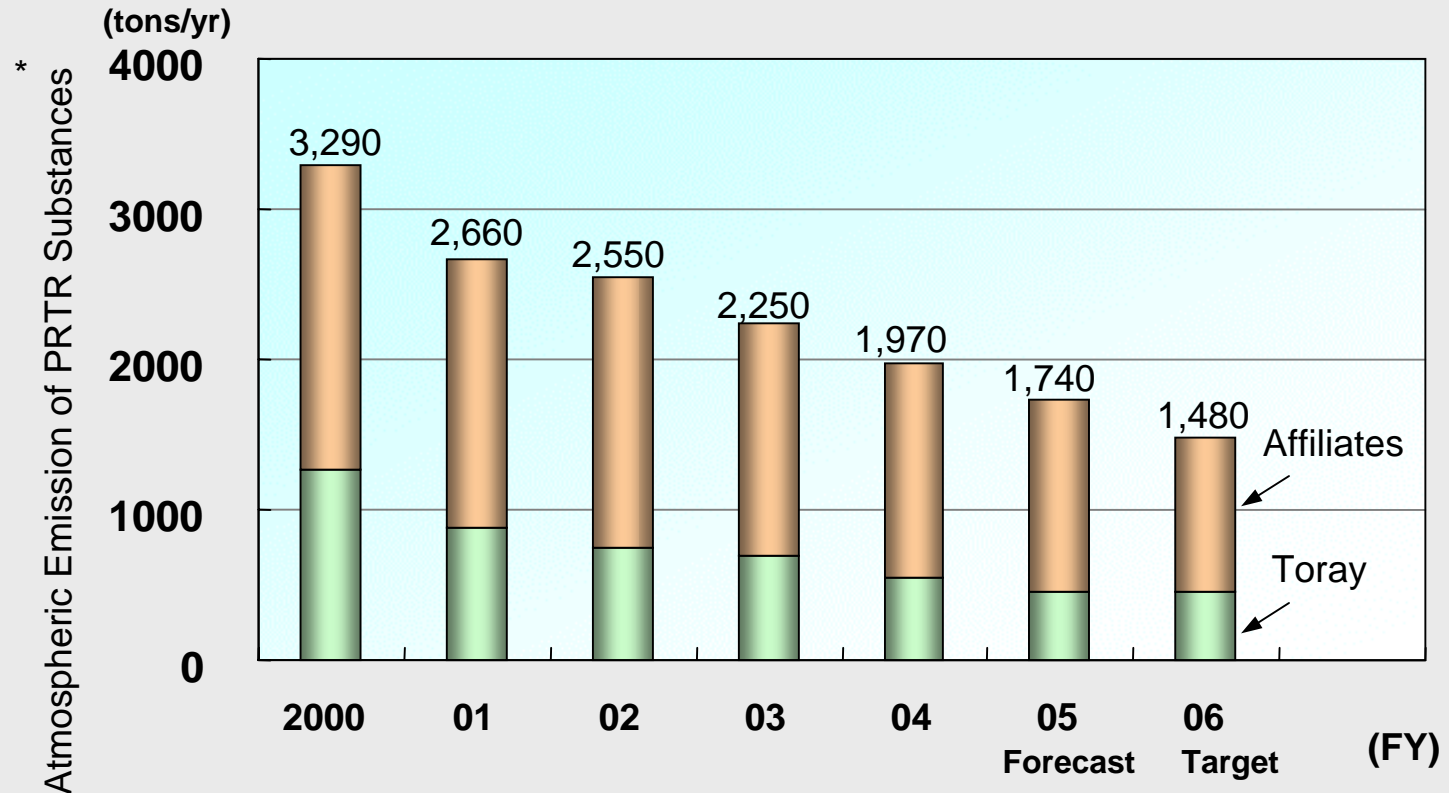
(yen/kg – CO₂ conversion)



- Toray reduced its greenhouse gases emissions by 6% over 1990 result (ahead of Kyoto Protocol goals) during 2005 and will reduce 10% before 2008. As a group, Toray will further promote reduction of greenhouse gases emissions.
- The Group will control eco-efficiency index and expand businesses while reducing environmental burdens.

Reducing Chemical Substances Emissions

Reduction measures in atmospheric emissions of chemical substances :
Installation of organic gas adsorption and recovery system



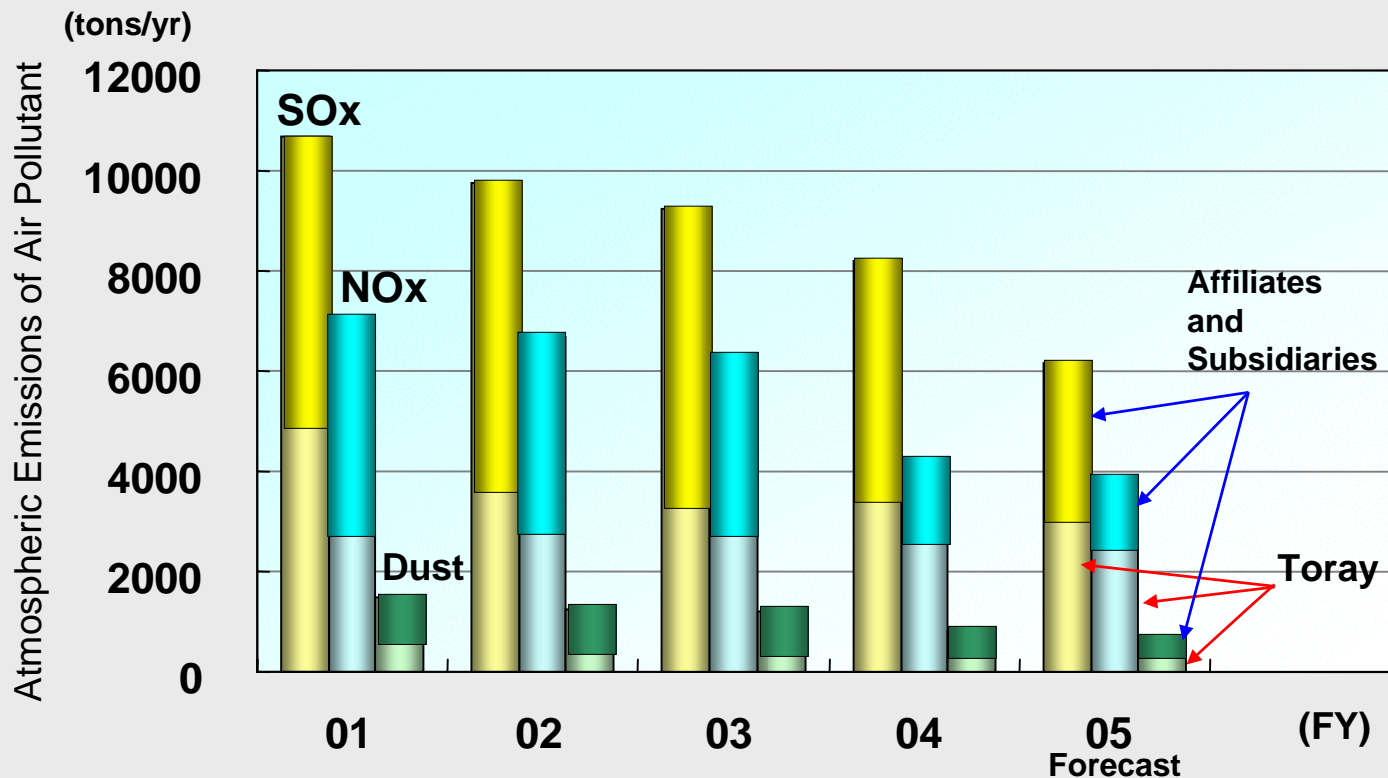
* PRTR (Pollutant Release and Transfer Register) : system for chemical substances dealing companies of reporting the volume of chemical emissions as well as the volume transferred as waste

We are steadily reducing chemical substances emissions and will set up further targets and tackle to achieve new goals.

Preventing Air Pollution

Measures to prevent air pollution

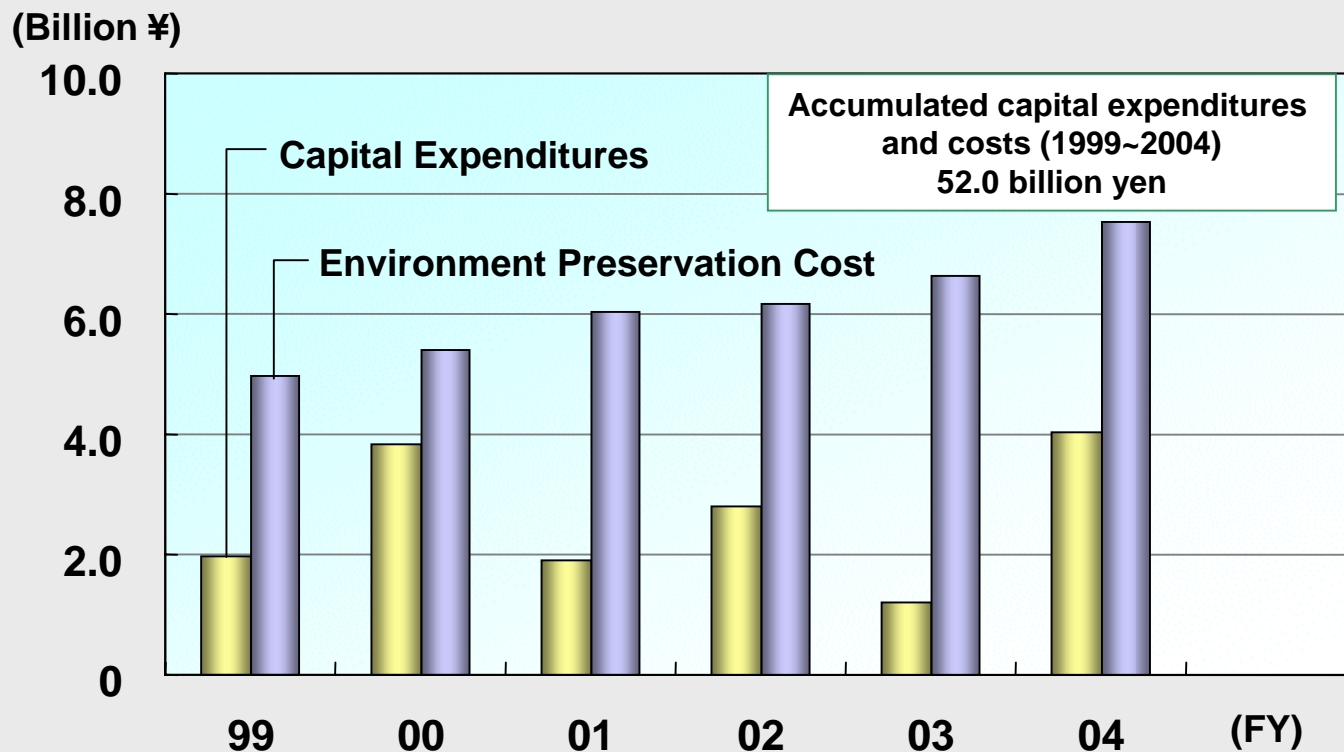
1. Conversion of fuel to natural gas
2. Efficiency improvement of desulfurization systems



We are steadily reducing emissions of air pollutants and will further work on such measures as conversion of fuels and efficiency improvement of desulfurization systems and others.

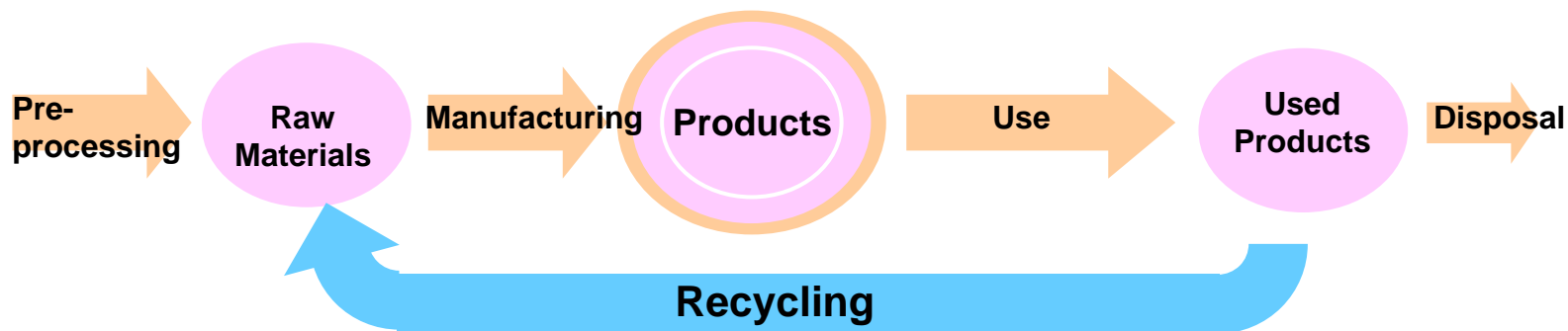
Environmental Preservation Investments

Toray has disclosed environmental accounting data in accordance with the Ministry of the Environment's guidelines since 1999 which includes environment preservation cost, energy conservation cost, and recycling and other costs.



We will further invest in necessary environmental preservation matters which leads to steady environmental improvement.

Environmentally-friendly and Recycled Products



● **Environmentally-friendly Products** : Products which reduce environmental burden at any part of its total lifecycle

CO₂ gas reduction

Energy reduction

Water purification

Air purification

Hazardous materials reduction

Less Energy

Clean

● **Recycled Products** : Products whose raw materials are made from used products or manufacturing process wastes

Basic Policies of Stepping Up Environment and Recycling Efforts



“Ecodream” is Toray’s overall brand to describe our advanced activities in resource saving and global environment conservation for the goal of developing a sustainable recycling-oriented society.

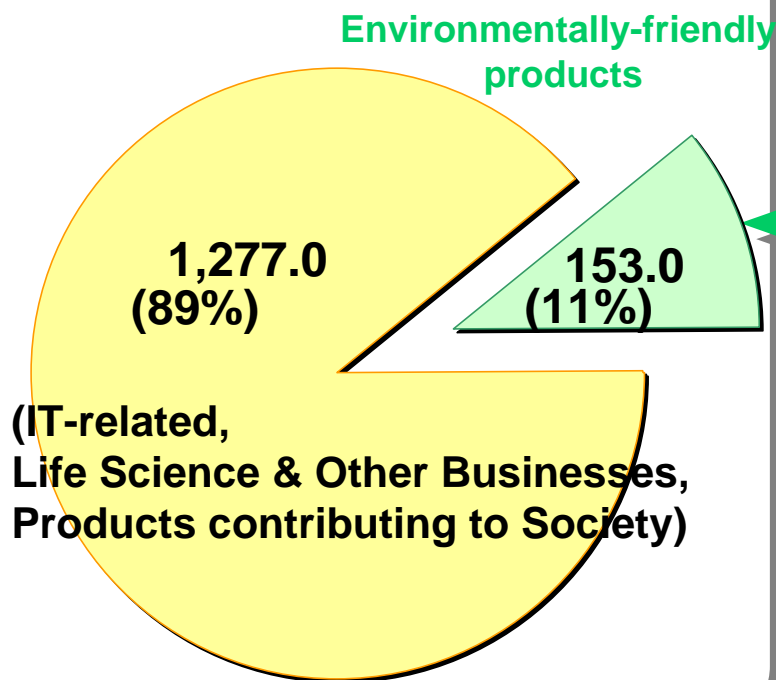
Clean & Less Energy

- “Ecodream”
 - Prevention of global warming, contribution to environment preservation
 - Expansion of environmentally-friendly products
 - Promotion of recycling activities
 - Promotion of CSR activities
- “Ecodream” plan : Double the sales of environmentally-friendly products within five years
- Establish exclusive department for environment and recycling as well as company-wide committee to conduct environment-related activities (Global Environment Committee, Recycling Committee)

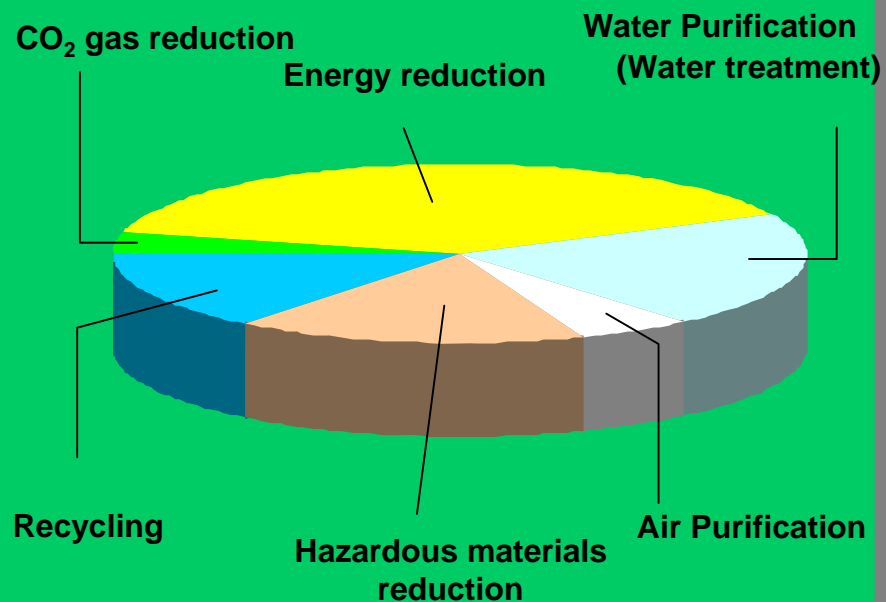
Present State of Toray Group Environmentally-friendly Products



Toray Group Consolidated Net Sales
¥1,430.0 billion in FY Mar/06



Net Sales Composition by Expected Effects



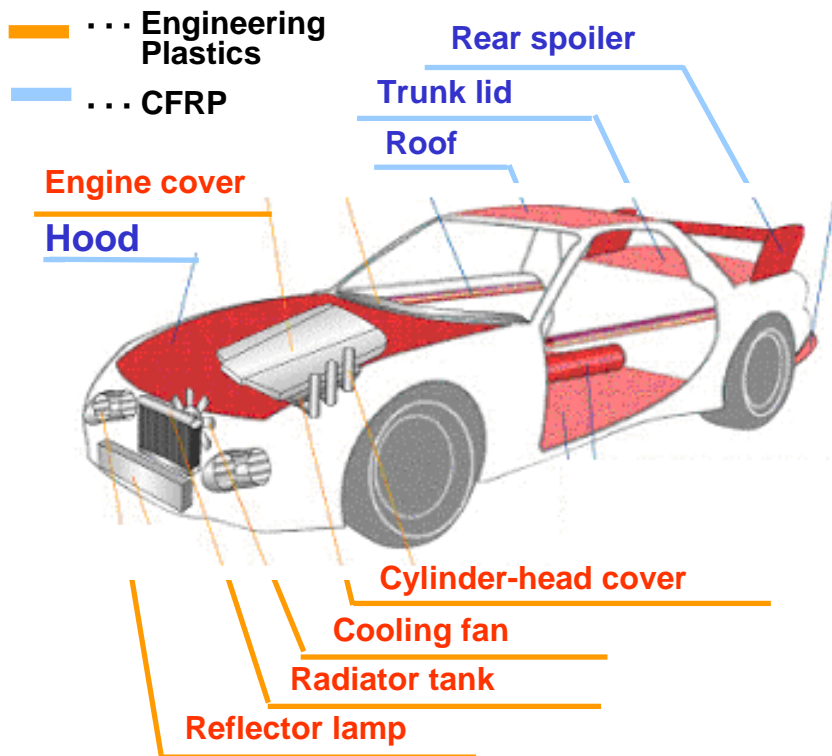
Sales of environmentally-friendly products are estimated to be ¥153.0 billion, 11% of total Group sales in FY Mar/2006.

Products and Technologies by Expected Effects

Expected Effects	Products
CO ₂ Gas Reduction	PLA (Polylactic Acid) fibers, plastics, films 3GT fibers & textiles Bamboo composite fibers Cellulose fibers Soybean protein-fibers Flexible and heat resistant films
Energy Reduction	Torayca* for transport machineries Engineering plastics Components for turbine generators Components for fuel cells Films for solar cells Capacitor films for hybrid cars
Water Purification (Water treatment)	RO (reverse osmosis) membranes UF·MF membranes Immersed membranes for MBR Water treatment system businesses Torayvino*
Air Purification	Heat resistant bag filters (PPS, PTEF fibers) Air filters
Hazardous Materials Reduction	Non-halogen fire-retardant (fibers & textiles, plastics, films) Waterless CTP plate Non-halogen circuit materials Heavy metal-free color filters
Recycling	PET Nylon 6 PBT ABS PPS CFRP Toraysurou* DMSO

Energy Reduction through Weight Reduction of Automobiles

Engineering Plastics and CFRP Application Sections



Present Situation

Application section of engineering plastics is expanding conducive to energy reduction through weight reduction

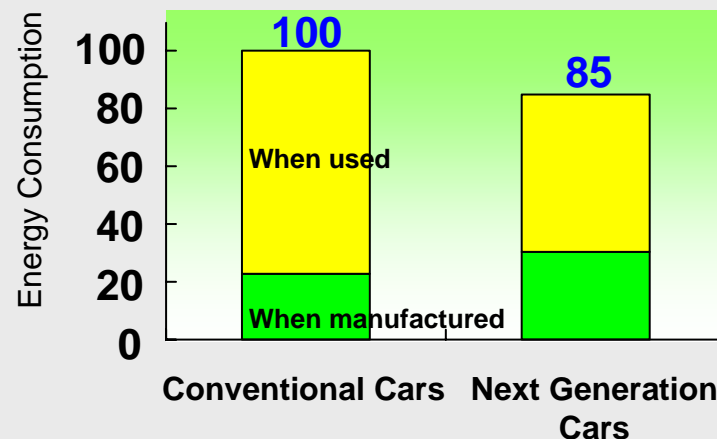
Expand application section of engineering plastics and CFRP for the benefit of energy reduction (green house gas reduction).

