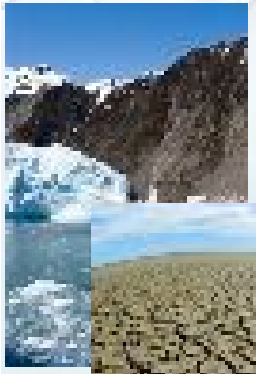
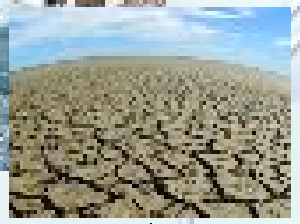
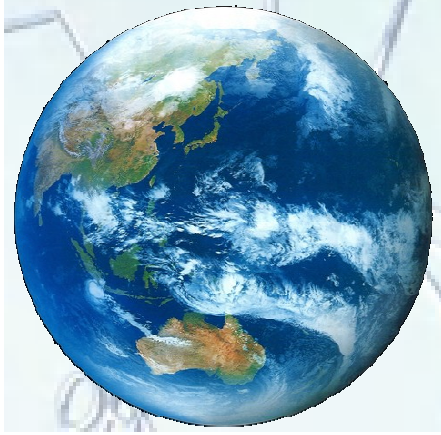
'TORAY'
Innovation by Chemistry

March 25, 2009

<IT-2010 IR Seminar No. 6>

"Toray New Business Strategies focused on the Global Environment"

~ To build a Sustainable Low-Carbon Society ~


Chiaki Tanaka
Executive Vice President and
Representative Director
Toray Industries, Inc.

Contents

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- Global Environmental Issues and Business Climate
- Toray's Approach to Global Environmental Issues
  - Toray Project "EcoChallenge" -
    - Environment Preservation
    - Solutions to Global Environmental Issues
      - Energy Saving, New Energy Resources
      - Biomass
      - Water Treatment
- Conclusion

Global Environmental Issues

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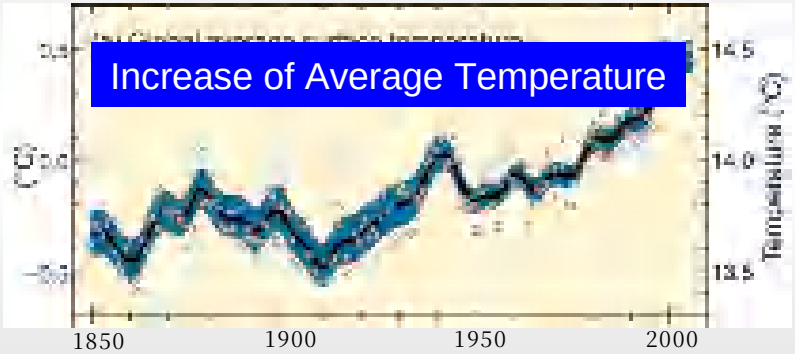
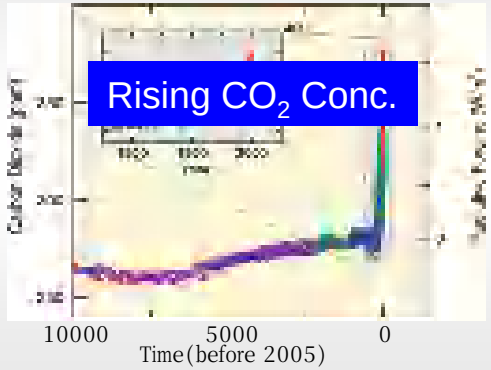
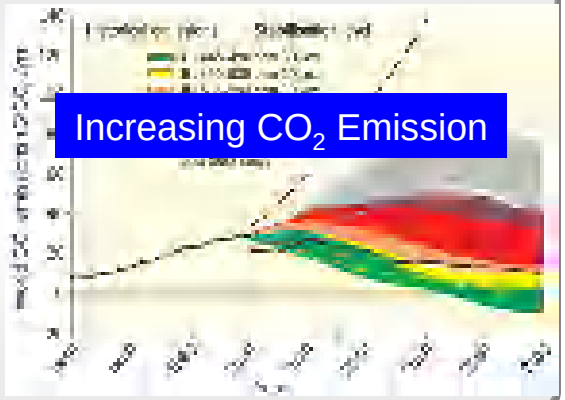
①Global Warming and CO_2 Emission Increase