Future Trends

- Expand application section of engineering plastics
- Properly adopt CFRP into automobile applications

	Conventional Cars	Next Generation Cars
Used amount by car	Engineering Plastics 30 kg	Engineering Plastics 60kg CFRP 300kg
Vehicle weight (when conventional car is 100)	100	64

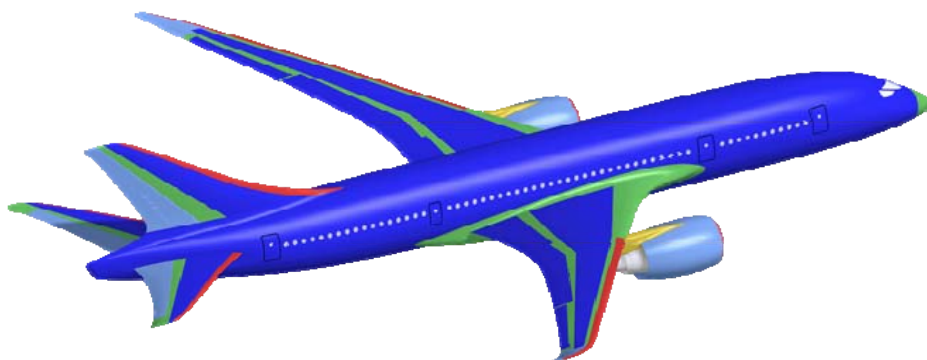
Energy Consumption Comparison by LCA Method (conventional cars counted as 100)



Energy Reduction through Weight Reduction of Aircrafts

CFRP Application Sections of Next Generation Aircrafts

B787 (Next generation medium-sized aircraft)



- | | |
|--|---|
|  CFRP |  Aluminum |
|  CFRP (special structure) |  Other metal |
|  GFRP | |

Future Trends

- Increase CFRP as structural materials
- Select CFRP as primary structural material in large quantity

Next Generation Aircrafts

- Tare can be reduced by 20% when usage of CFRP is extended up to 50%
- Fuel consumption can be reduced by 20% when efficiency derived from advanced engine is included

Usage of CFRP for aircraft application is increasing significantly

Toray Products Contributing to Energy Reduction

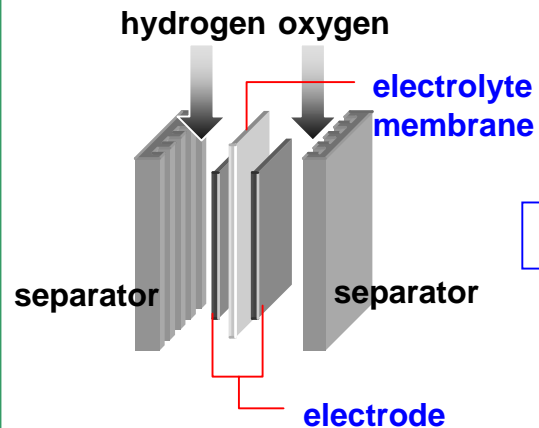


Wind Turbine Generators



Carbon fiber composite materials for Windmill blades

Fuel Cells



Polymer electrolyte membrane

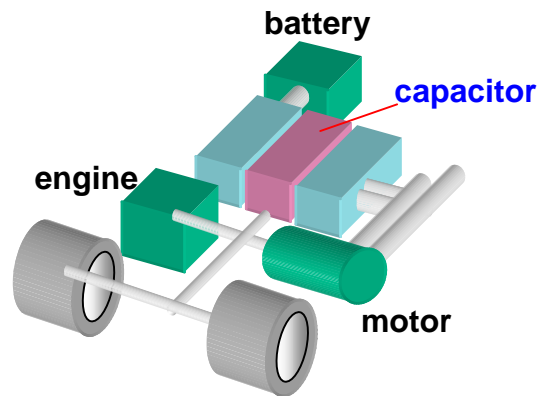
C/C paper for electrode

Solar Cells



Back Sheet Films

Hybrid Cars



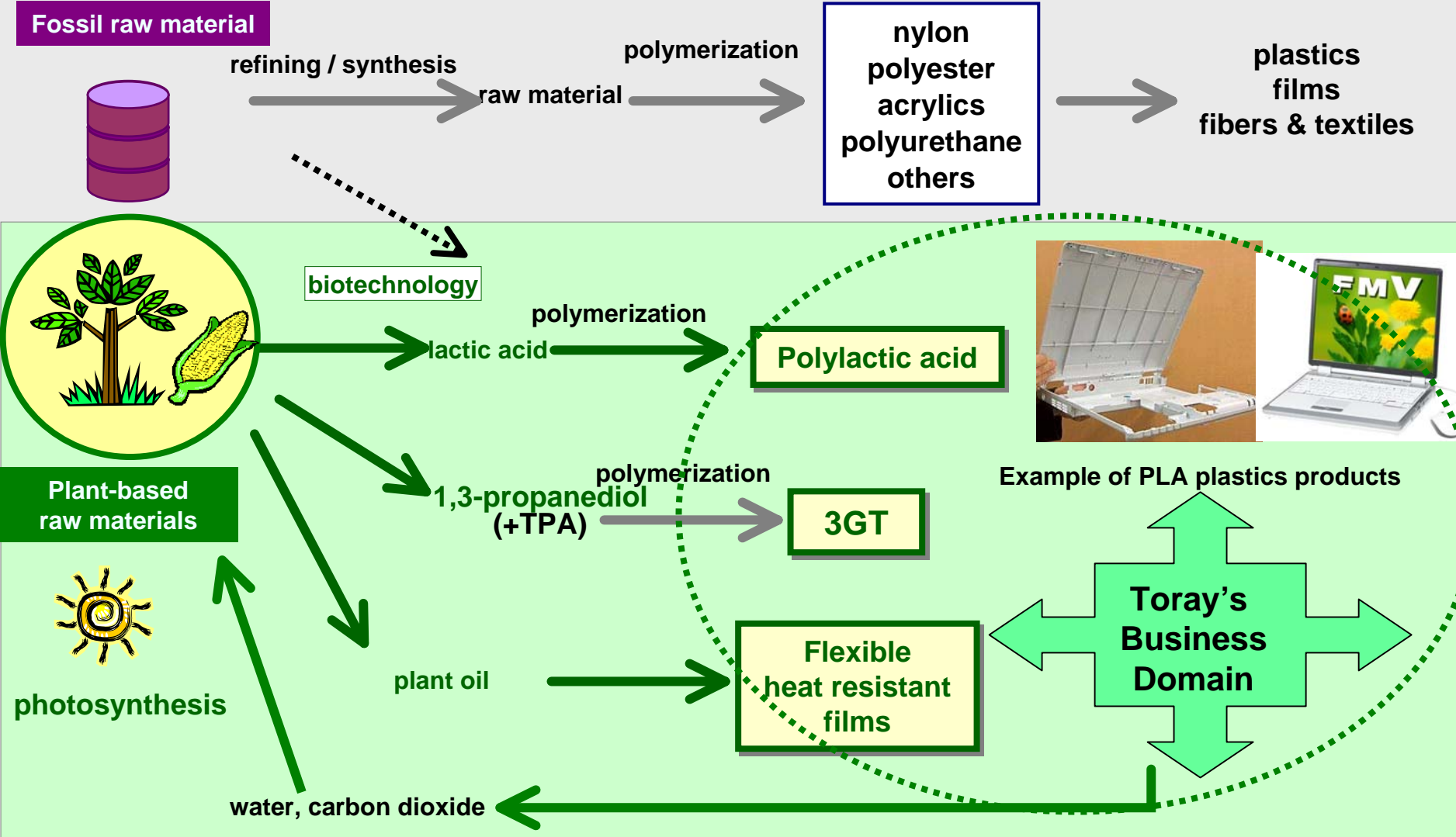
PP film for high-capacity capacitors

Capacitor case (PPS)

We are expanding a variety of products in wide business areas which contributes to energy reduction

Development of Non-petrochemical Raw Materials

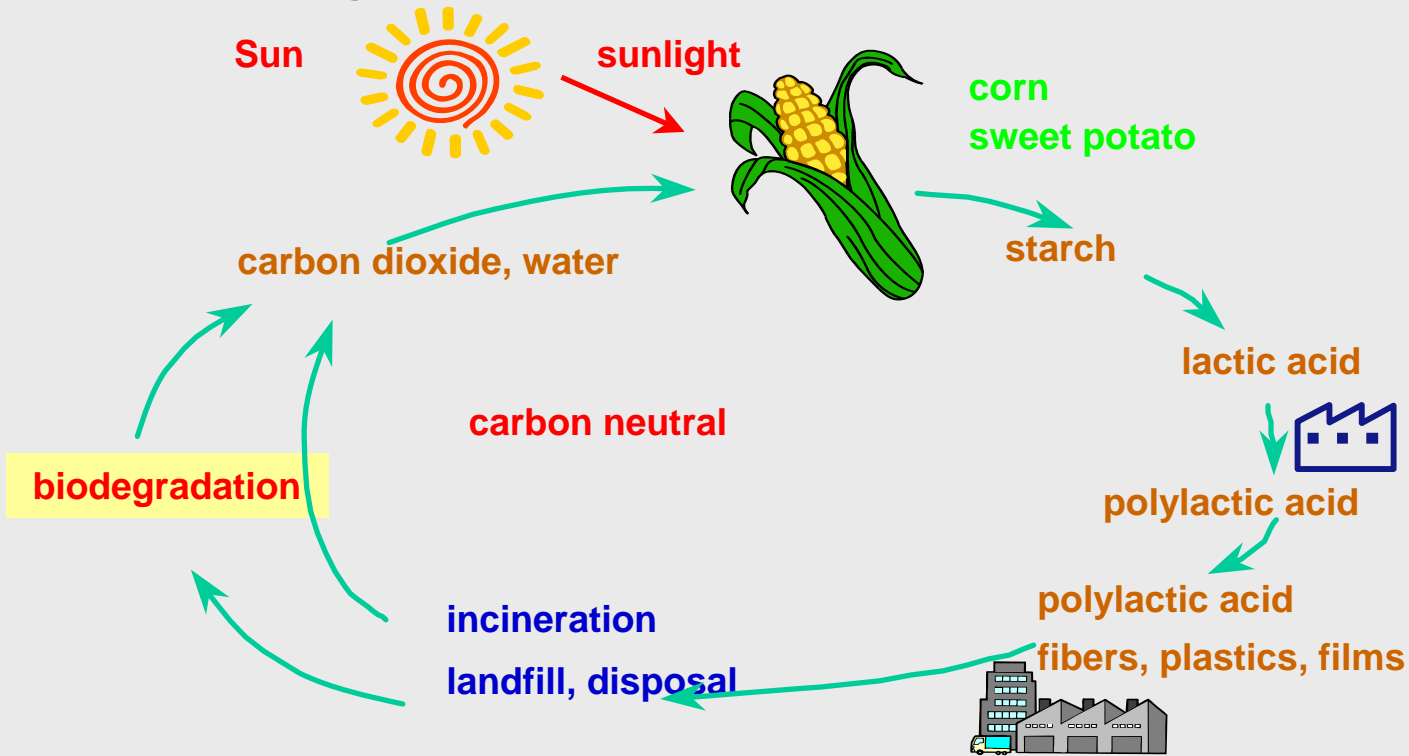
Toray is developing non-petrochemical raw materials making full use of biotechnology



Contribution of PLA Products to the Environment



- “100% plant-based raw materials” made from corn or sweet potato
- “Biodegradable materials” which gradually degrade into carbon dioxide and water after landfill or disposal
- “Carbon neutral” which prevents CO₂ increase, the cause of global warming, even after incineration



Developing fibers & textiles and plastics products under and overall polylactic acid brand

Environment Surrounding Polylactic Acid

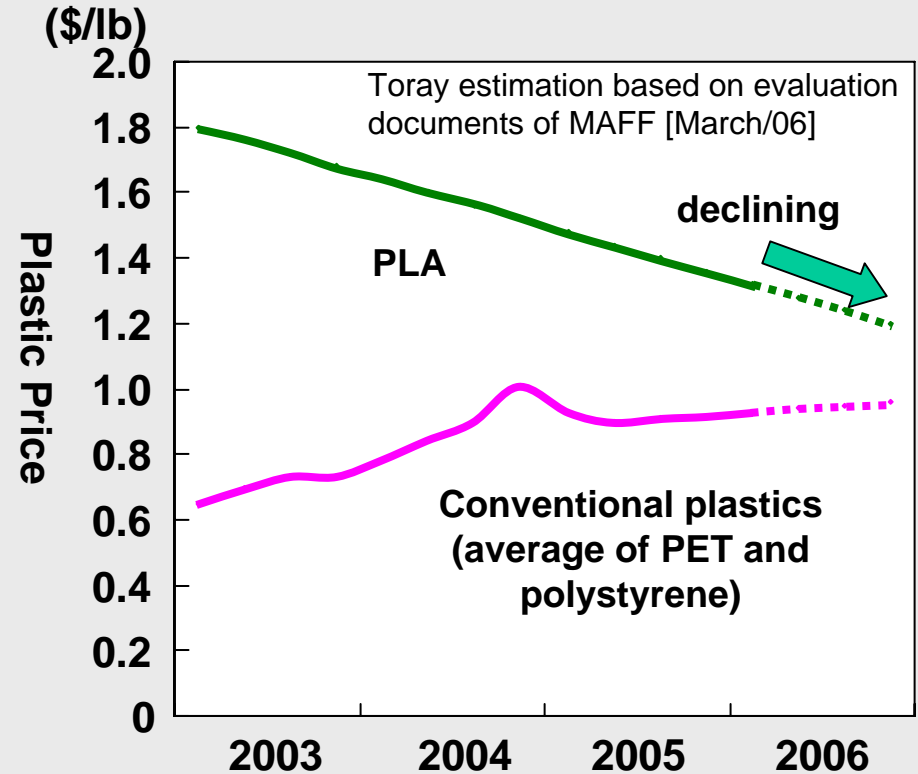
Nonpetroleum-based polylactic acid which does not lean on precious resources, leads to 40~60% of resource saving compared to that of conventional plastics

Required quantity of petroleum to make one tatami equivalent carpet

Polylactic Acid	2.6LTR Further reduction through wind-power generation
Nylon	6.4LTR
Polypropylene	4.0LTR
Polyester	4.0LTR

* Oil equivalent conversion of required energy amount to produce BCF yarn for one tatami (about 1.7m₂) equivalent carpet

Price trend images of PLA plastics (Estimation of North American Market)



The crude oil prices soared from \$30/bbl to about \$60/bbl during this period

- Plant-based raw materials are expected to expand drastically through growing recognition of global environment issues
- Undisturbed by soaring oil prices, polylactic acid will constantly continue to reduce costs

Fundamental Technologies and Example of Product

Toray Technologies

High-strengthening Technology

- Nucleus formulation
- Stereo complex

Nano-alloy Technology

- Alloy (PMMA, POM)
- Compatibility formulation

Softening Technology

- Elastomer formulation

Hydrolysis Control Technology

- Terminus closure chain extension

Flame Retarding Technology

- Non-halogen fire retardancy formulation

Fibers & Textiles

Apparel



Automobile materials



Industrial material



Interior

Plastics

Office automation equipment/home appliances/automobiles/miscellaneous goods, others



Personal computers

DVD



Films

Industrial applications/packaging materials, others



plain type



flexible type



blister pack

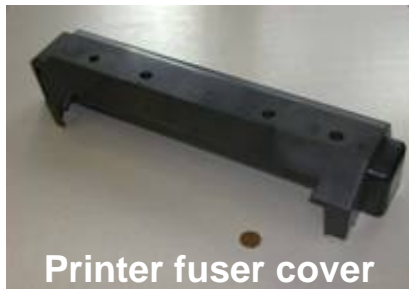


molding

- Develop various applications utilizing Toray's unique fundamental technologies
- Promote expansion of PLA businesses as company-wide project through establishment of exclusive in-house conference

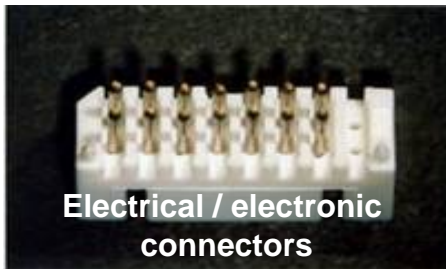
Environmentally-friendly Products in the IT Areas

Flame-retardant plastics components



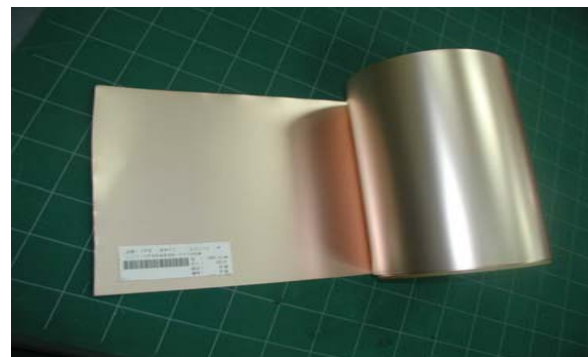
Printer fuser cover

Halogen free



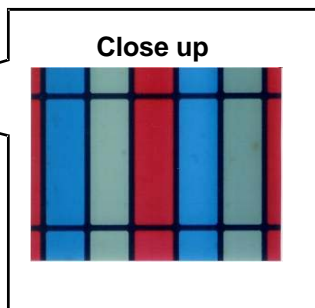
Electrical / electronic connectors

Copper clad laminated polyimide film



Halogen free

TOPTICAL*, LCD color filters



Close up

No harmful heavy metal (Cr)

Waterless printing plate



Butterfly Mark



Waterless Printing. Naturally.

No harmful wastewater

Toray will enlarge its growing IT-related business area while giving consideration to the environment effects through development and provision of eco-friendly materials.

Basic Policies and Present States of Recycling

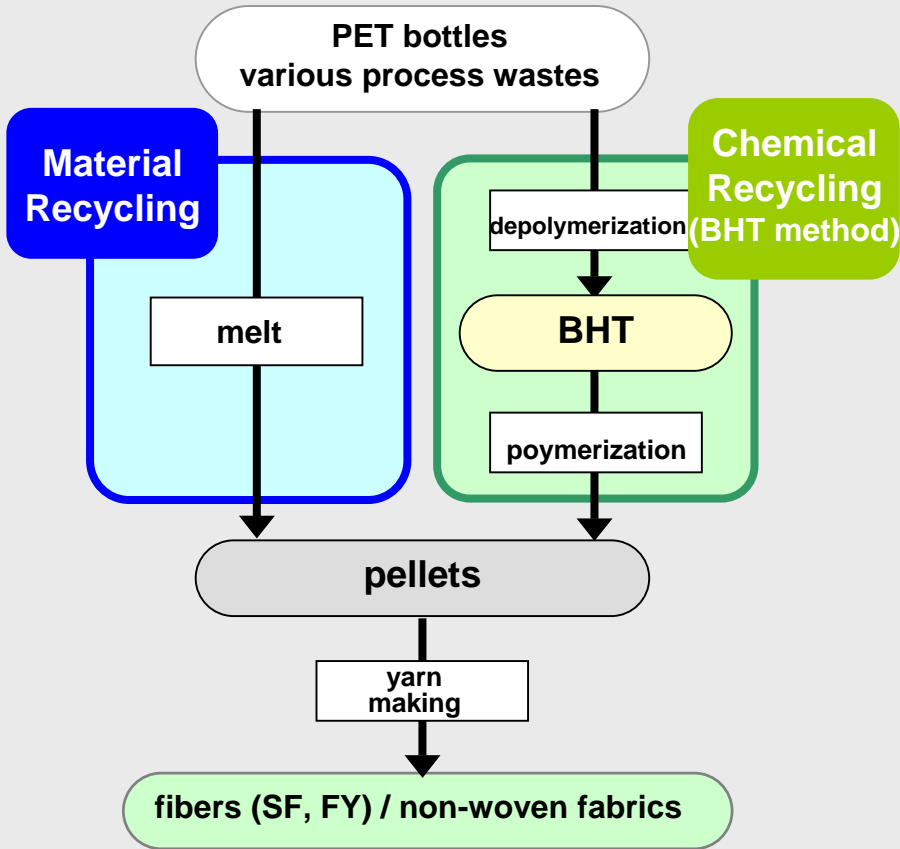


Basic Policies : - Positively expand and promote recycling activities
 - “Less energy recycling” is the bases where appropriate recycling technologies are applied according to the materials

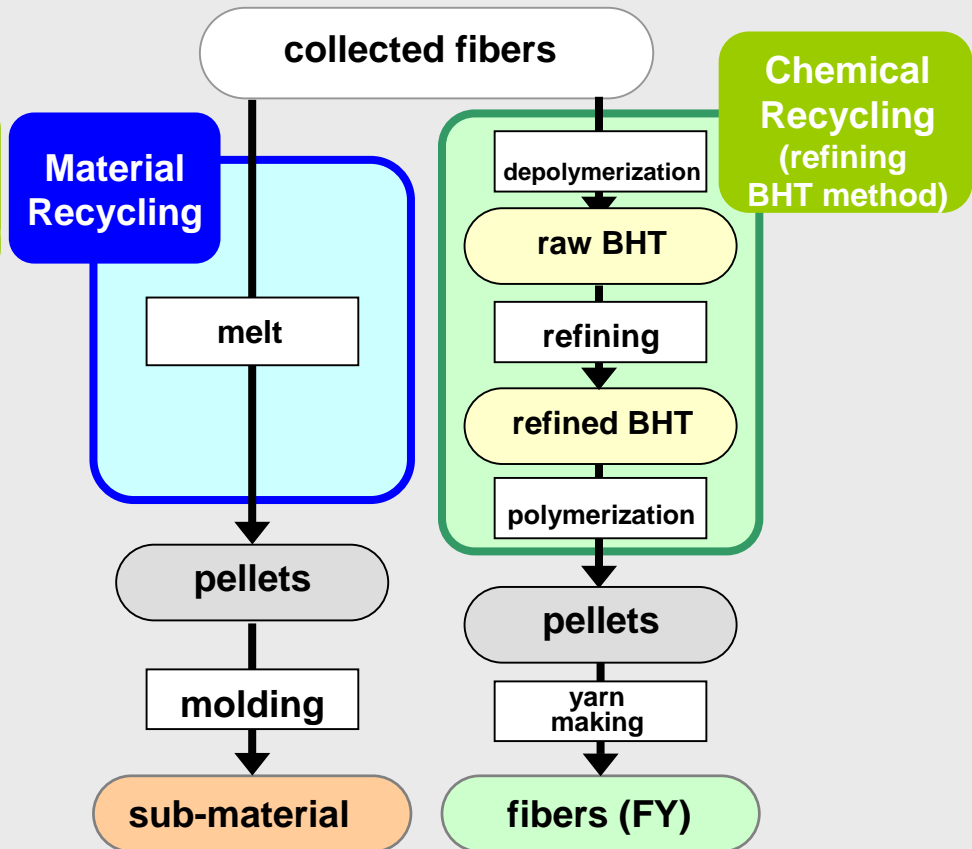
Recycling Method	Fibers & Textiles	Plastics	Composite Materials, others
Material Recycling (reuse without decomposing polymers)	Nylon 6	ABS	Carbon Fibers
	PET	Nylon	CFRP
	Acrylics	PBT	DMSO
		PET	Toraysurou*
		PPS	
Chemical Recycling (system to chemically decompose into raw materials for reuse)	Nylon 6	PET	
	PET		
Thermal Recycling (incineration heat recovery)	PET		CFRP

Recycling of Polyester Fibers

Recycling type



Collection and recycling type

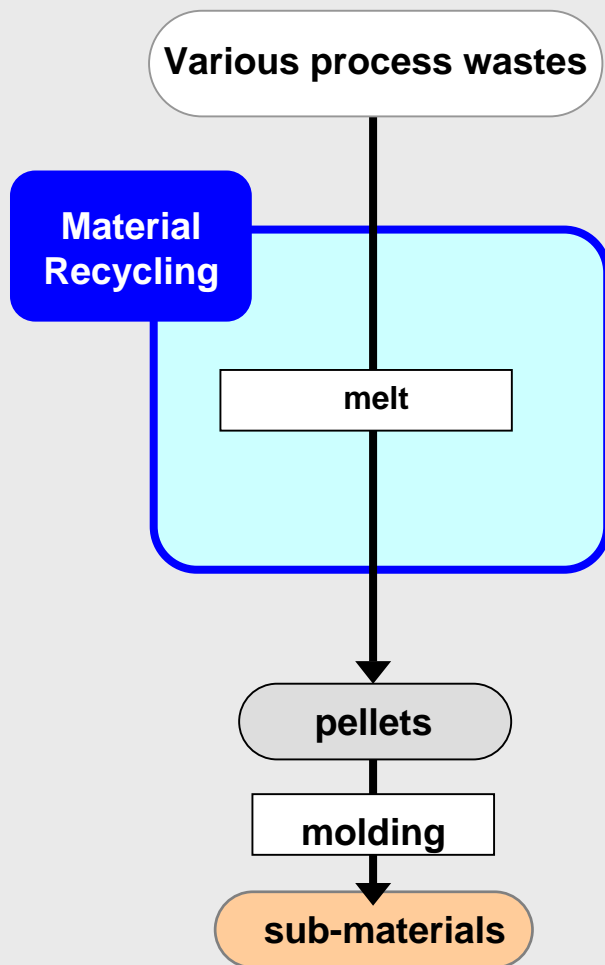


Recycled volume : material 8,300tons, chemical 6,100tons ; Total 14,400tons (05 forecast)

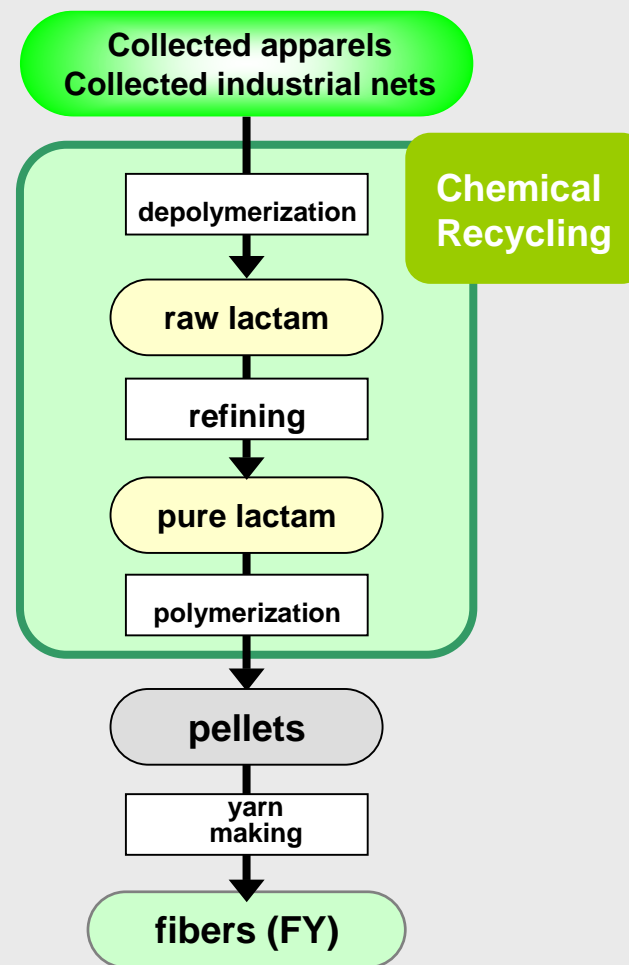
Top recycling volume in Japan by utilizing diversified recycling technologies

Recycling of Nylon 6 Fibers

Recycling type

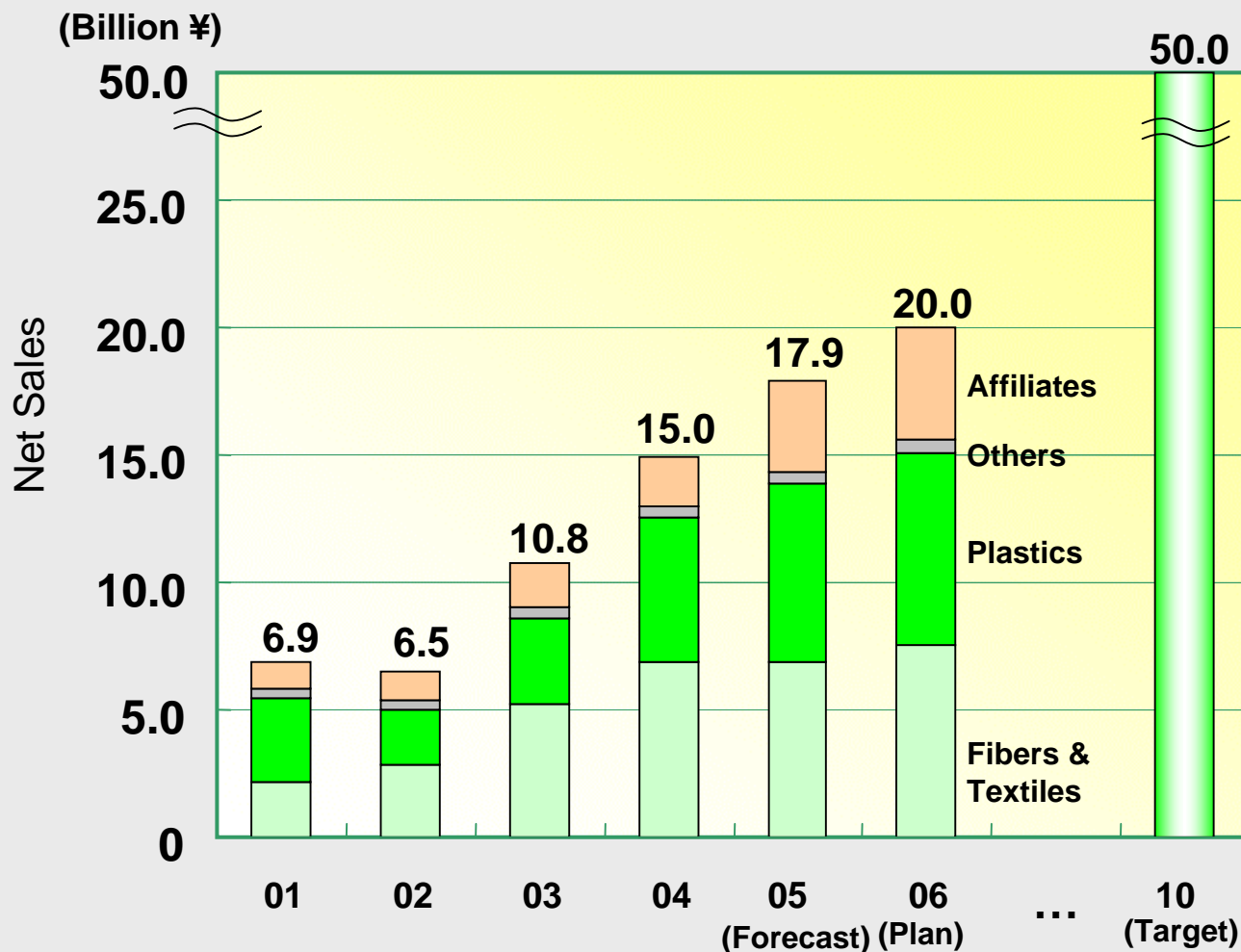


Collection and recycling type



Promote recycling positively by utilizing unique chemical recycling technologies

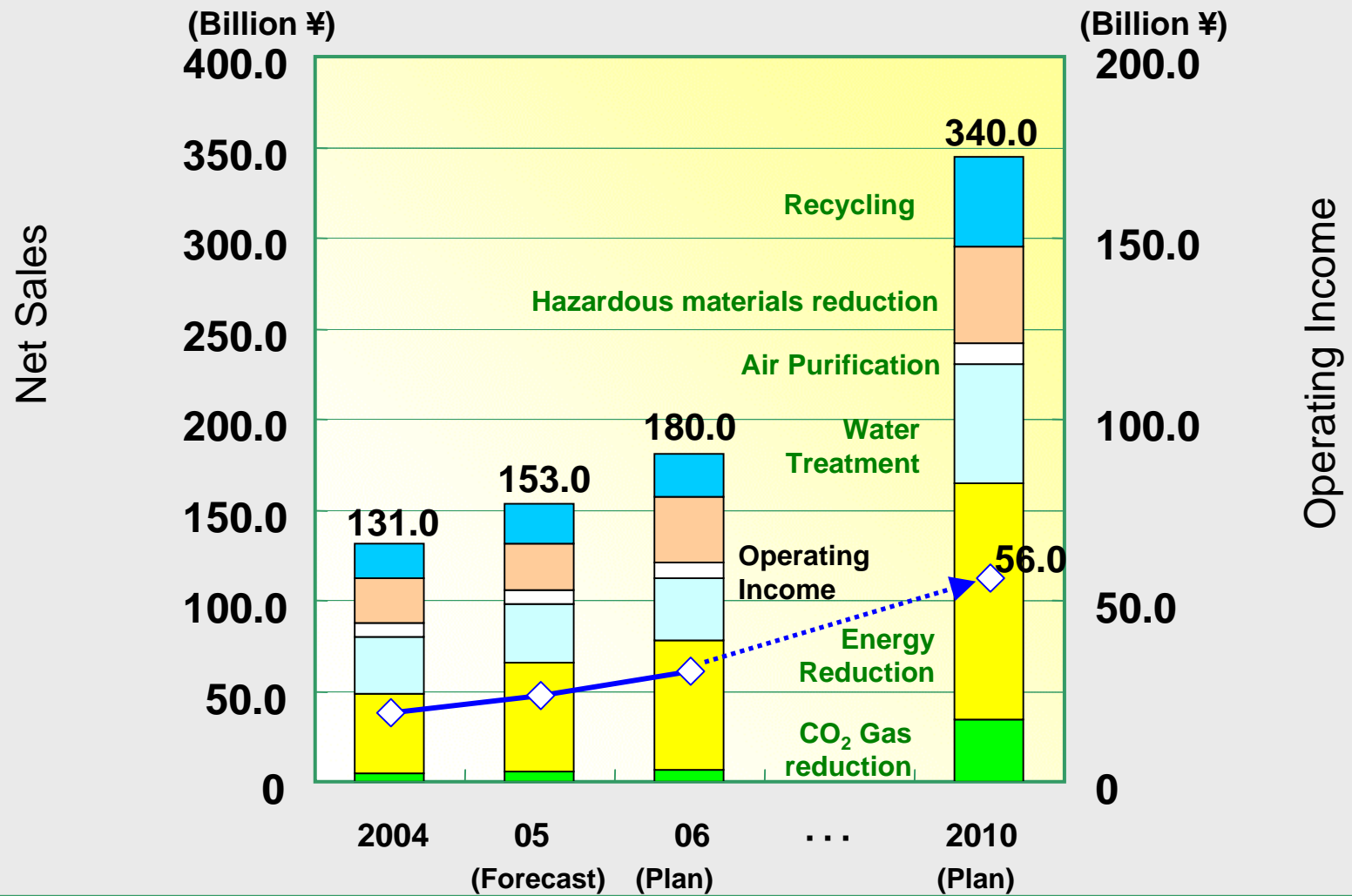
Expansion of Recycling Activities



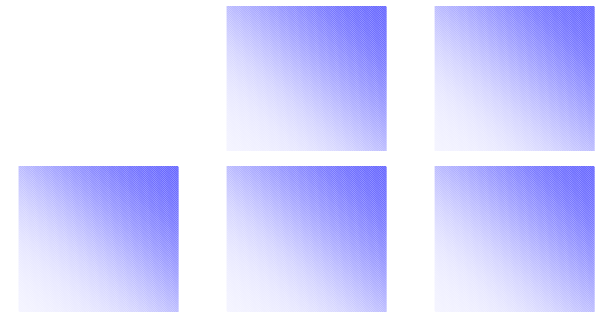
Promote recycling activities to achieve the target of 50 billion yen in net sales of recycled products businesses in FY 2010.



Expansion of Sales through Ecodream* Plan



Expand environmentally-friendly products businesses to double or more the FY 2005 results in FY 2010 where net sales target is 340.0 billion yen and operating income to be 56.0 billion yen.



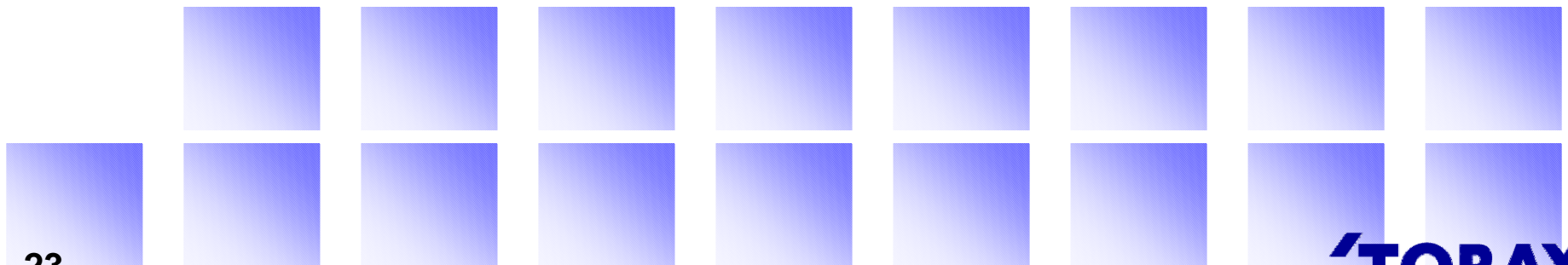
◆ **Summary**

Executive Vice President & Representative Director
Hiroaki Kobayashi

◆ **Outline and Strategies of
Water Treatment Business**

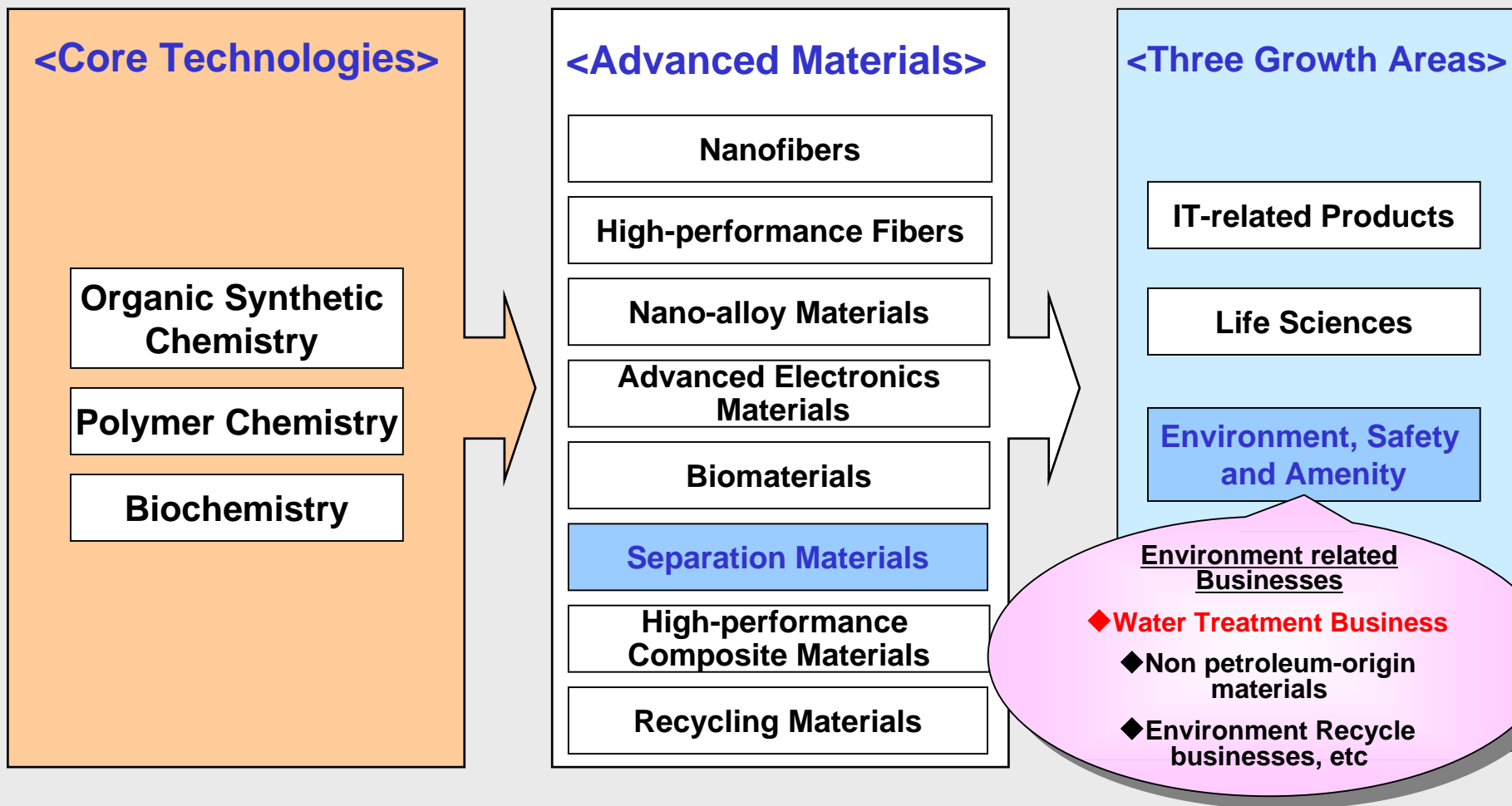
Managing Director

Akihiro Nikkaku



1. Overview and Policies of Toray's Water Treatment Business
2. Water Problems and Water Related Markets in the World
3. Membrane Technologies and Toray's Membrane Products
4. Large Water Treatment Projects in the World
5. Outline and Strategies of Toray's Water Treatment Business
6. Organization and Policies of Research and Development for
Water Treatment Technologies in Toray
7. Summary