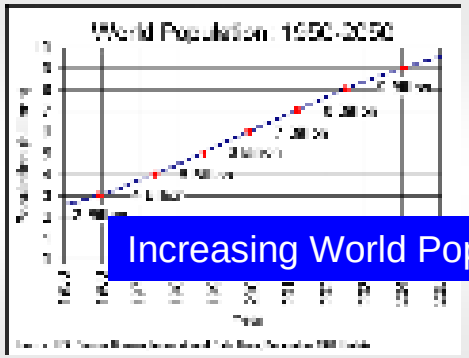
(Source：Climate Change 2007 Synthesis Report)

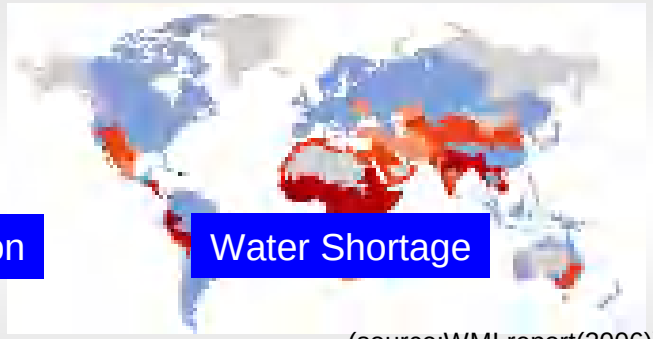






②Global Water Shortage



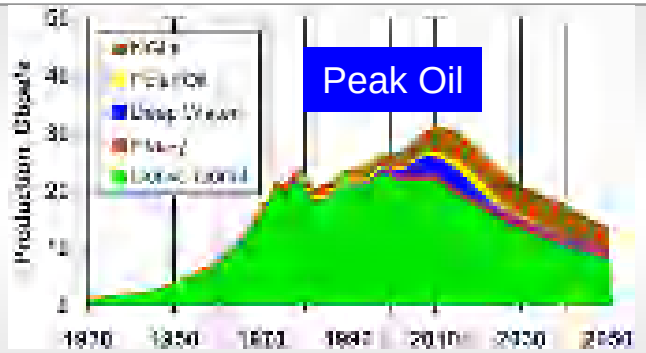


(source:WMI report(2006))

③Depletion of Resources

Resource	Proven Reserves	R/P Ratio
Oil	1,188.6Gbarrel (2004)	40.5
Coal	909.064Gt (2004)	164
Natural gas	179Tm3 (2004)	66.7
Uranium	4.59Mt (2003)	85

Depletion of Natural Resource



(Source：C.J.Campbell et al,ASPO(2004))

Business Climate

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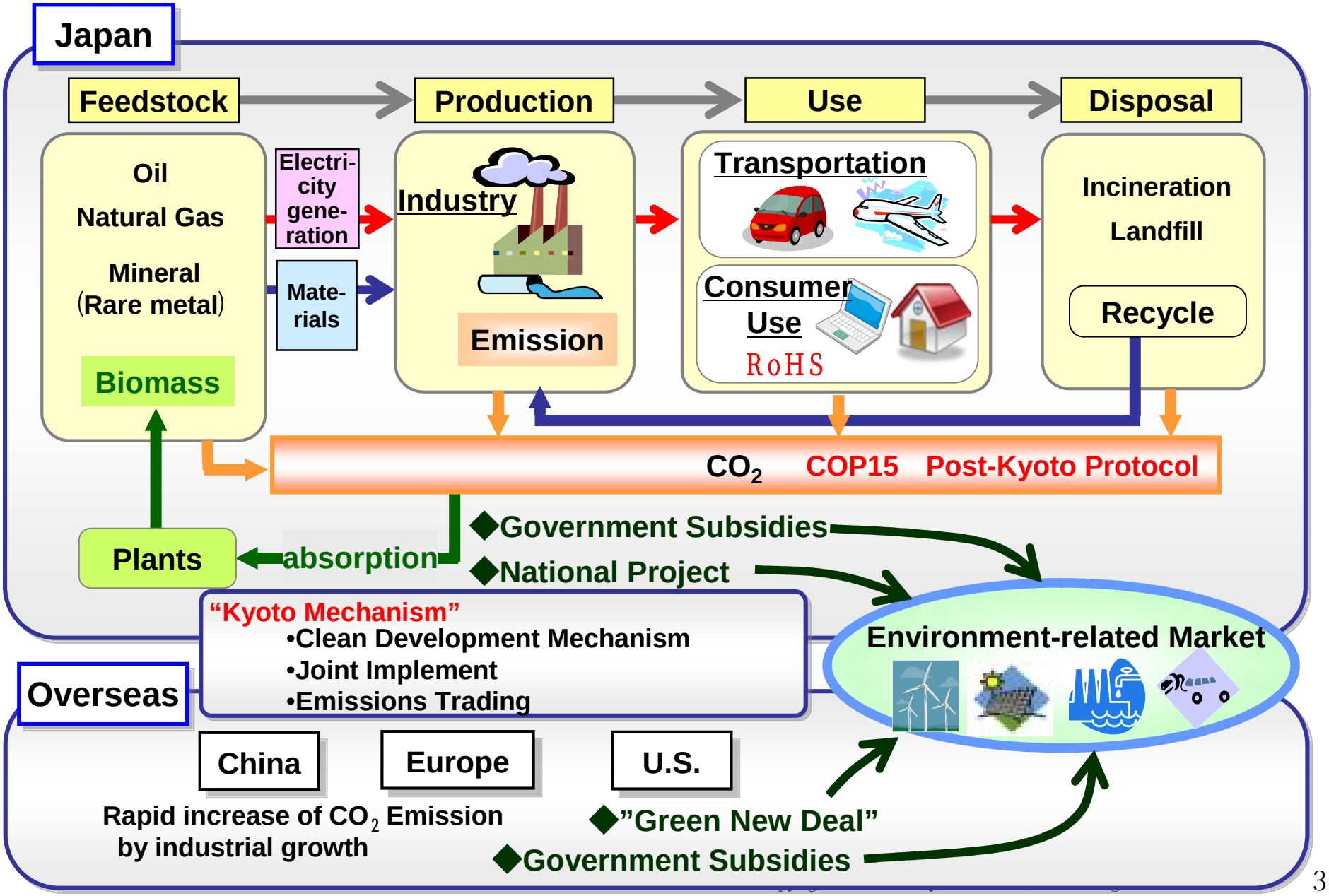

Solutions to Environmental Issues

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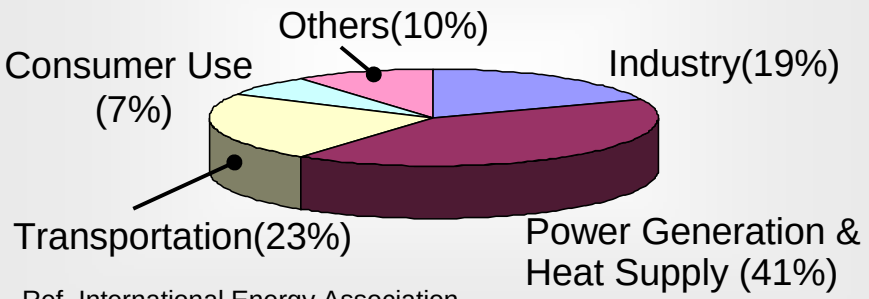
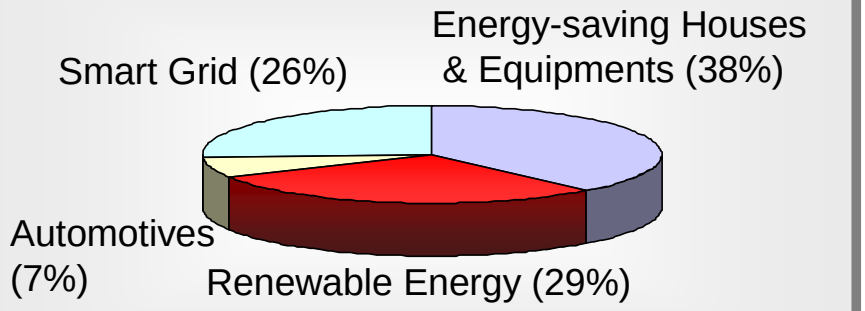
CO_2 Emission (Global)

Total 28Billion tons (2006)