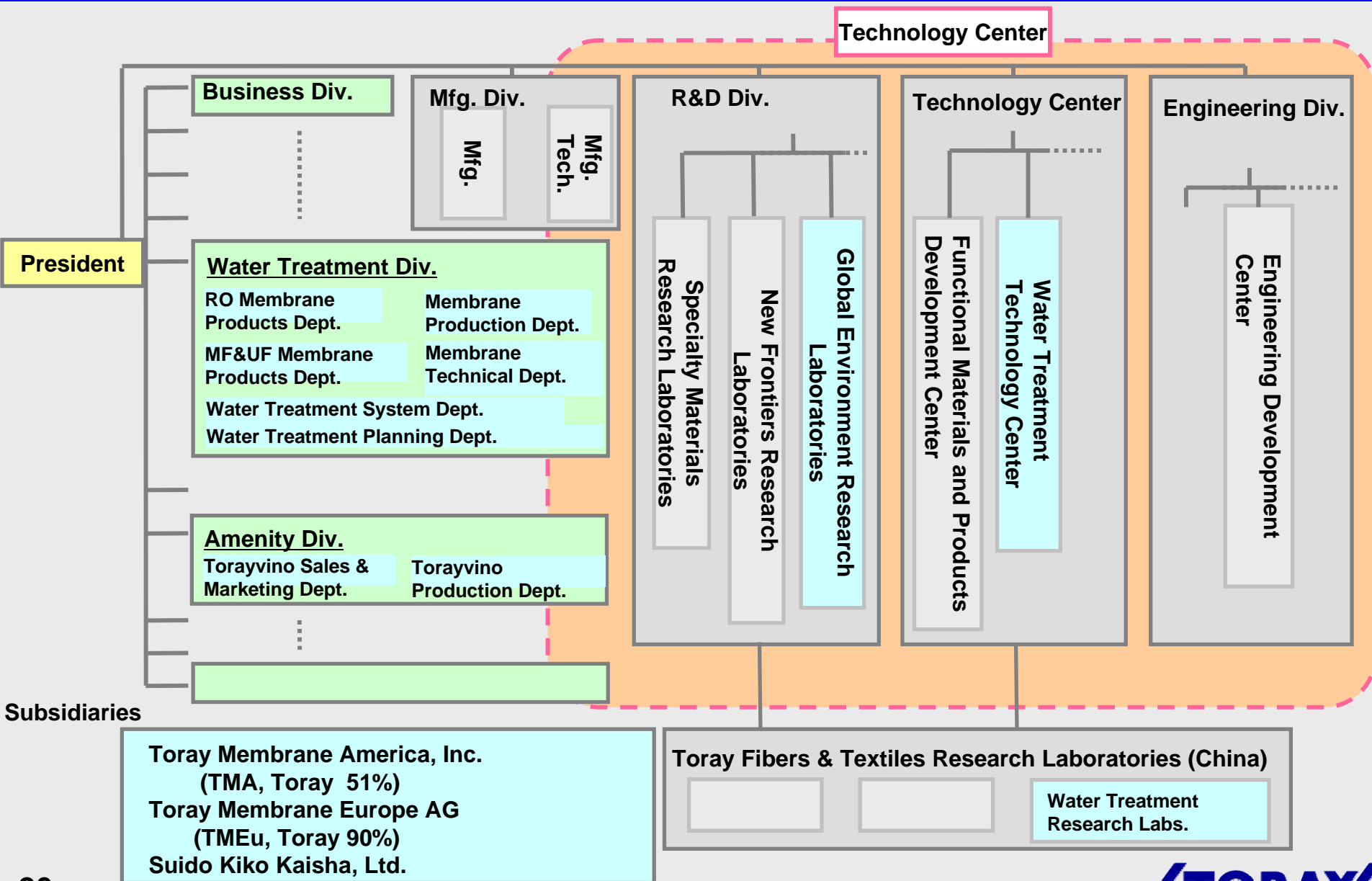
Position of Water Treatment Business in Toray Group



**Cultivate Water Treatment Business
as a core of Environment related Businesses**



Organization of Toray's Water Treatment Business





History of Toray Water Treatment Business

Fiscal Year	~1980	1981~1990	1991~2000	2001~
RO/NF membranes	◆ 1968 Started research on RO membrane	◆ 1980 Started marketing ROMEMBRA* for ultra pure water plants	◆ 1996 Installed in a large brackish water desalination plant	◆ 2001 Installed in a large seawater desalination plant
Hollow Fiber UF/MF membranes			◆ 1990 Started research on UF membrane	◆ 2000 Started research on MF membrane ◆ 2002 Started trial marketing MF membrane
MBR			◆ 1996 Started research on MBR membrane	◆ 2003 Started trial marketing
Water treatment systems	◆ 1975 TEK started water treatment business (84- Business with Rural Sewage and human waste treatment facilities)		◆ 1994 Started seawater desalination technology development project	◆ 2004 Transferred domestic businesses to Suido Kiko
Torayvino*		◆ 1986 Started marketing Torayvino*		
Subsidiaries			◆ 2000 TMA established	◆ 2003 Took control of Ropur (TMEu) ◆ 2004 Took control of Suido Kiko ◆ 2004 Established water treatment Research Labs

Types of Membranes and Toray's Products

Size	0.001 μm	0.01 μm	0.1 μm	1 μm	10 μm
Separation materials	Ion, Low molecule weight organics	High molecular weight polymer	Colloid	Clay	
	Trihalomethane Monovalent Ions	Agricultural & Organic Material Multivalent Ions	Virus	Bacteria	Coliform Cryptosporidium
Types	RO (Reverse Osmosis)		NF (Nanofiltration)	UF (Ultrafiltration)	MF (Microfiltration)
Toray's membrane products	<p>RO/NF membrane</p>		<p>PAN Hollow Fiber UF membrane</p>	<p>PVDF Hollow Fiber MF membrane</p>	<p>Immersed membrane for MBR</p>
			<p>PS Hollow Fiber MF membrane Home Water Purifiers Torayvino*</p>		

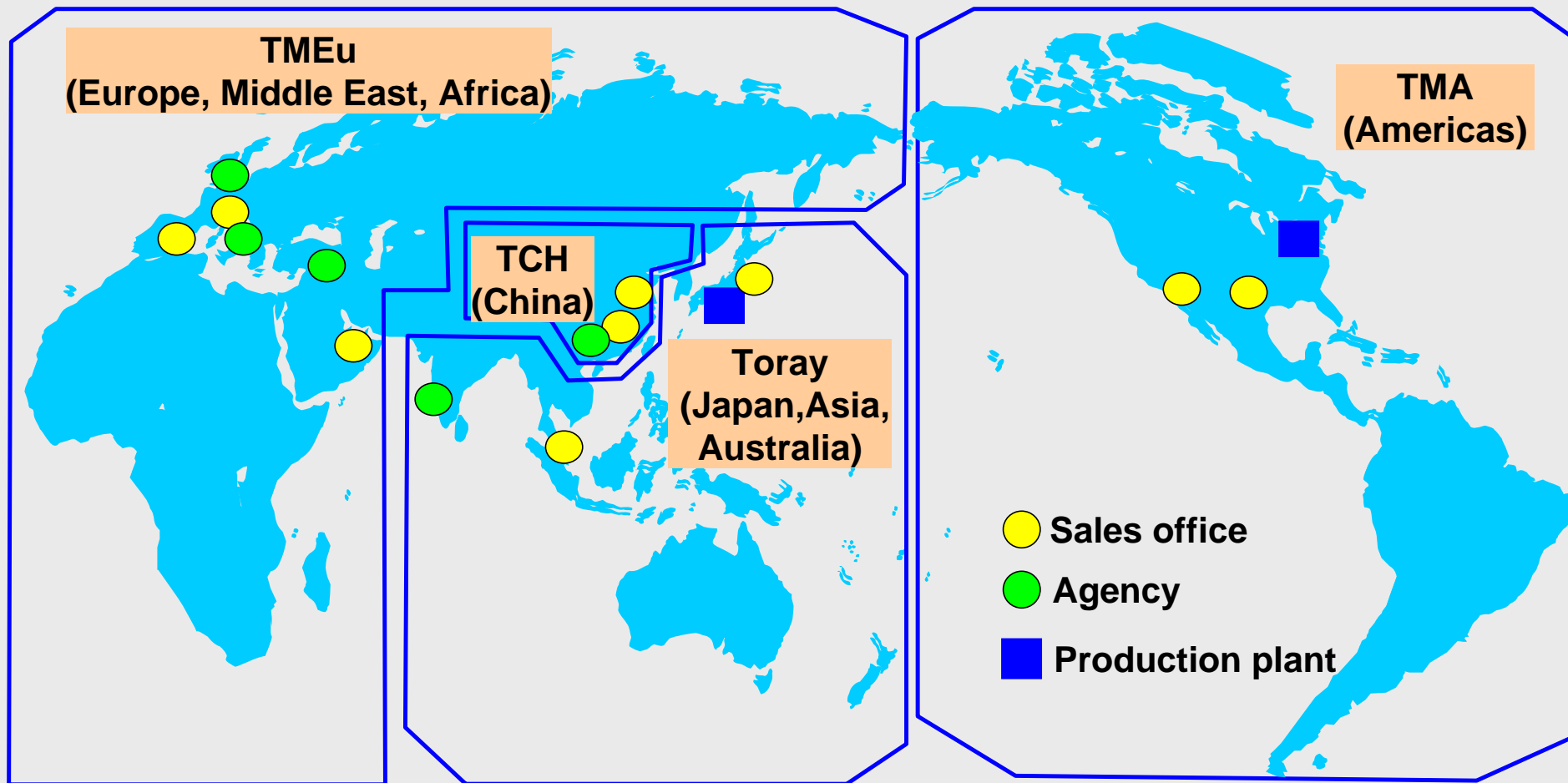
Policies of Toray's Water Treatment Business

- **Expand and Strengthen global sales system utilizing superior membrane technologies and variety of products**
 - Global operations in Japan, US, Europe and China
- **Strengthen profit structure by arrangement of production systems and increasing production capacity**
 - Membrane production in Japan; Element and Module production in suitable places
- **Expand Sales of home water purifiers Torayvino***
- **Utilize Suido Kiko and enlarge water treatment systems business**
- **M&A**

Enlarge membrane
business

Expand business areas
by utilizing membranes

Global Operations of Toray's Water Treatment Business

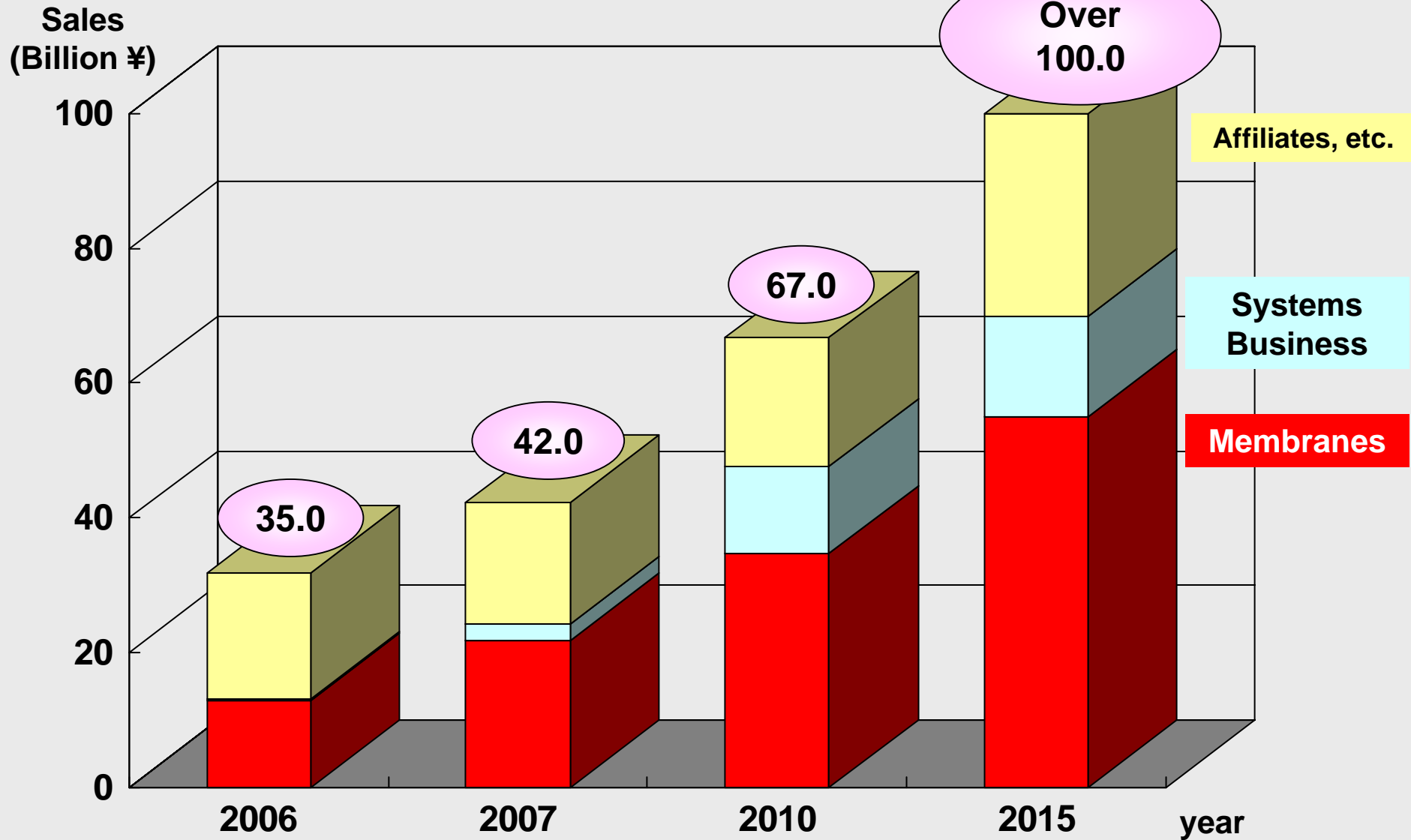


Established global sales & marketing team
Develop membrane business in world wide market

Strengthen global operations



Business Plan of Toray's Water Treatment Business



Target - Over 100 Billion Yen in 2015



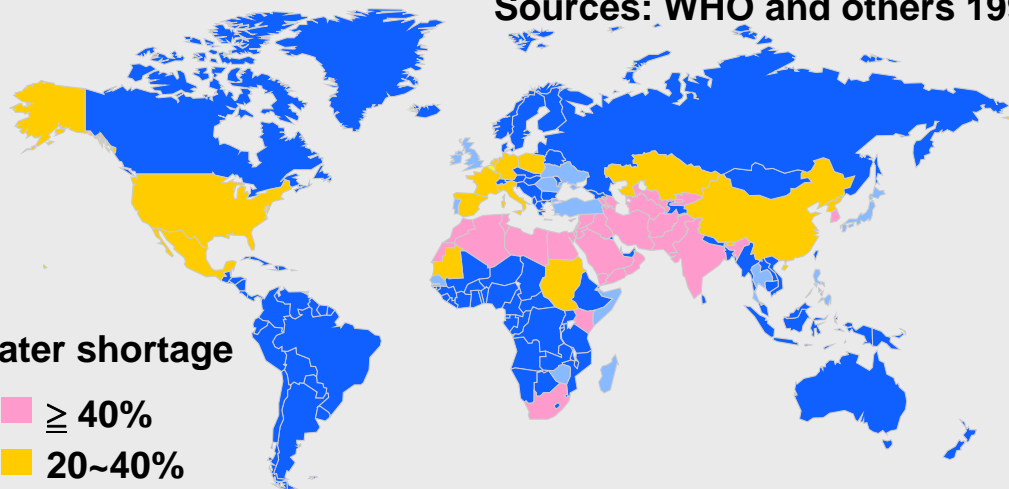
World Water Shortage - Now and Future

◆ World population is **6.5 billion**

- **1.1 billion people** do not have good drinking water (including water for daily life)
- **2.4 billion people** do not have sanitary accommodations (wastewater and human waste treatment)

Water shortage presumed regions in 2025

Sources: WHO and others 1996

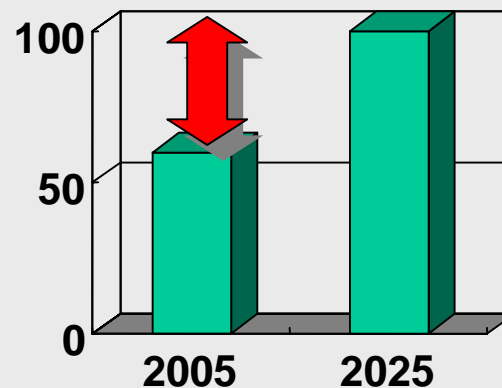


Water shortage

- $\geq 40\%$
- 20~40%
- 10~20%
- $\leq 10\%$

Water Shortage :
 $(1 - \text{Water supply} / \text{water demand}) \times 100$

World water and sewerage business size (Trillion yen)

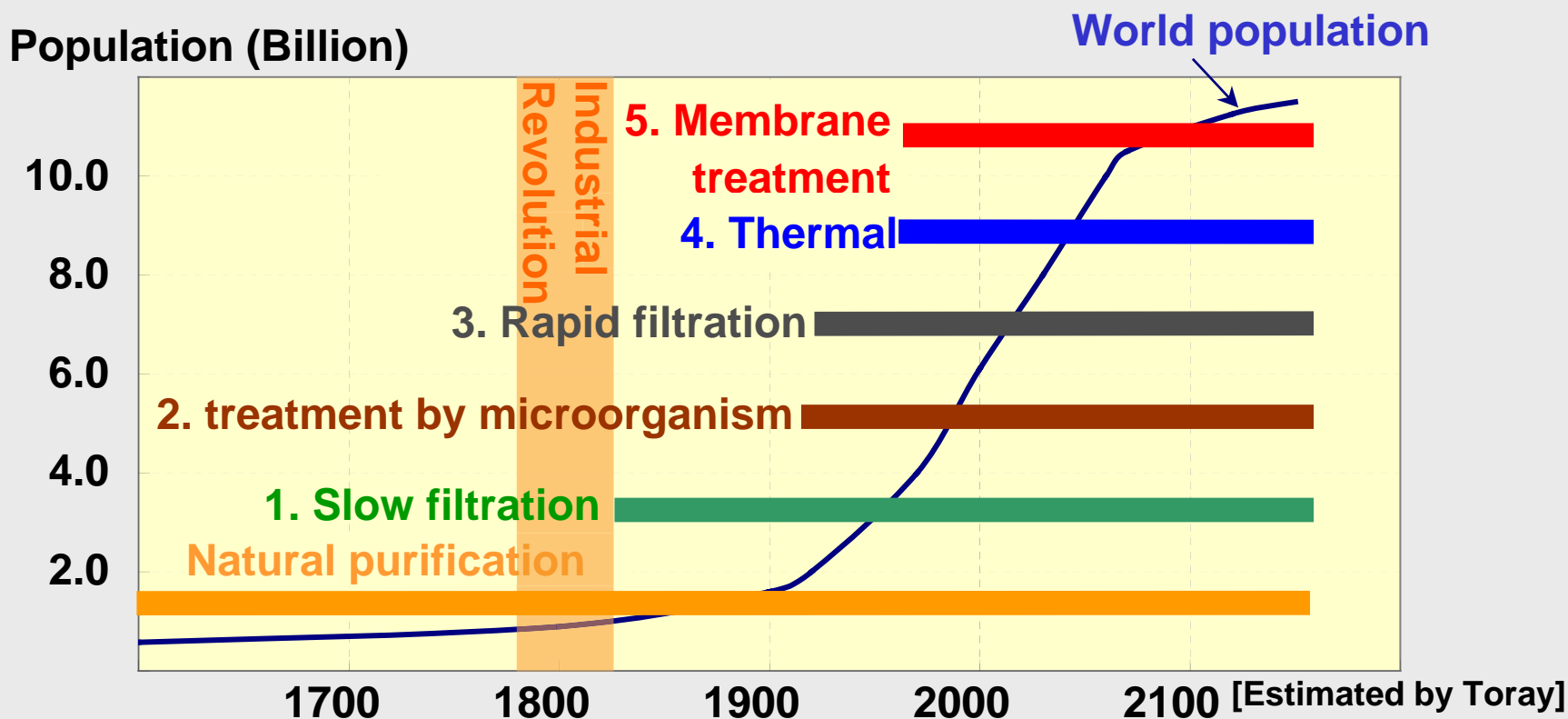


[Estimated by Toray]

Increase demand by 40 trillion Yen

World water and sewerage business size will increase by 40 trillion yen over 20 years

Increase of World Population and Development of Water Treatment Technologies



Difficult to secure quantity and quality of water **only by natural purification** due to the rapid increase of population



Membrane technology, which **enable precise control of water quality and high speed treatment**, is essential in 21st century

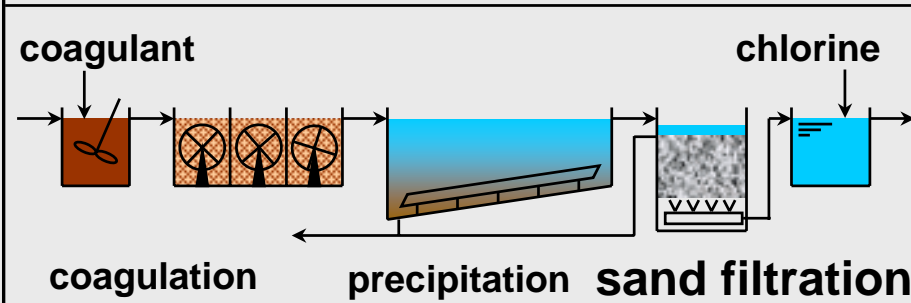
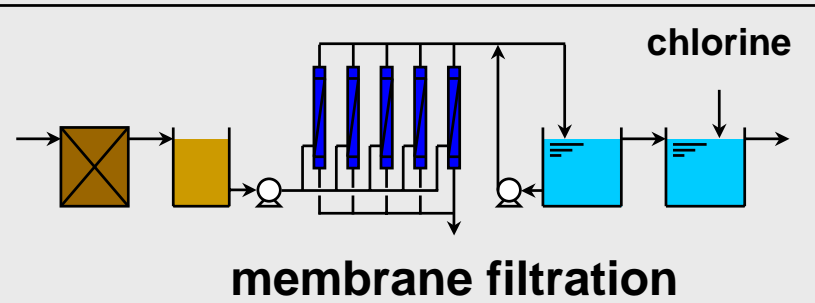
Water Treatment Business Market and Target Areas for Toray Group

[Estimated by Toray]

		Main companies		Toray- G Business Area		Market size (2025)
		World	Japan	Present	Target	
Water service (water /sewerage)	Management (possession of property)	Public	Public			100 trillion yen
	Operation (operation & maintenance)	Veoria G Suez G Thames G				
Engineering Procurement & Construction (EPC)	Construction		MHI Hitachi Zosen			10 trillion yen
	Engineering		Kurita Organo			
Equipment / Materials supply	Equipment	GE, Dow				1 trillion yen
	Chemicals					
	Membrane	Dow, US Filter	Toray, Asahi			

By utilizing membrane business, develop business in **equipment facilities, chemicals, engineering and operation & maintenance areas**

Why Membrane Processing Method is Required?

Conventional Process (Ex. Rapid filtration)		Membrane Process	
 <p>coagulation precipitation sand filtration</p>		 <p>membrane filtration</p>	
Problems	difficult to manage the operation on the feed water quality Ex) Cryptosporidium (protozoa)	Characteristics	Possible to secure good water despite the fluctuation of quality of water
	cumbersome operation and maintenance insufficient technicians		Possible to operate automatically
	difficult to secure land		Small-footprint

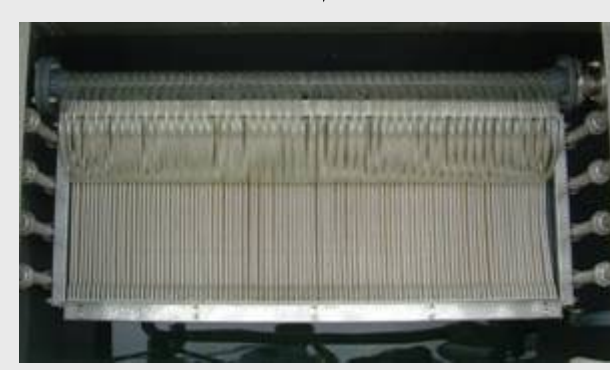
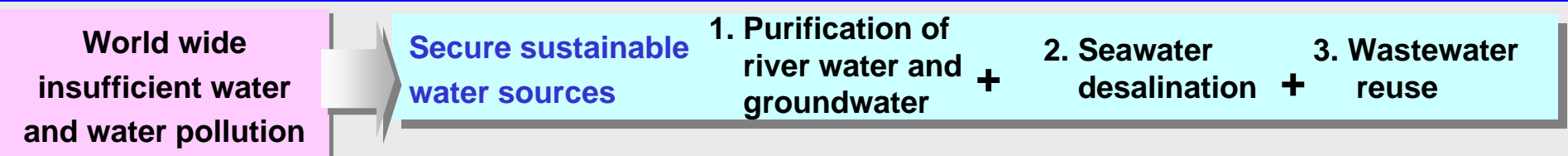
◆ Remove pathogenic microorganisms very well

(high quality and safe processed water)

◆ Compact facilities and fast processing (suitable for decentralize processes)

Membrane process makes possible water treatment which are suitable for any targets and regional conditions and to **secure safe water** with **low environment load**

Practical Use Fields of Membranes



Hollow Fiber MF membrane

RO (Reverse Osmosis) membrane

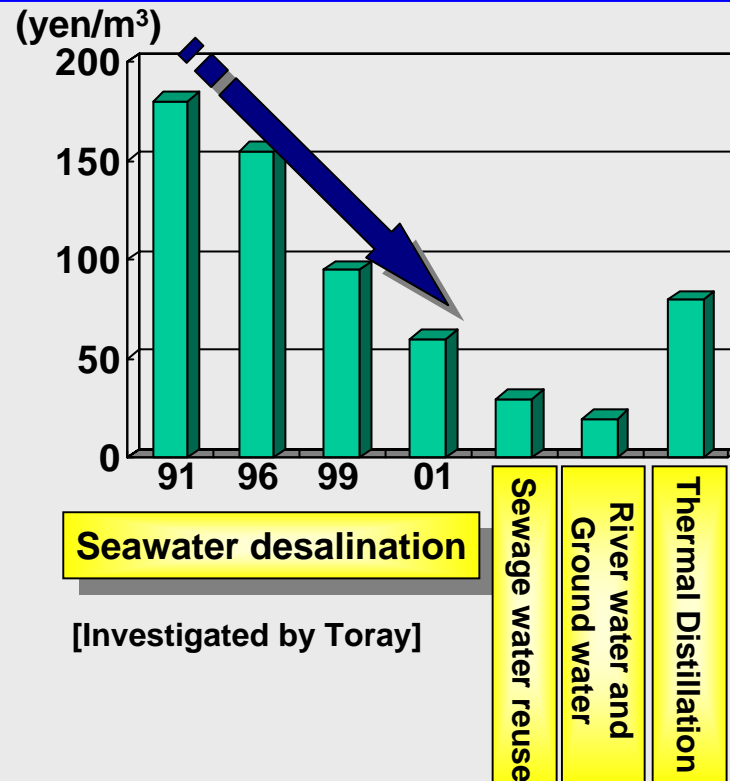
Immersed membrane for MBR

Processed water is utilized for drinkable, industrial and agricultural use

Water Production Costs by Membrane Processing

Water Production Costs by Membrane Processing

Water Production Method	Water production costs (yen/m ³)
Purification of river water and ground water (MF membrane)	20~30
Sewage water reuse (MF+RO membrane)	20~40
Seawater desalination (RO membrane)	60~80
(Ref.) Seawater desalination (Thermal Distillation)	90~140



Seawater desalination

[Investigated by Toray]

(Reference) World consumer prices of water

Type of Water	Supply price (yen/m ³)
Tap water (*)	10~700
Industrial water (*)	10~70
Ultra pure water	500~1000
Bottled water	20,000~300,000

*The consumer prices of tap water and industrial water reflect delivery costs and service costs besides production costs. However, the prices are decided with policy and are not necessarily calculated with actual costs.

Development of **membrane technologies** and **process technologies** decreased water production cost of membrane process (especially seawater desalination), and became competitive.

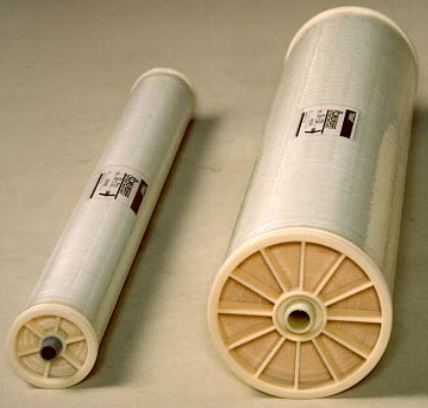



Membrane Manufacturers in the World

[Investigated by Toray]

		RO	NF	UF	MF	MBR
Overseas	DOW / Filmtec (US)	◎	◎			
	Koch (US)	◎	△	○	○	○
	Zenon (Canada)			◎		◎
	US Filter (US)				◎	○
	Norit (Netherlands)			◎		○
Japanese	Toray	◎	○	○	○	○
	Nitto Denko /Hydranautics (US)	◎	◎	○		
	Toyobo	○		△	△	
	Daicel Chemical	○		○		
	Asahi Chemical / Pall (US)			○	◎	○
	Mitsubishi Rayon				○	○
	Kubota					◎

◎ :High share product ○ :product in the market △ :under development

Toray's Membrane Products

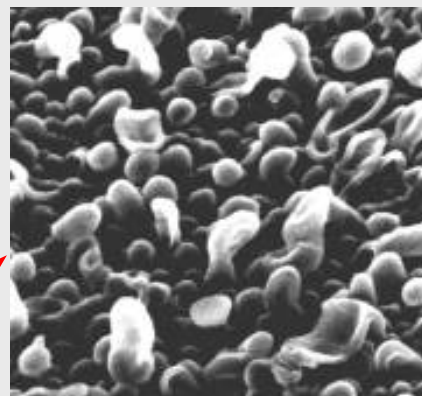
Types	RO/NF membrane	UF/MF membrane	Immersed membrane for MBR	Torayvino*
Appearance of product				
Removable material	Ion, Dissolved organic matter	Suspended solid, Bacteria, Virus	Activated sludge	Wastes, rust Residual chlorine, Lead
Application	Seawater desalination, Brackish water desalination Wastewater reuse, Ultra pure water production	Drinking water production, Treatment of wastewater, Pre-treatment for RO membrane, Industrial process water production	Treatment and reuse of wastewater	Home water purifier

RO (Reverse Osmosis) Membrane

Feed Water

Separation membrane

Crosslinked aromatic polyamide
200 nm



200 nm

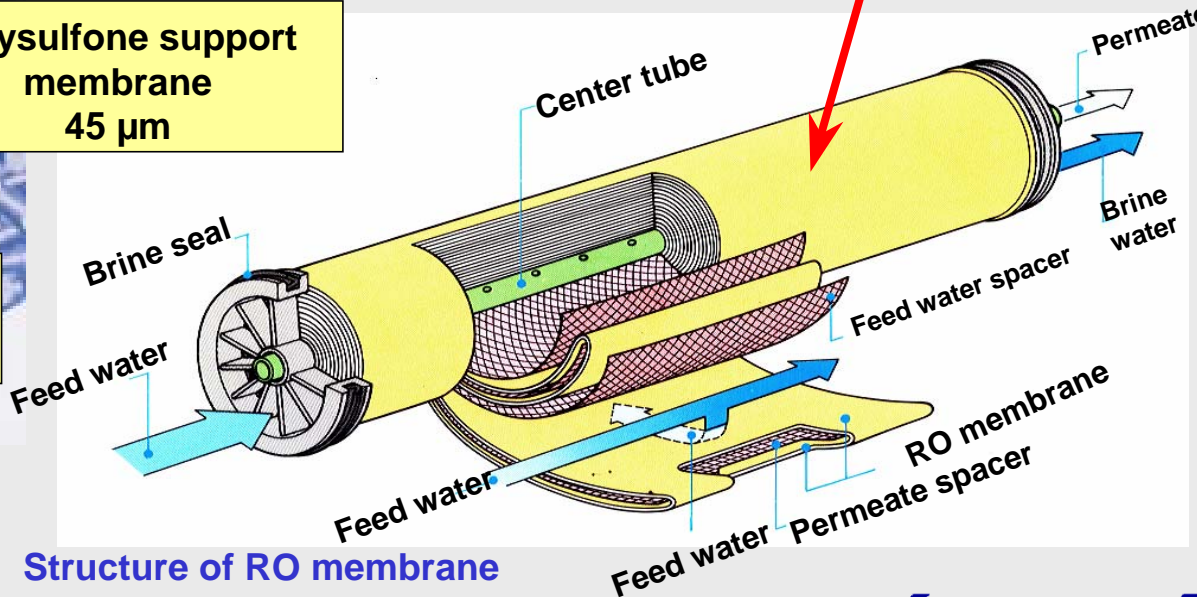
Surface structure of RO membrane



Polysulfone support membrane
45 μm

Polyester non-woven fabric
150 μm

Structure of RO membrane



Structure of RO membrane element

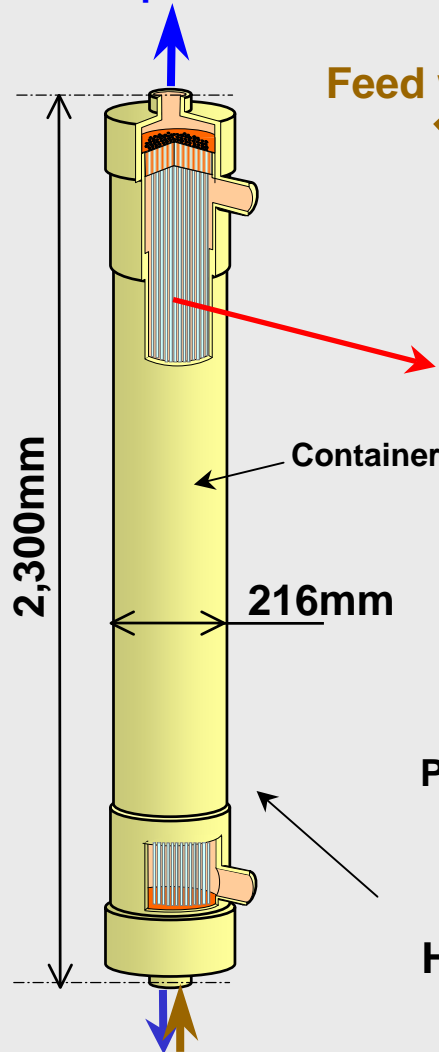
Permeate

Hollow Fiber MF (Microfiltration) Membrane



Water purification plant by membrane treatment

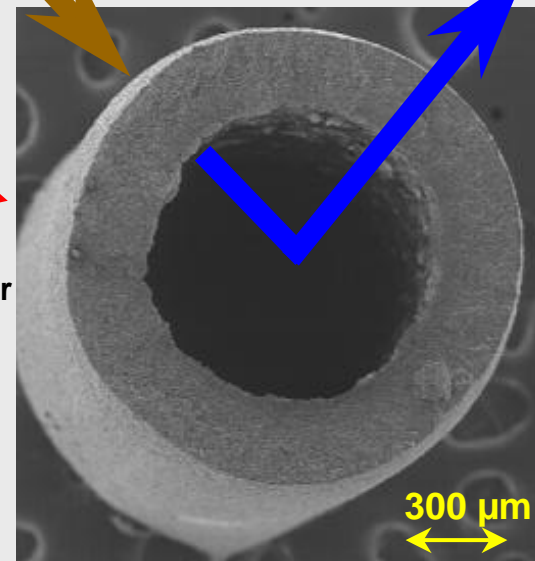
Membrane permeate water



Discharged water Feed water

Feed water

Membrane permeate water

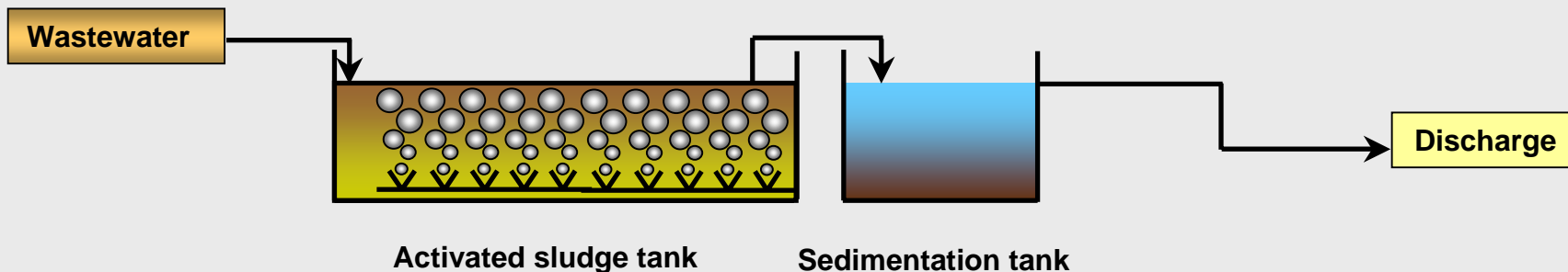


PVDF Hollow Fiber MF membrane

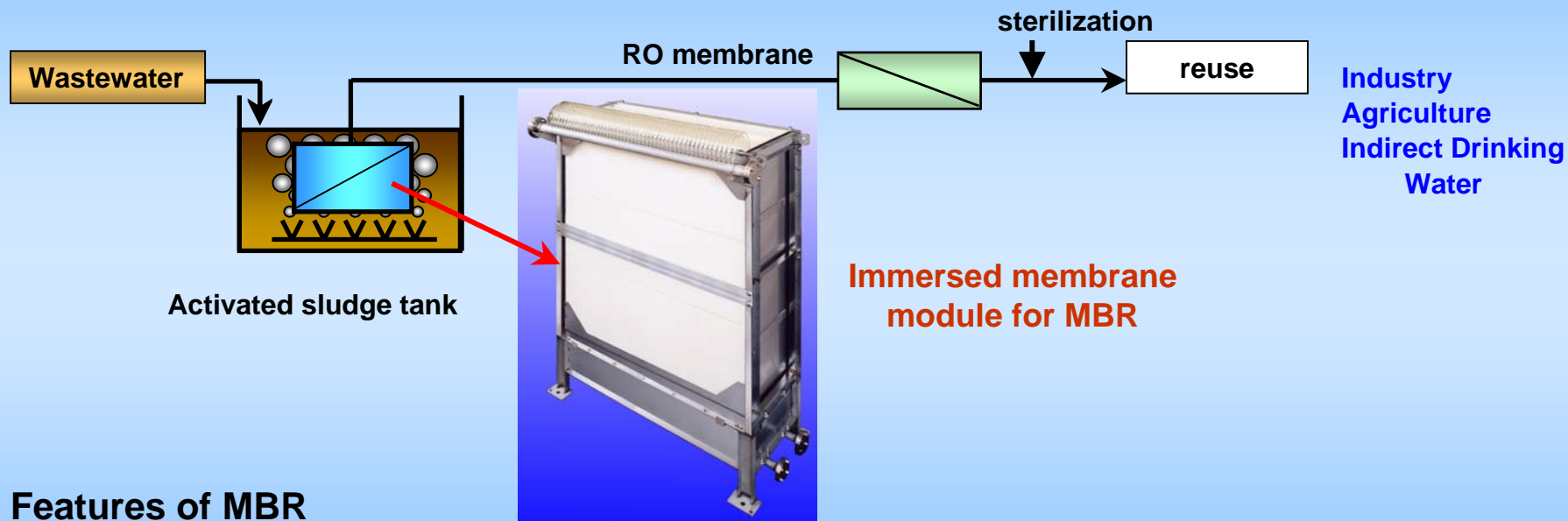
Hollow Fiber membrane module

Immersed Membrane for MBR

Conventional activated sludge method



MBR (Membrane Bioreactor, membrane separation activated sludge method)



Features of MBR

- (1) Good quality of permeate water
- (2) small footprint
- (3) Wastewater reuse by combination with RO

Home Water Purifiers, Torayvino*

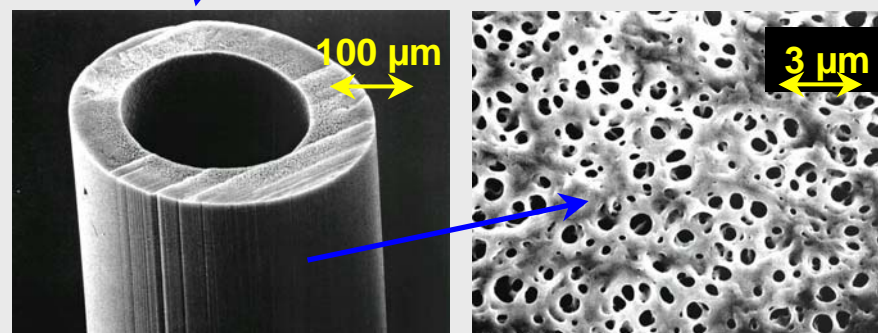
- Removes the micro level dirt, bacteria, and red rust mixed in drinking water through MF Hollow Fiber membrane
- Removes chlorine and mold odor through simultaneous use of granular activated carbon