Ref. International Energy Association

U.S. Investment in Environment



Based on the White House data

Map of Innovative Technologies

Category	Improvement of Efficiency	Low CO_2 Emission
Power Generation	**New energy** High Performance Energy Storage	Nuclear Energy Wind Energy Photovoltaics CO_2 Capture & Storage
Transportation	**Energy-saving** Light-weight Materials	Hybrid & Electric Vehicles Fuel-cell Cars Biomass Fuel
Consumer Use	Energy-saving Houses & Equipments Energy Management Systems	Fuel-cell
Industry	**Water Treatment･Air Purification･ Environmentally-friendly Products** Highly efficient Filtration Technology	**Biomass** Biomass-based Polymer Products

Toray has summarized and rearranged a table published by METI

Contents

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Toray's Approach to Global Environmental Issues

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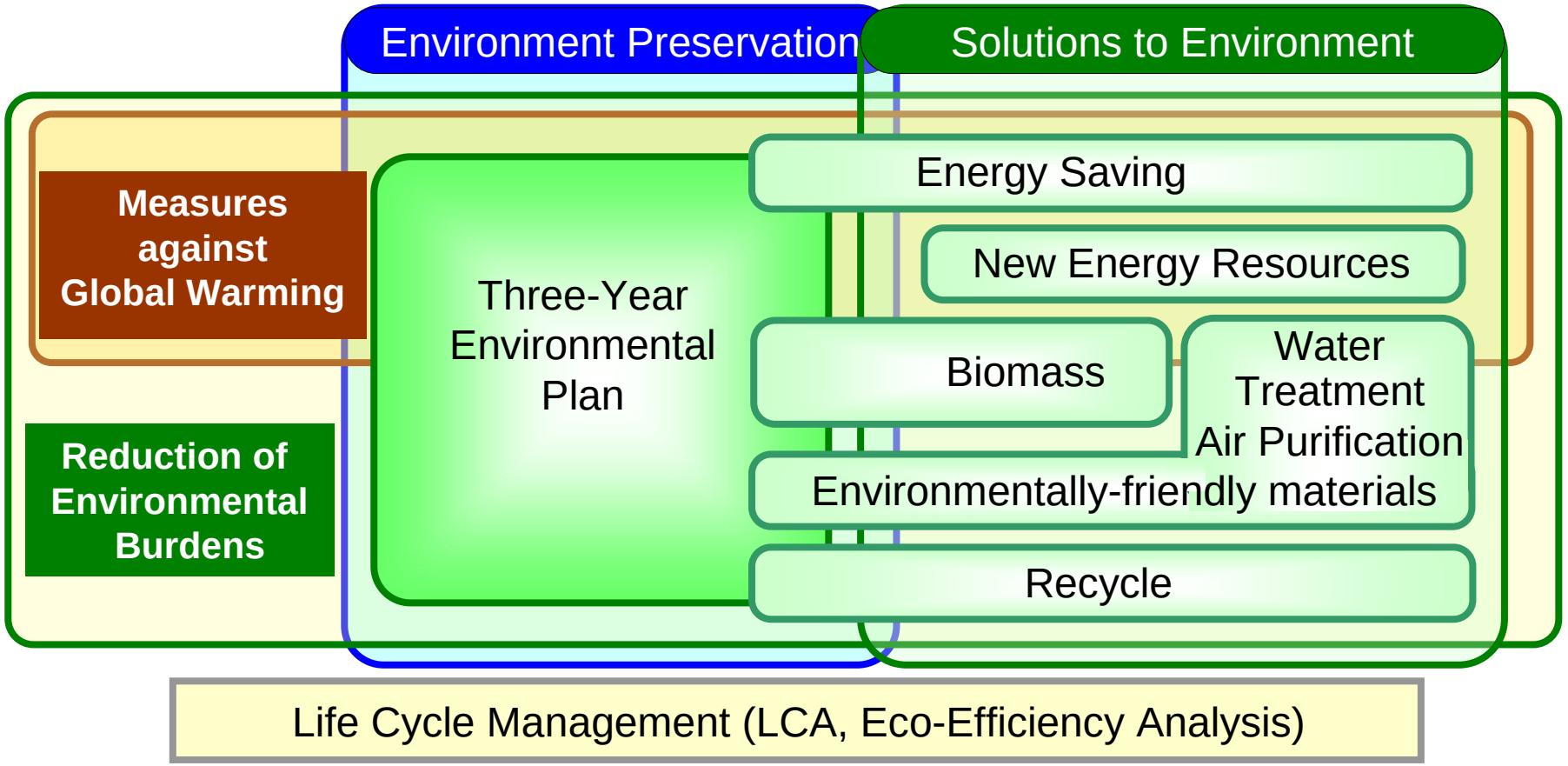
Management Policy