Directly tap-connected water purifier



Inside cartridge (observation window)



PS Hollow Fiber MF membrane Surface structure of membrane

Large scale Seawater Desalination RO Plants in the World

	Country	Plant Site	Capacity* (m ³ /d)	Operation	RO membrane manufacturer
1	Israel	Ashkelon	272,520	2005	Dow
2	UAE	Taweelah	227,300	(2009)	(to be determined)
3	Saudi Arabia	Rabeeg	205,000	(2008)	Toyobo
4	Algeria	Hamma	200,000	(2006)	Toray (informally appointed)
5	California, USA	Huntington Beach	190,000	(2006)	Hydra
6	UAE	Fujairah	170,000	2003	Hydra
7	Trinidad and Tobago	Point Lisas	136,000	2002	Toray
7	Singapore	Tuas	136,000	2005	Toray
9	Australia	Perth	130,000	(2006)	Dow
10	Saudi Arabia	Yanbu	128,000	1998	Toyobo
11	Spain	Carponeras	120,000	2001	Hydra
12	Saudi Arabia	Jeddah	113,600	1994	Toyobo
13	Florida, USA	Tampa Bay	95,000	(2006)	(to be determined)
14	Israel	Palmachim	92,250	(2006)	Toray
15	Saudi Arabia	Al Jubail	91,000	2000	DuPont** / Toray (25%)

*10,000m³/d of water is equivalent to daily life water of 40,000 people

** DuPont withdrew from RO business in 2001

[Investigated by Toray]



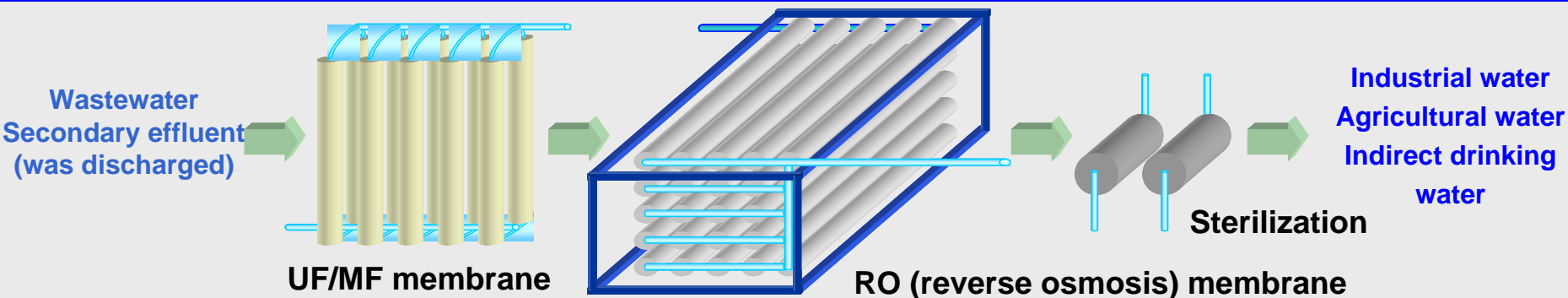
Largest Seawater Desalination Plant in the Asia-Pacific Region - Tuas, Singapore



Photo credit : Hyflux (Singapore)

Using Toray's high boron rejection RO membranes
Production capacity is 136,000 m³/day

Large Scale Membrane Treated Wastewater Reuse Plants in the World



	Country	Plant Site	Capacity (m ³ /d)	Operation	UF/MF membrane Manufacturer	RO membrane manufacturer
1	Kuwait	Sulaibiya	320,000	2005	Norit	Toray
2	USA	Fountain Valley	220,000	2007	US Filter	Hydra
3	Singapore	Ulu Pandan	140,000	(2006)	Asahi Kasei	Hydra
4	USA	West Basin	75,000	1997~2001	US Filter	Hydra
5	Singapore	Kranji	40,000	2003	US Filter	Hydra
5	China	Tianjin	40,000	(2006)	US Filter	Dow, Toray
7	Singapore	Bedok	32,000	2003	Zenon	Hydra
8	Singapore	Seletar	24,000	2004	Hyflux	Toray
9	USA	Scottsdale	22,700	1998	US Filter	Koch
10	Australia	Luggage Point	14,000	2000	Pall	Dow

World's Largest Wastewater Reuse Plant Sulaibiya, Kuwait

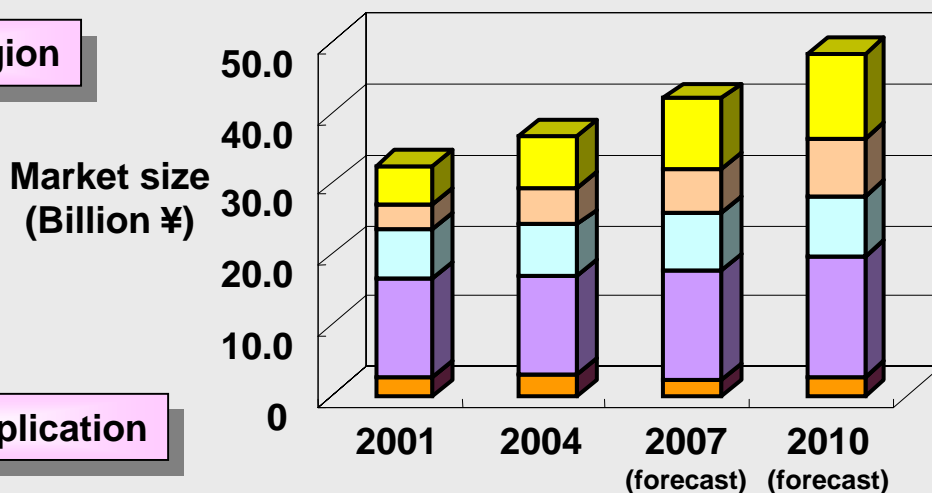


Photo credit : GE-Ionics (USA)

Using Toray's low-fouling RO (reverse osmosis) membranes
Production capacity is 320,000 m³/day

Market Size of RO Membranes

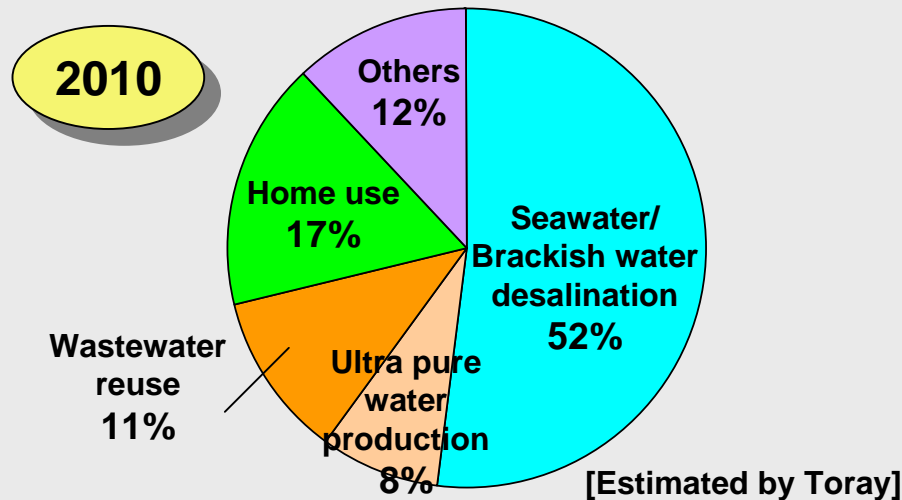
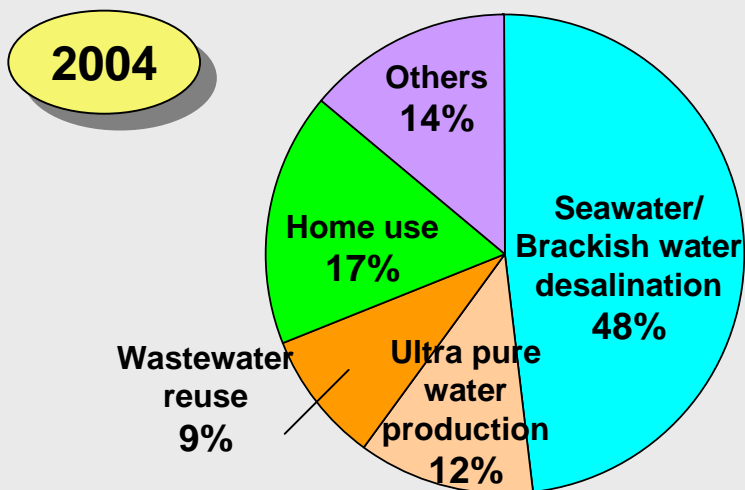
Market by region



Growth rate

Asia	9.4%/yr
Middle East	9.1%/yr
Europe	2.4%/yr
North America	2.3%/yr
Japan	-0.2%/yr

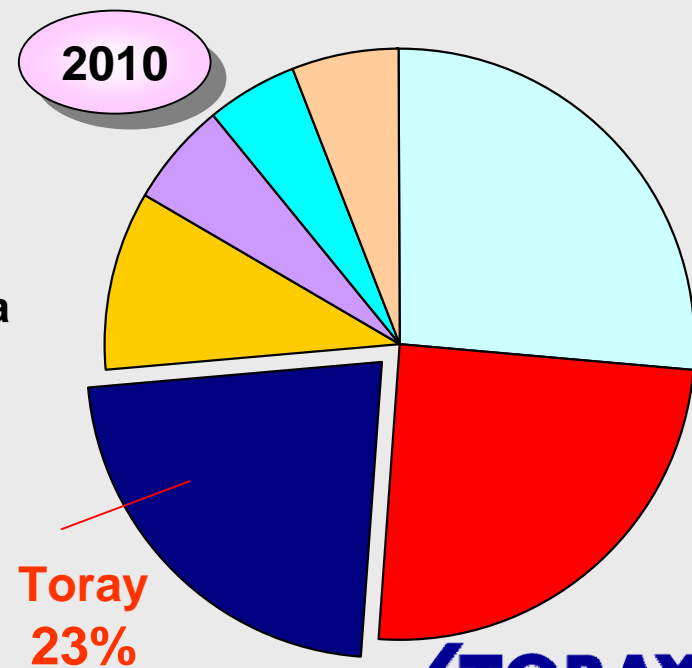
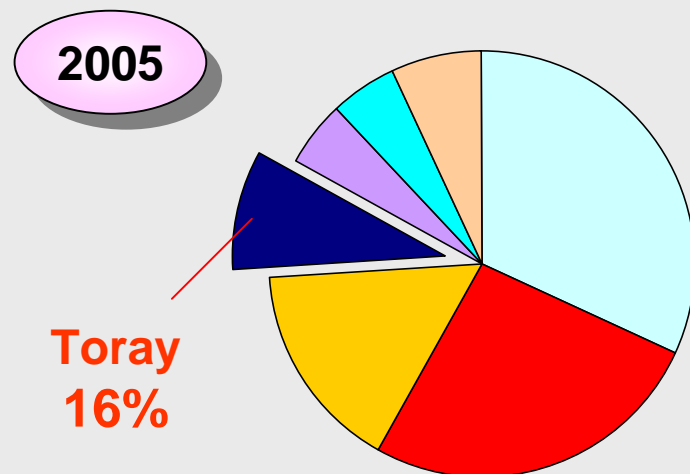
Market by application



Asia and Middle East are predicted to expand by regional factors while seawater / brackish water desalination and wastewater reuses are expected to expand by application.

Business Strategies of RO Membranes

- **Expand business utilizing high performance membrane**
 - Seawater desalination application (high boron rejection membrane)
 - Wastewater reuse (low-fouling membrane)
- **Strengthen marketing competitiveness**
 - Develop global marketing system
 - Strengthen engagement with major engineering-related companies
- **Enlarge marketing area**
 - Arrange bases in USA, Europe, and Middle East
 - Increase personnel and business agents in China
- **Strengthen cost competitiveness**
- **Develop and commercialize new products**



Water Treatment Plants in the World using Toray RO Membrane

KAE Curacao
 <Netherlands, Antilles>
 11,400 (1998)



Mas Palomas
 <Spain, Canary Island>
 13,500 (1985)



Daesan/Hyundai
 <Korea>
 84,000 (1997)



Okinawa *
 <Japan>
 40,000 (1997)



Point Lisas
 <Trinidad and Tobago>
 136,000 (2002)



Tuas
 <Singapore>
 136,000 (2005)



Sulaibiya
 <Kuwait>
 320,000 (2005)



Al Jubail *
 <Saudi Arabia>
 91,000 (2000)



Plant Site
 <Country>
 Capacity (m³/d) (Operation start)

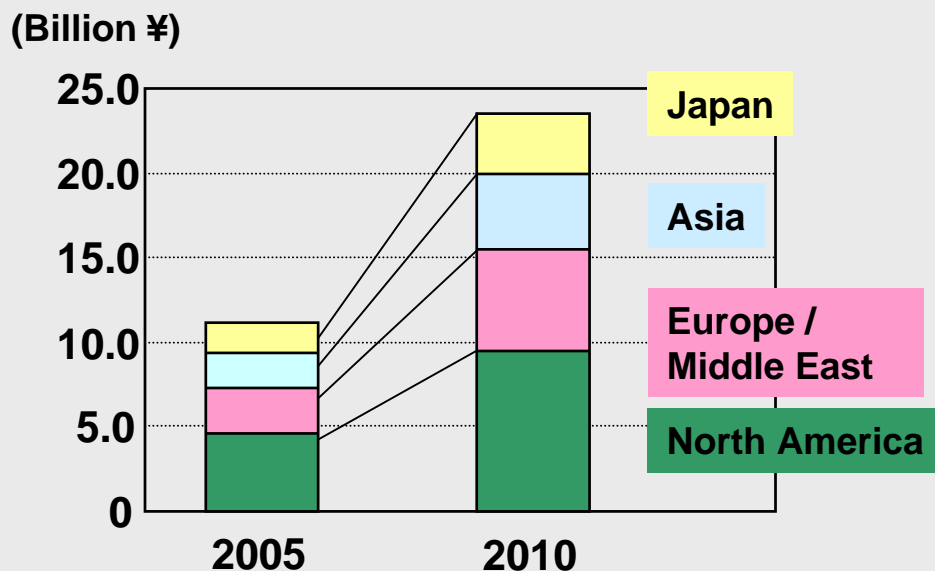
*Joint delivery with other companies
 [Toray research]

Cumulative installation : about 6,400,000 m³/day
 (as of seawater desalination **over 1,000,000 m³/day**)

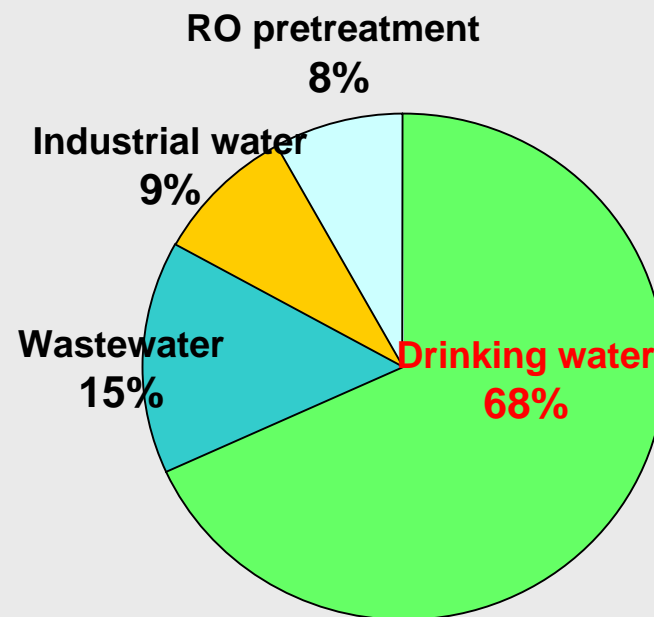
- About 10% of world's seawater desalination RO
- Equivalent to water for daily use of 4,000,000 people

Hollow Fiber UF / MF Membranes Market

Market by region



Market by application (2005)



[Estimated by Toray]

Drastic expansion mainly in USA and Europe
 (annual growth rate : about 15%)
 Drinking water application accounts for about 70%

Superiority of Toray's Hollow Fiber MF Membrane

		A	B	C	D	Toray
Material		PP	PVDF	PES	PVDF	PVDF
Permeability* (m ³ /m ² /day)		4.8	1.5	3.0	5.3	6.7
Membrane area (m ²)		30	56	35	50	72
Test results at overseas water purification plant	Recovery (%)	-	90	-	90	95
	Electric power consumption rate (kWh/m ³)	-	0.38	-	0.31	0.15
	Frequency of chemical cleaning	-	once in 3 months	-	once in 2 months	once in 6 months or more

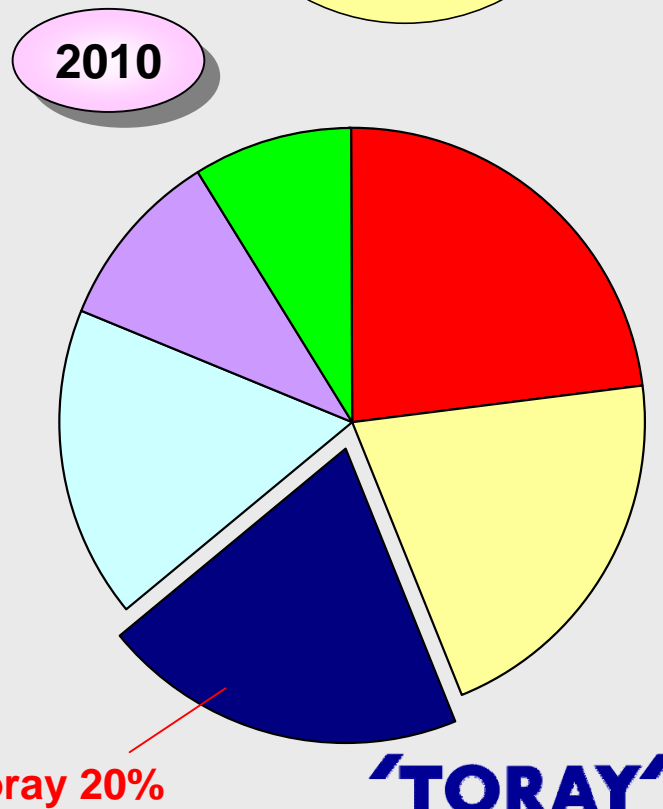
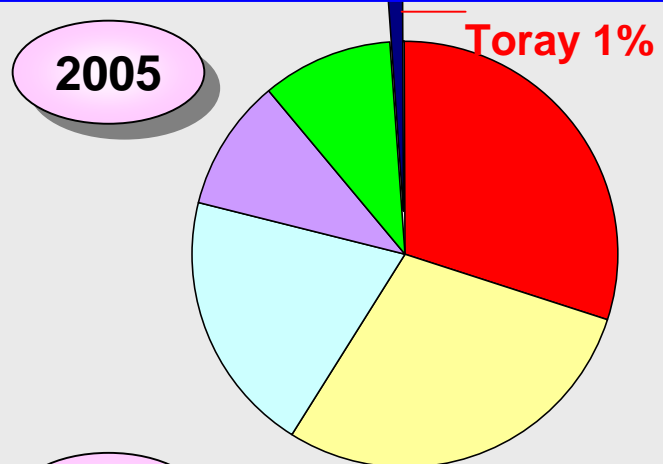
*Test condition : pure water, 50kPa

[Estimated by Toray]

World leading in permeability, stain resistance, durability, and in module size
Evaluated at overseas water purification plants in terms of high recovery rate,
low electric power consumption, and long-term stable operation

Business Strategies of Hollow Fiber UF / MF Membranes

- **Expand sales by utilizing high performance membranes**
- **Enlarge marketing area**
 - North America, Middle East, China
 - Wastewater reuse, industrial water, large size seawater pretreatment
- **Sales expansion in Japan and East Asia**
 - Cooperation with Suido Kiko and Japanese engineering companies
 - Involvement in East Asia development project of drinking water treatment technologies
- **Increase production capacity**
- **Commercialization of new product**



Major Water Treatment Plants using Toray MF Hollow Fiber Membrane

Ohio (USA)
for boiler water
RO pretreatment
3,300 (2004)



Ishikawa
drinking water
5,000 (2002)



Ishikawa
drinking water
8,000 (2003)



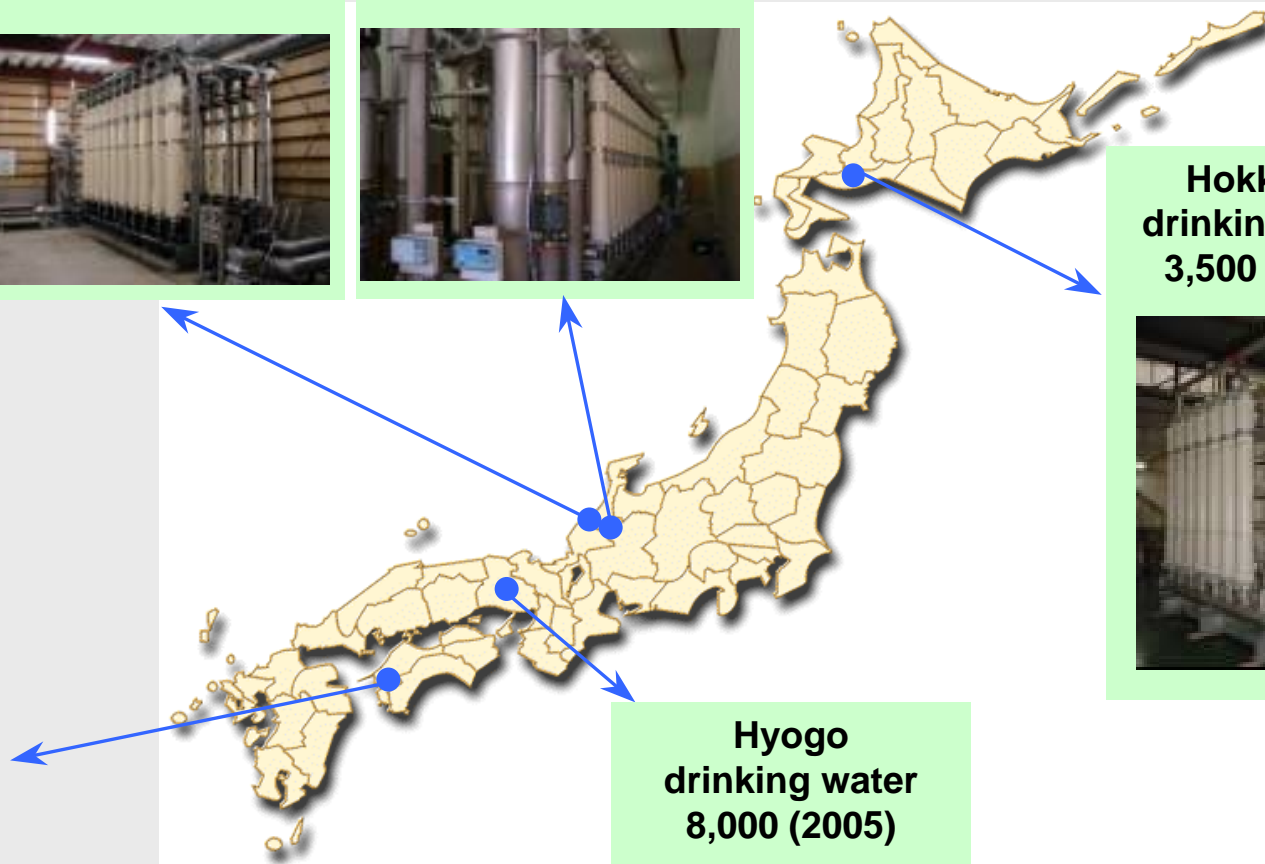
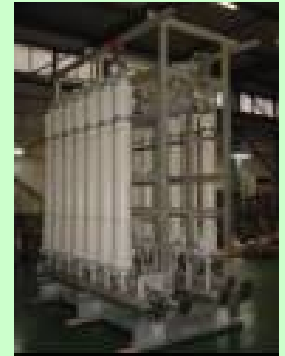
Ohio (USA)
for boiler water
RO pretreatment
3,200 (2004)



Ehime
for seawater
desalination
RO pretreatment
2,700 (2003)

Hyogo
drinking water
8,000 (2005)

Hokkaido
drinking water
3,500 (2003)

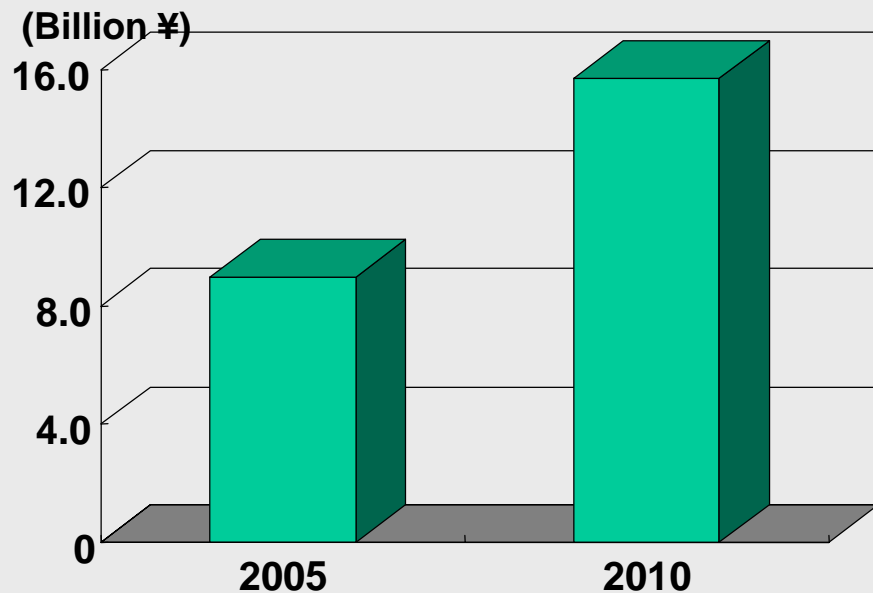


Plant site	Application	Capacity (m ³ /day)	(Operation start)
Ohio (USA)	for boiler water RO pretreatment	3,300	(2004)
Ishikawa	drinking water	5,000	(2002)
Ishikawa	drinking water	8,000	(2003)
Ohio (USA)	for boiler water RO pretreatment	3,200	(2004)
Ehime	for seawater desalination RO pretreatment	2,700	(2003)
Hyogo	drinking water	8,000	(2005)
Hokkaido	drinking water	3,500	(2003)

[Investigated by Toray]

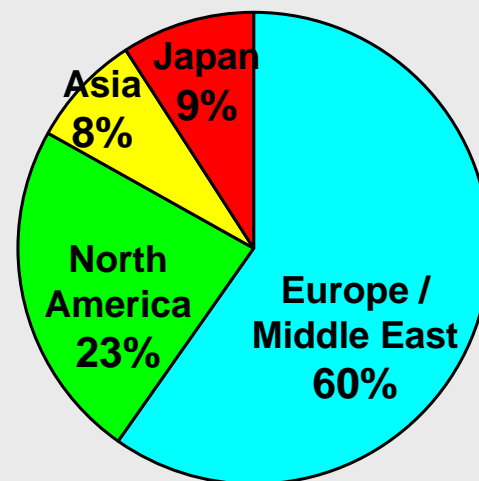
Market of Immersed Membrane for MBR

Market size



Annual growth by about 15%

Market by region (2005)



[Estimated by Toray]

Europe, Middle East, North America accounts for about 80%

MBR is highly evaluated for its good water quality, small footprint, and ability to reduce excess sludge.

The market is yet undeveloped

Superiority of Toray's Immersed Membrane for MBR (1) Comparison in Spec.

	A	B	Toray
Membrane type	Hollow Fiber membrane	Flat sheet membrane	Flat sheet membrane
Material	PVDF	PVC	PVDF
Pore size(μm)	0.04	0.4	0.08
Permeability* ($\text{m}^3/\text{m}^2/\text{day}$)	0.45	0.6	0.75
Flux per-module footprint ($\text{m}^3/\text{day}/\text{m}^2$)	170	103	233
External cleaning	necessary	unnecessary	unnecessary

*actual operation

[Estimated by Toray]

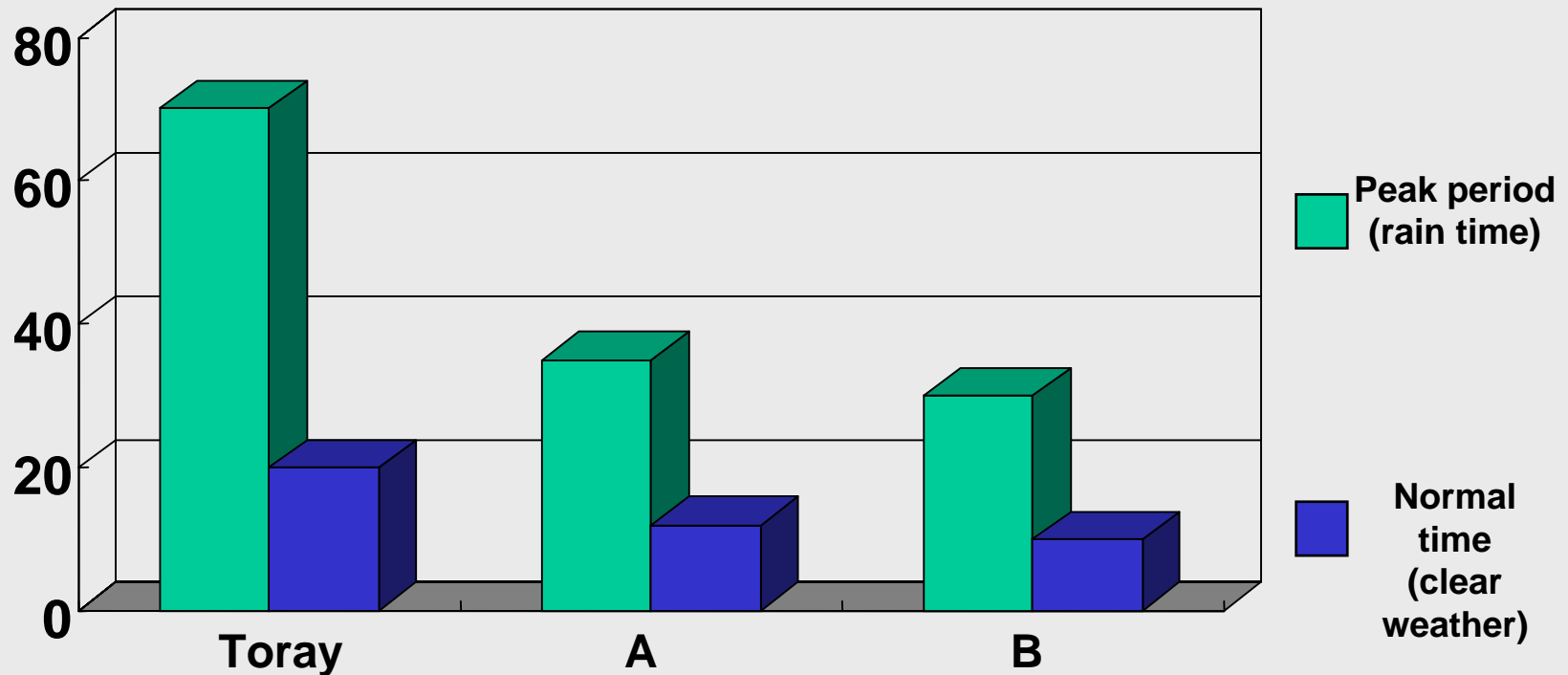
Toray MBR is high-durability, high-permeability and less clogging.

Superiority of Toray's Immersed Membrane for MBR

(2) Comparison in permeability

Test results at Beverwijk (Netherlands) sewage-treatment plant (2003)

Permeability*
(L/m²/time)

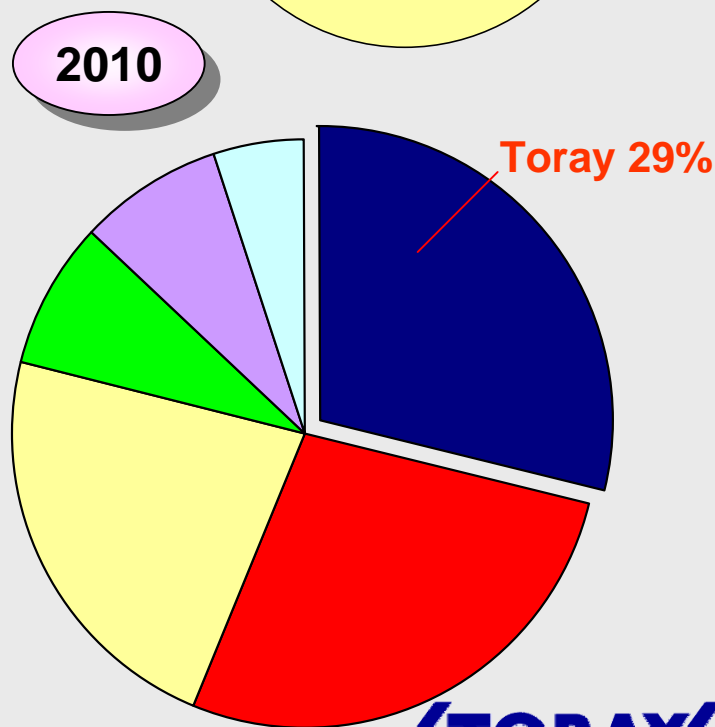
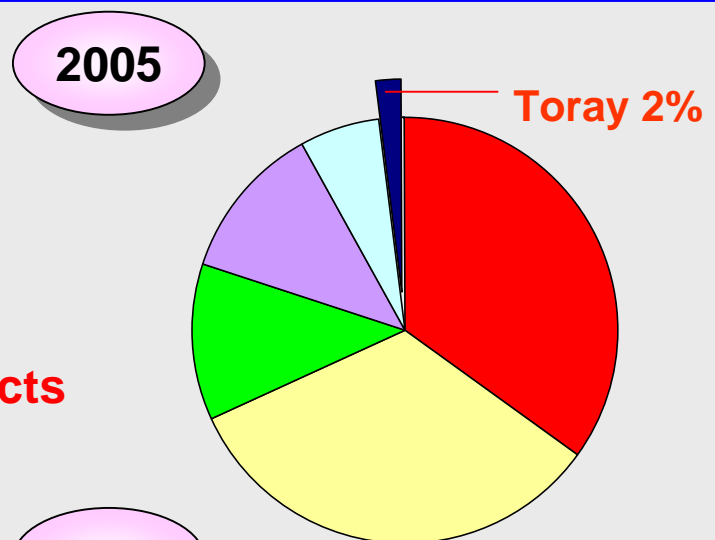


*actual operation

Toray MBR offers twice the permeability proven by direct comparison to others.

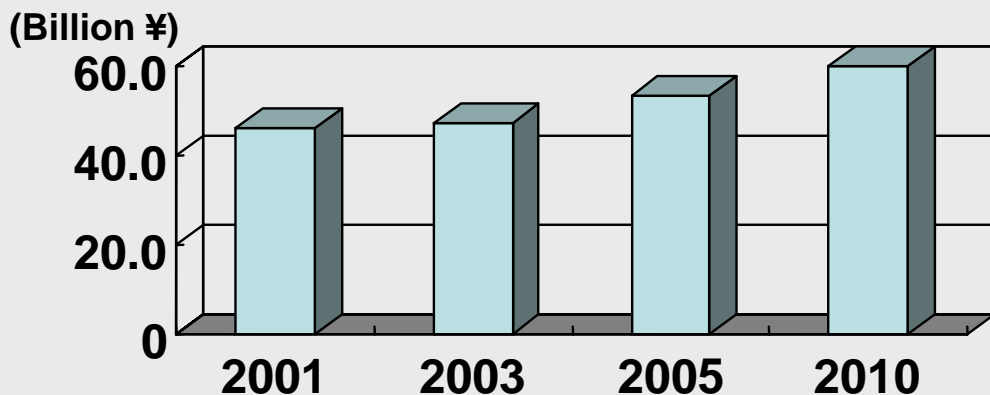
Business Strategies of Immersed Membrane for MBR

- Expand sales by utilizing high performance immersed membrane elements
- Win orders of large wastewater treatment projects (size over 10,000 m³/day)
- Strengthen marketability in Europe, USA, and the Middle East
- Increase production capability



Market of Home Water Purifiers (in Japan)

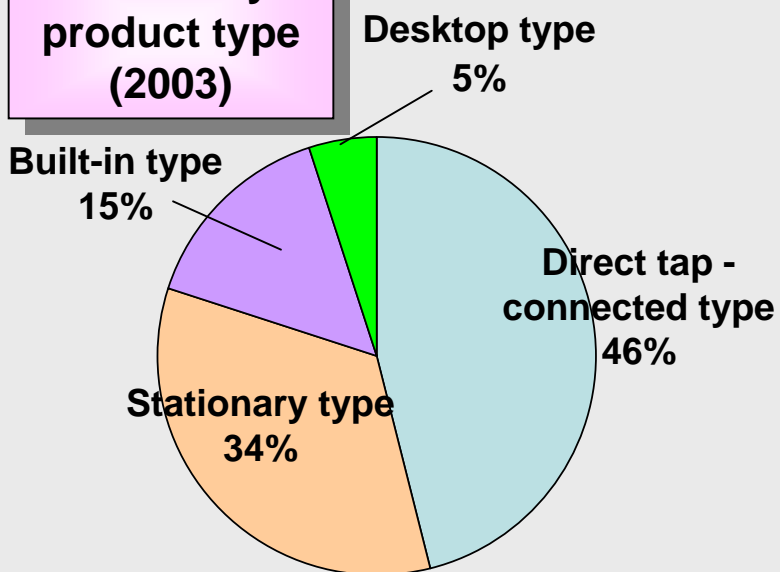
Market size



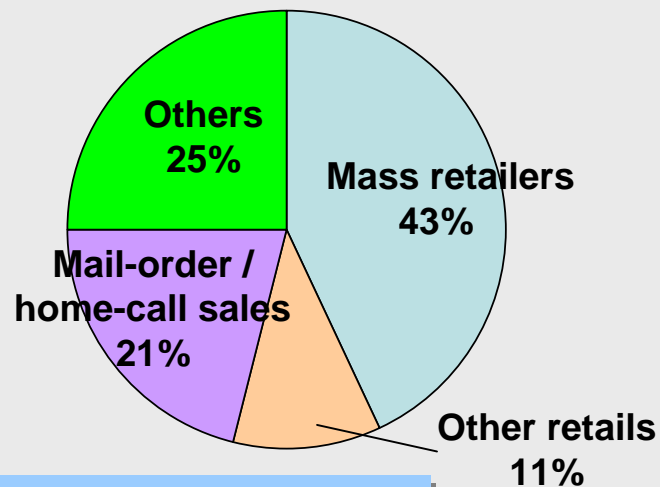
The market is expanding

[Estimated by Toray]

Market by product type (2003)



Market by market channel (2003)



Product types and market channels are becoming diversified

Business Strategies of Torayvino*, Home Water Purifiers



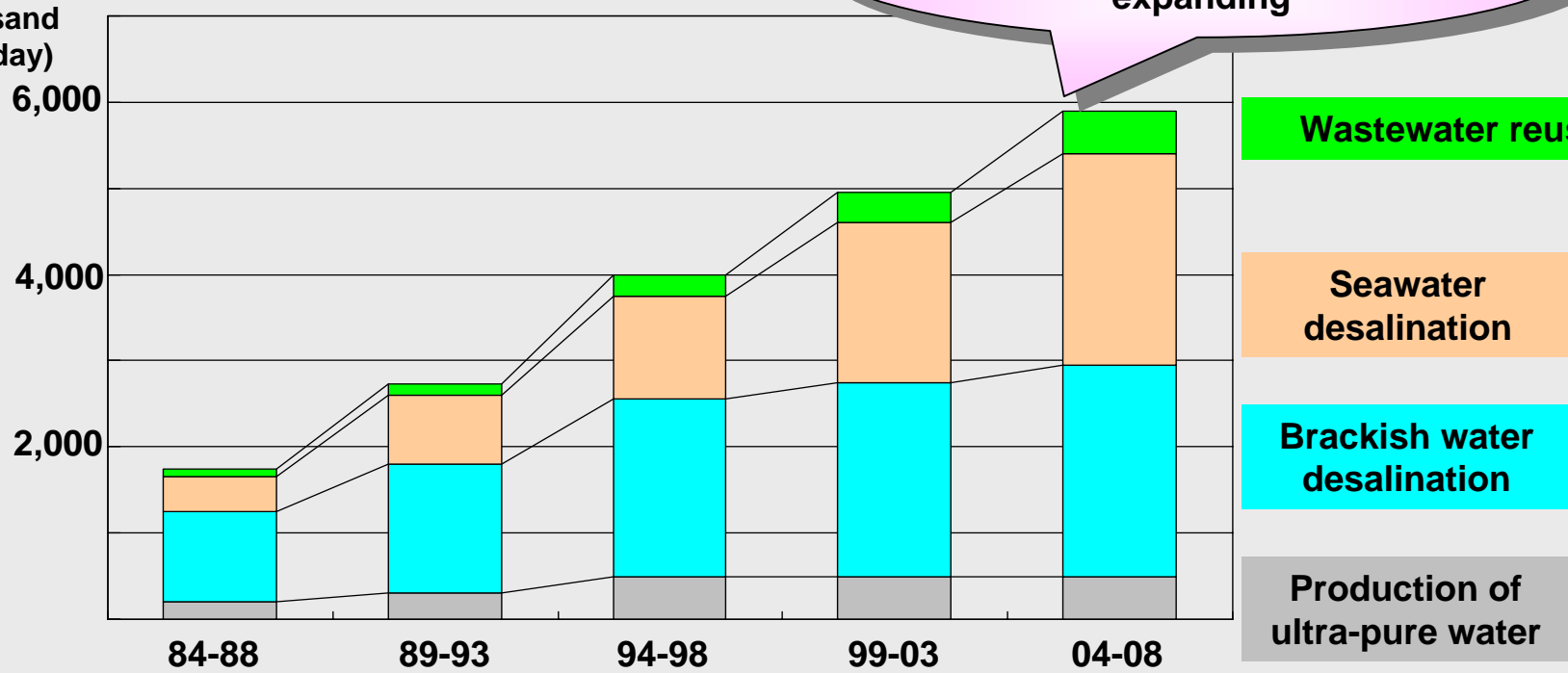
- **Increase share in the retailer market which is the revenue base**
 - Expand sales for general supermarkets, DIY stores, home appliance retailers, and camera retailers
 - Strengthen product lineups other than current mainstay item, the direct tap-connected type
- **Sales expansion to market channels other than retailers**
 - Marketing of high-performance products
 - Strengthen sales to department stores, specialty shops, mail-order sales, and home-call sales
- **Advance to overseas market**
 - Develop products equipped with performance and features matching the different water quality conditions of each country
 - Develop global market centering USA and China to include South East Asia and Europe