Toray Group consistently strives to make a contribution to society through the environment

Project "EcoChallenge"

Toray Group's initiative is to proactively save resources and preserve global environment to build a sustainable low-carbon society



Project EcoChallenge(1)

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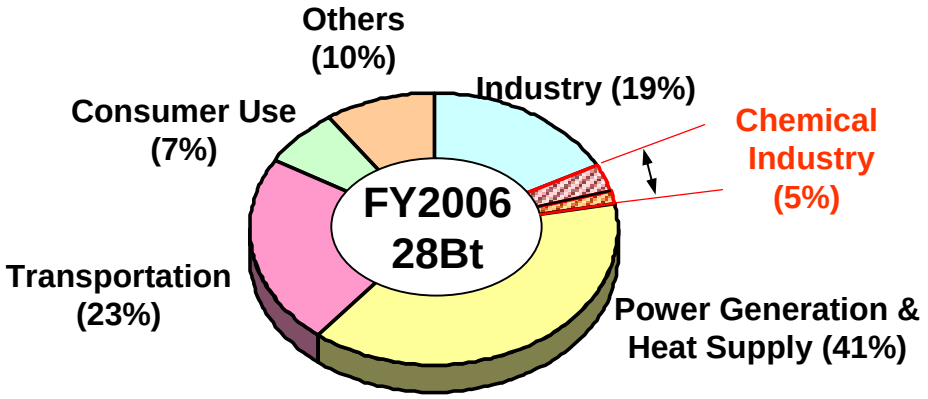
Toray's Mission toward a Sustainable Society



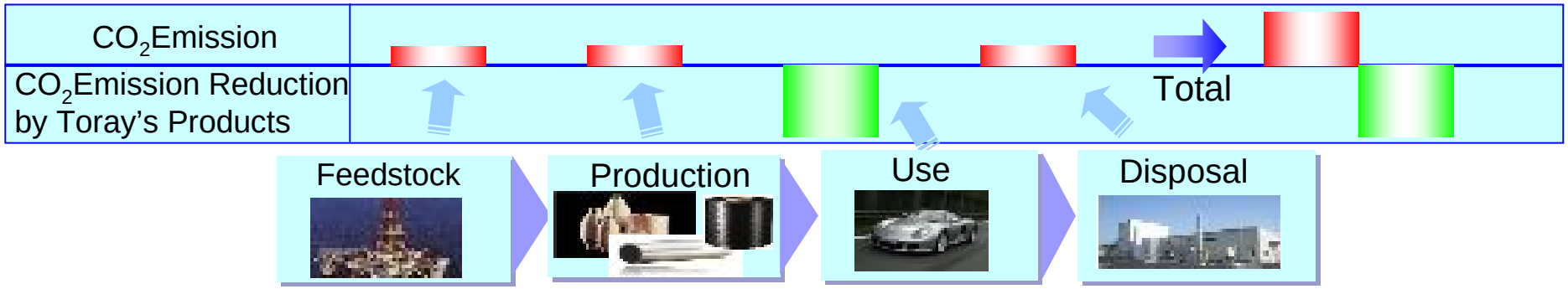
- Global CO_2 emission is 28 billion tons.
- Global CO_2 emission needs to be halved by 2050.
- Chemical industry accounts for 5% of global CO_2 emission.
- Emission reduction in manufacturing has limited effect.

Chemical industry shall contribute to CO_2 emission reduction from the perspective of ***Life Cycle Management*.**

Contribution to Global Environment by the Life Cycle Management

【Effects of CO_2 Emission Reduction in entire Life Cycle】

$$\textbf{Contribution Factor of } CO_2 \textbf{ Abatement} = \frac{\text{Effect of } \textbf{\textit{CO}}_2 \textbf{ \textit{Emission Reduction}} \text{ in entire Life Cycle}}{\textbf{\textit{CO}}_2 \textbf{ \textit{Emission}} \text{ in Feedstock, Production and Disposal}}$$



Toray shall continue to improve Global Environment by increasing its *"Contribution Factor"*

Project EcoChallenge(2)

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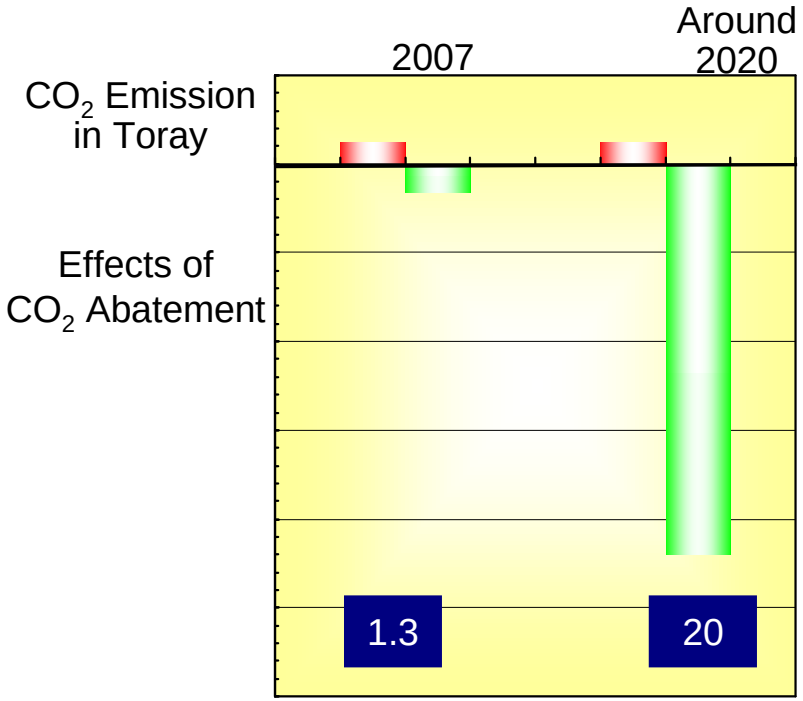
Target of Project EcoChallenge

	2007		Around 2020
Contribution Factor of CO_2 Abatement	1.3	➡	20
Sales of Environmentally-friendly Businesses (in Billion Yen)	214	➡	1,000

Contribution Factor of CO_2 Abatement



Environmentally-friendly Products Business

	Processes	Products
GHG Capture & Storage		Capture of CO_2 & CFC's substitute
Energy Saving	Energy Saving Processes	Weight Reduction; Energy-saving House
New Energy Resources		Power Generation Power Storage; Bio-fuel
Biomass		Bio-chemicals
Water Treatment	Waste Water Treatment	Water Treatment
Air Purification	Waste Gas Treatment	
Environmentally-friendly Products		Hazardous Substance-free
Recycle	Recycle of Waste in mfg. processes	Easy-to-recycle

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Environment Preservation
- Policy and Management System-

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(1) Management System

"Uniform Management in Toray Group"

-1993: Environmental Audit started (1995 : overseas)

-2000: "Toray Group Environmental Management Standard " established

(The standard at the same level as Japan is applied to the developing countries.)

(2)"10 Basic Environmental Rules"
–established in January, 2000 -

Toray clarified the intention of management, and it announced the rules to society officially while disseminating it to employees.

1. Environmental preservation is the top priority
2. Prevention of global warming
3. Zero discharge of environmental pollutants
4. Use of safer chemicals
5. Promotion of recycling
6. Improvement of the level of environmental management
7. Contributing to society through environmentally improved technologies and products
8. Improvement of environment management in overseas business
9. Improvement of employees awareness of the environment
10. Sharing of environmental information with the society

We shall promote energy saving and work to reduce unit energy consumption & CO_2 emission.

We shall meet the challenge of developing new technologies and shall contribute to society through environmental improvement technologies as well as products that place a low burden on the environment.