Market share of
retailers
43% (2003)
→ 48% (2010)

Market in Target of Water Treatment Systems Business

Actual and forecast of RO plant construction by application

Plant capacity
(thousand
tons/day)



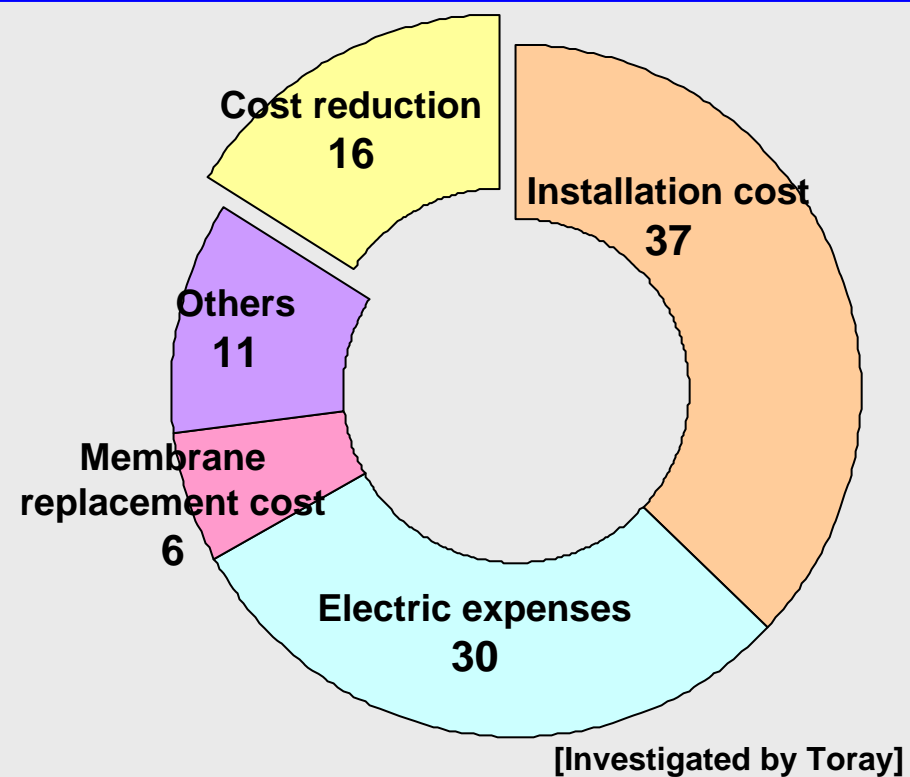
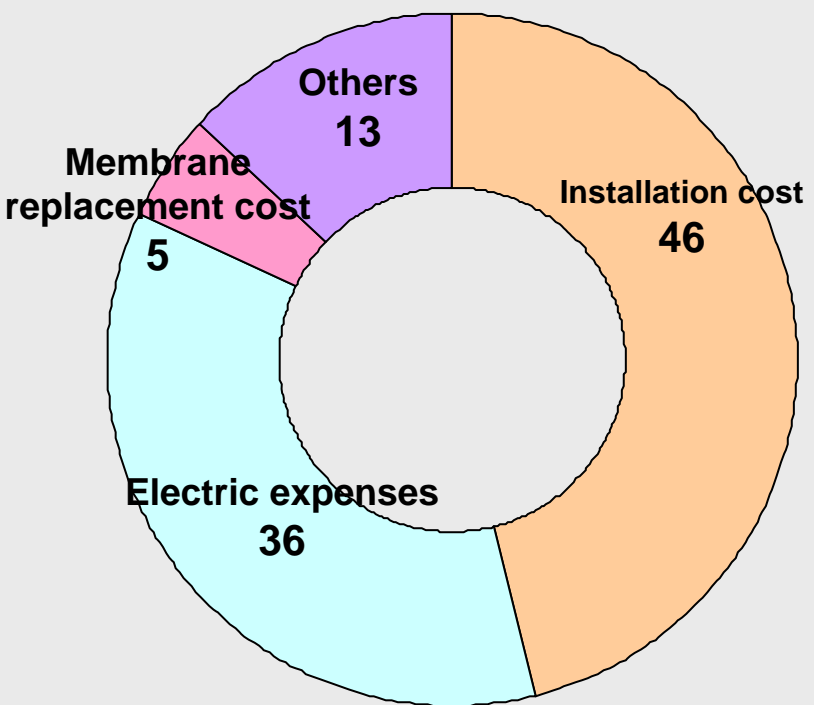
Seawater desalination / wastewater reuse market is expanding

- Wastewater reuse
- Seawater desalination
- Brackish water desalination
- Production of ultra-pure water

[Quote] : IDA data base

Focus on seawater desalination and wastewater reuse where the market is expanding and Toray has advantage.
Focus on the Middle East, China, and South East Asia.

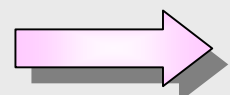
Low Cost Seawater Desalination Process



Conventional seawater desalination process
(recovery : 40%)

Low cost process
(recovery : 60%)

- 1) Development of unique high-recovery process
- 2) Development of highly pressure-resistance RO membrane



Achieved 16% of cost reduction

Business Strategies of Water Treatment Systems

- **Receive orders of large scale seawater desalination**

- **Systems in overseas market**

- Strengthen ability to respond to large EPC matters

- Collaboration with Suido Kiko

- **Develop business in China**

- Utilize local affiliated companies; establish partnership with local engineering companies

- **Strengthen technological competitiveness**

- Strengthen Integrated Membrane System (IMS) technologies
- Strengthen competitiveness in seawater desalination, wastewater reuse market

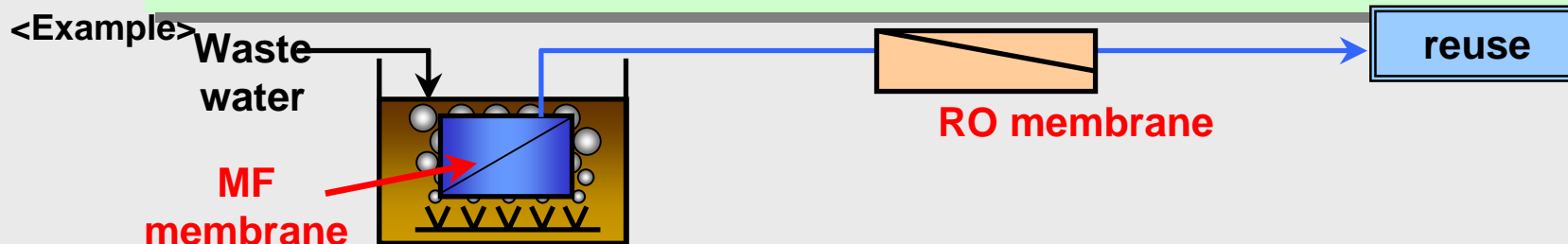
- **Full-scale entry into operation and maintenance business**

EPC :Engineering, Procurement & Construction
(delivery of equipment / construction work on contract)

Merits in IMS and Advantages of Toray's Water Treatment Systems Business

◆ IMS (Integrated Membrane System)

membrane-based water treatment system by combining membranes with dissimilar functions



◆ Merits in IMS :

Removes various substances in the water **through suitable membranes.**



Total system works efficiently **enhancing reliability and cost reduction.**

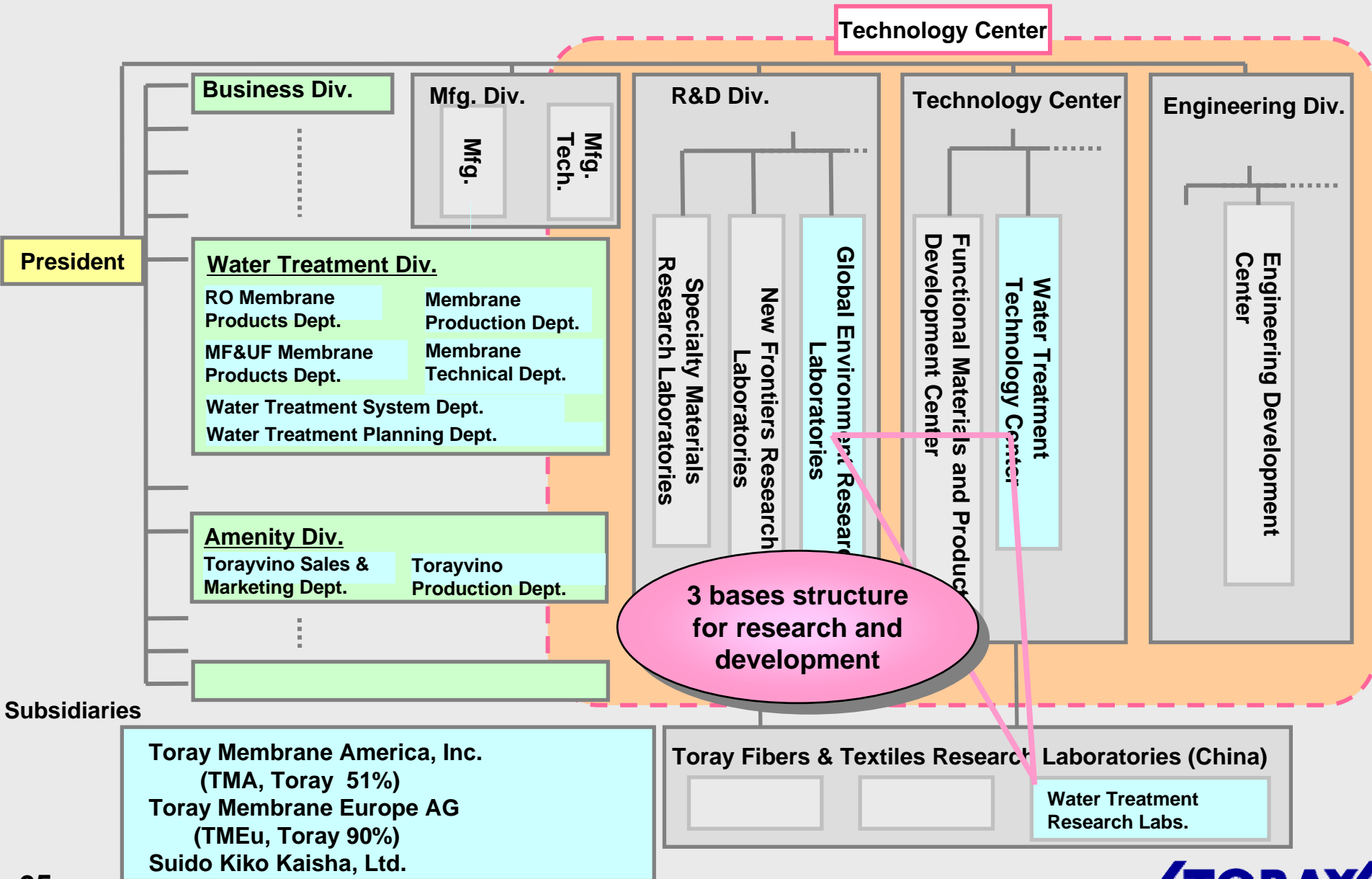
◆ Key points of IMS technologies

Integration of membrane selection (hardware) and operating technologies (software)



Brings out **Toray's strength** who possess all types of membrane and **experience in operating technologies of each membrane**

Research & Development System of Toray's Water Treatment Business



TFRC Water Treatment R&D Laboratories

Toray Fibers & Textiles Research Laboratories (China) Co., Ltd (TFRC)

TFRC

Fibers & Textiles Research Center (Nantong)
Polymer Materials Research Laboratories
(Shanghai)

Water Treatment Research Laboratories (Shanghai)

Operation of Water Treatment Research Laboratories

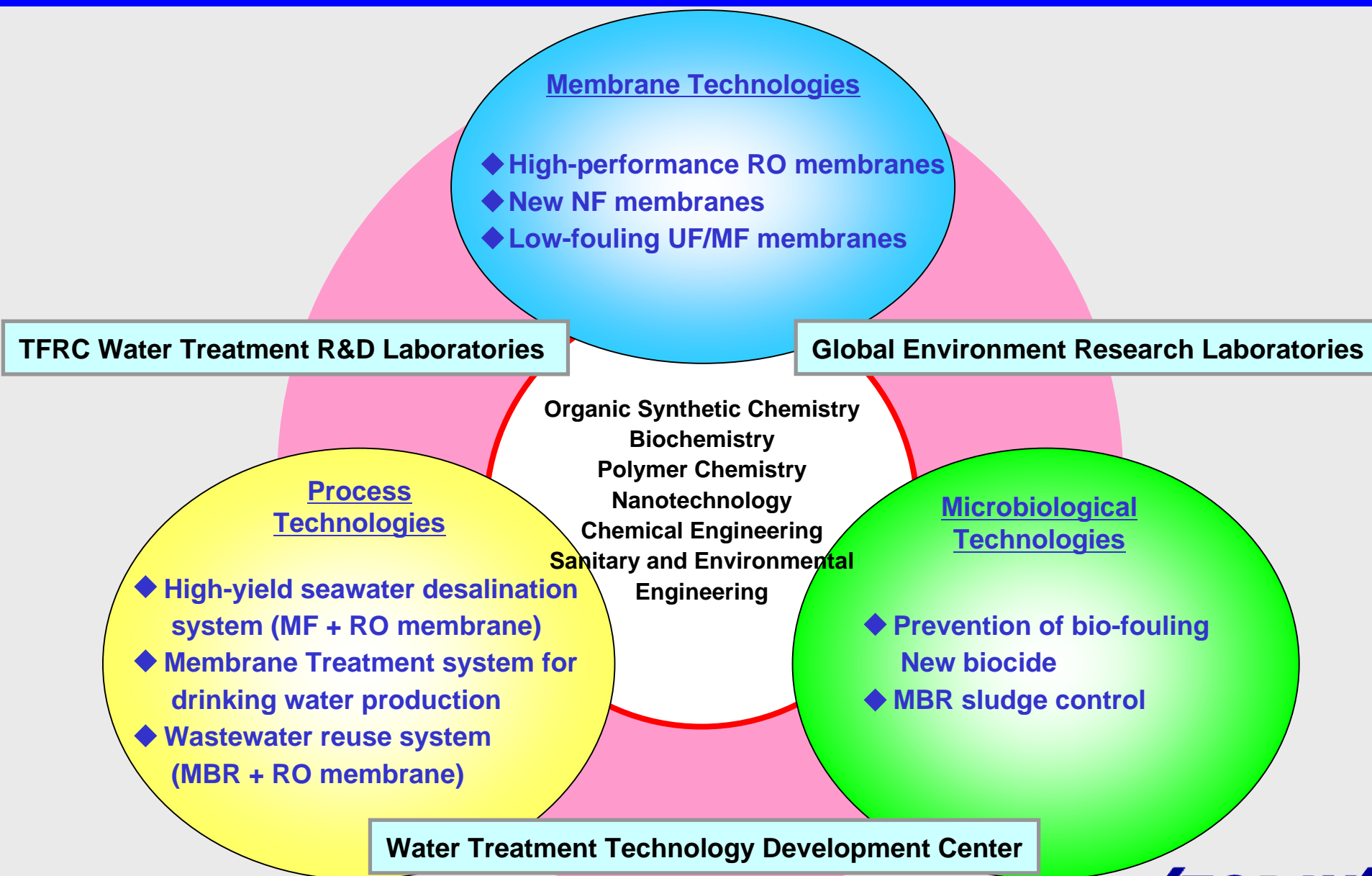
- Funded research from Toray water treatment- related departments (R&D, assistance for technology marketing)
- Collaboration and joint research study with Chinese universities and government research laboratories
- Develop appropriate water treatment systems for China
- Aim to be global base for water treatment research and development, assistance for technology marketing

General Manager, Dr. Yang Yufang

Currently 10 researchers, planned to increase to 20
during FY March/2007



R&D Themes of Water Treatment Business

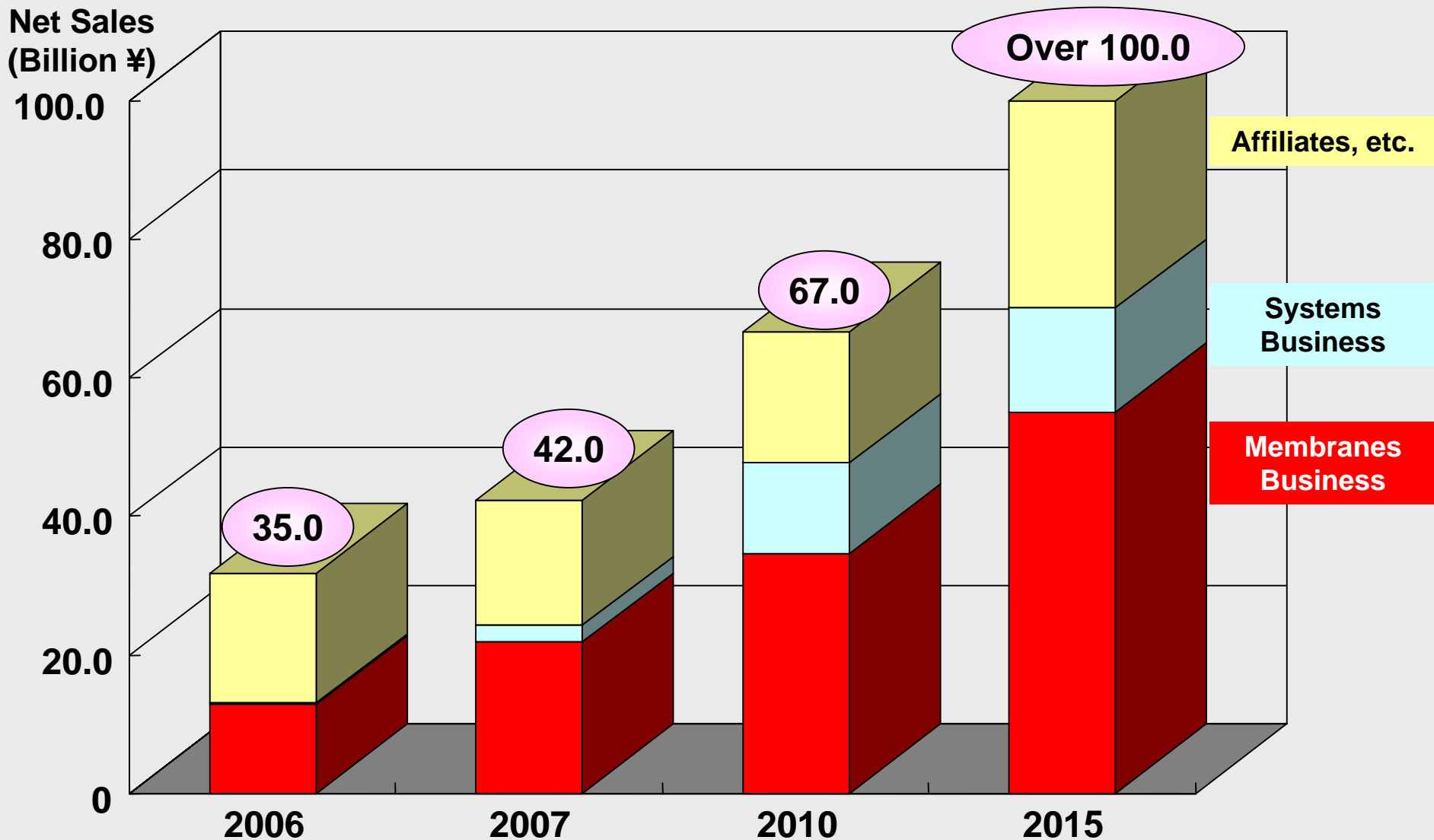


Expansion of Toray's water Treatment Business

- Appeal the high performance membrane products to the global market
 - Focus on seawater desalination system and wastewater treatment
 - Aim for No.1 in membrane business by 2010
- Expand sales of home water purifiers
 - Strengthen product lineups and develop new market
- Expand water treatment systems business
 - Integrate membranes and process technologies
 - Strengthen IMS technologies



Expansion of Toray's Water Treatment Business



**Expand water treatment business
to become the pillar of environment-related business**



Toray's membrane utilizing water treatment technologies will contribute to secure sustainable water resources and environment protection

River, lake, ground water



Sea water



Wastewater



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.