Environment Preservation
- Reduction of Environmental Burdens -

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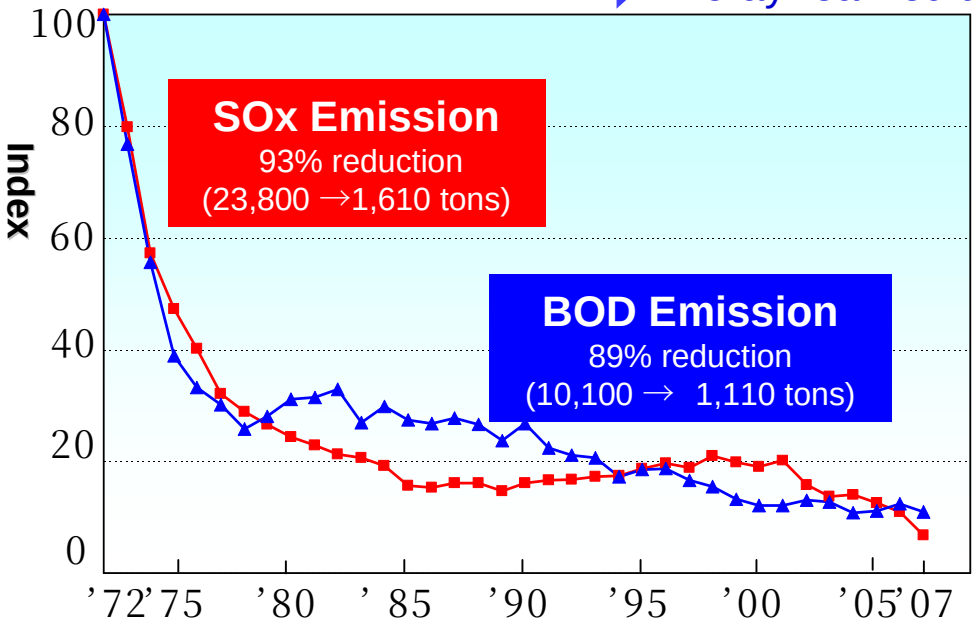
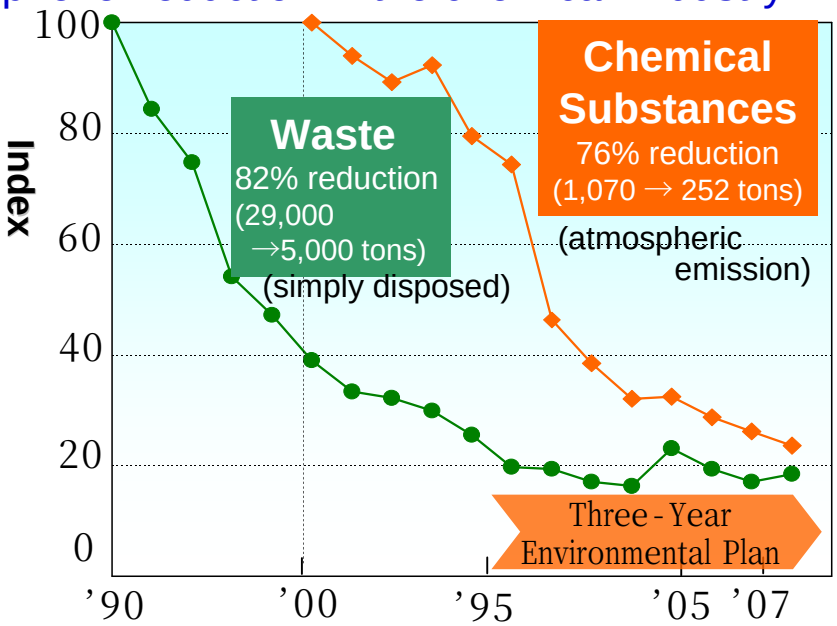
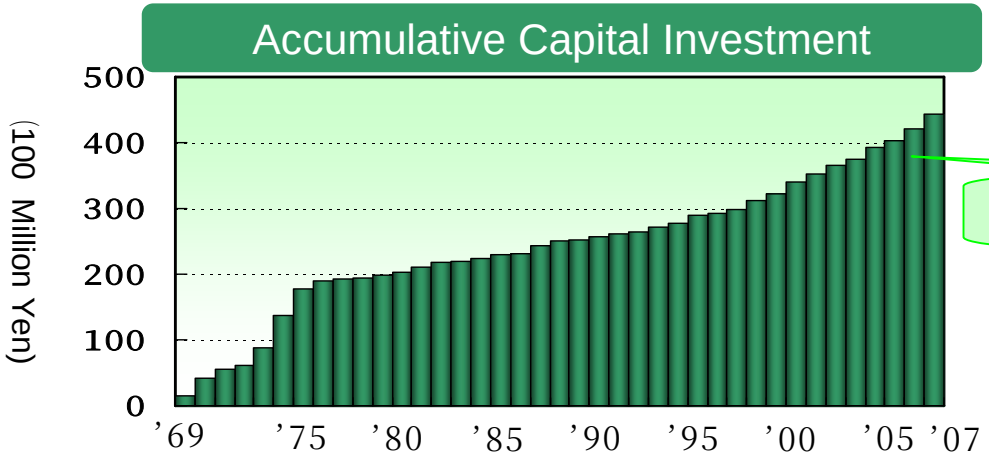
1. Toray tackled environmental burdens reduction from the 1970s, and achieved significant results
2. Toray started the “Three-Year Environmental Plan” in 2000, and attained further reduction

→ Toray realized top-level reduction in the chemical industry.







44.3 Billion Yen* was invested from 1969

(*: US$450 Million)

Environment Preservation
- Measures against Global Warming (1) -

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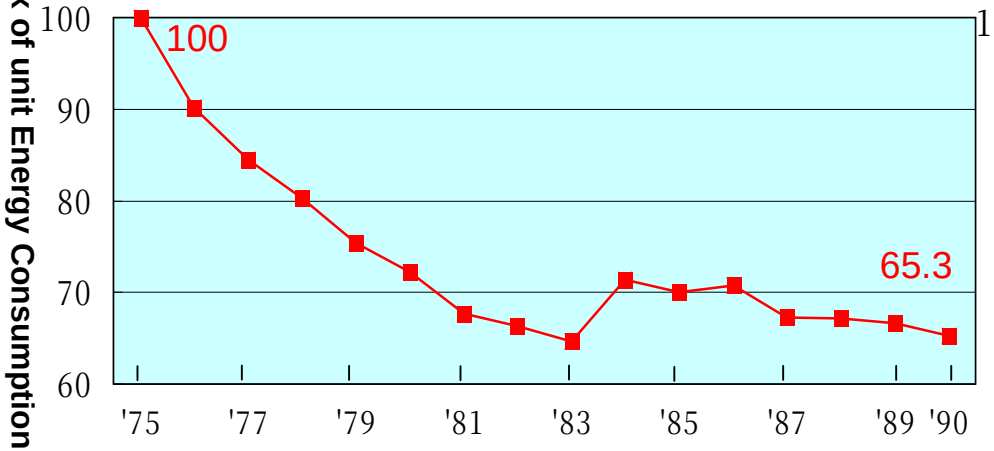
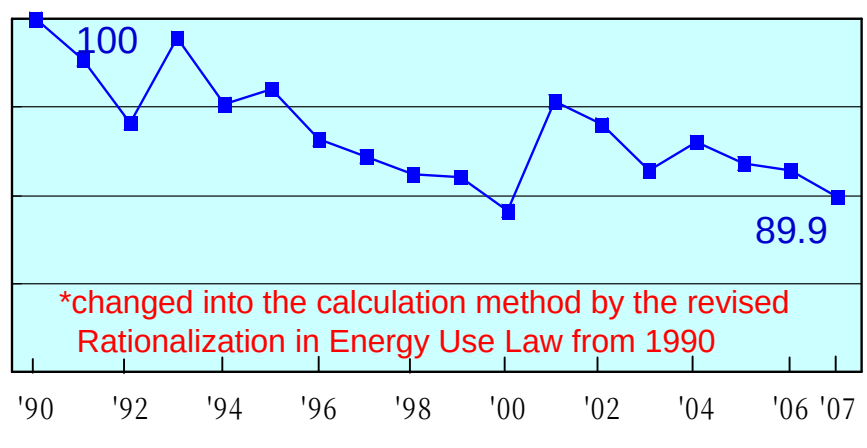
Promotion of Energy Saving

Unit energy consumption was reduced 35% by 1990 as compared with 1975 Level.
(3% of annual rate reduction)



Unit energy consumption was reduced 10% by 2007 as compared with 1990 Level.
(equivalent to 41% reduction as compared with 1975)



70s：-Full-scale energy-saving activities started
-Grass-roots energy-saving
-Energy-saving in the manufacturing process

80s：-Grass-roots energy-saving
-Energy-saving in the manufacturing process
-Energy-saving technologies meeting (1983)
-Technical diagnostics for energy-saving(1988)

90s：-Cogeneration
-Energy-saving in the manufacturing process
-In-company incentive for CO_2 reduction
(Investment effect: 1,000 yen/ton-CO_2)

2000 ~2008：-Super-low pressure steam electric generation (exhaust heat recycling)
- Natural-gas cogeneration
-Expanding in-company incentive for CO_2 reduction
(Investment effect: 2,000 yen/ton-CO_2)

Environment Preservation
- Measures against Global Warming (2) -

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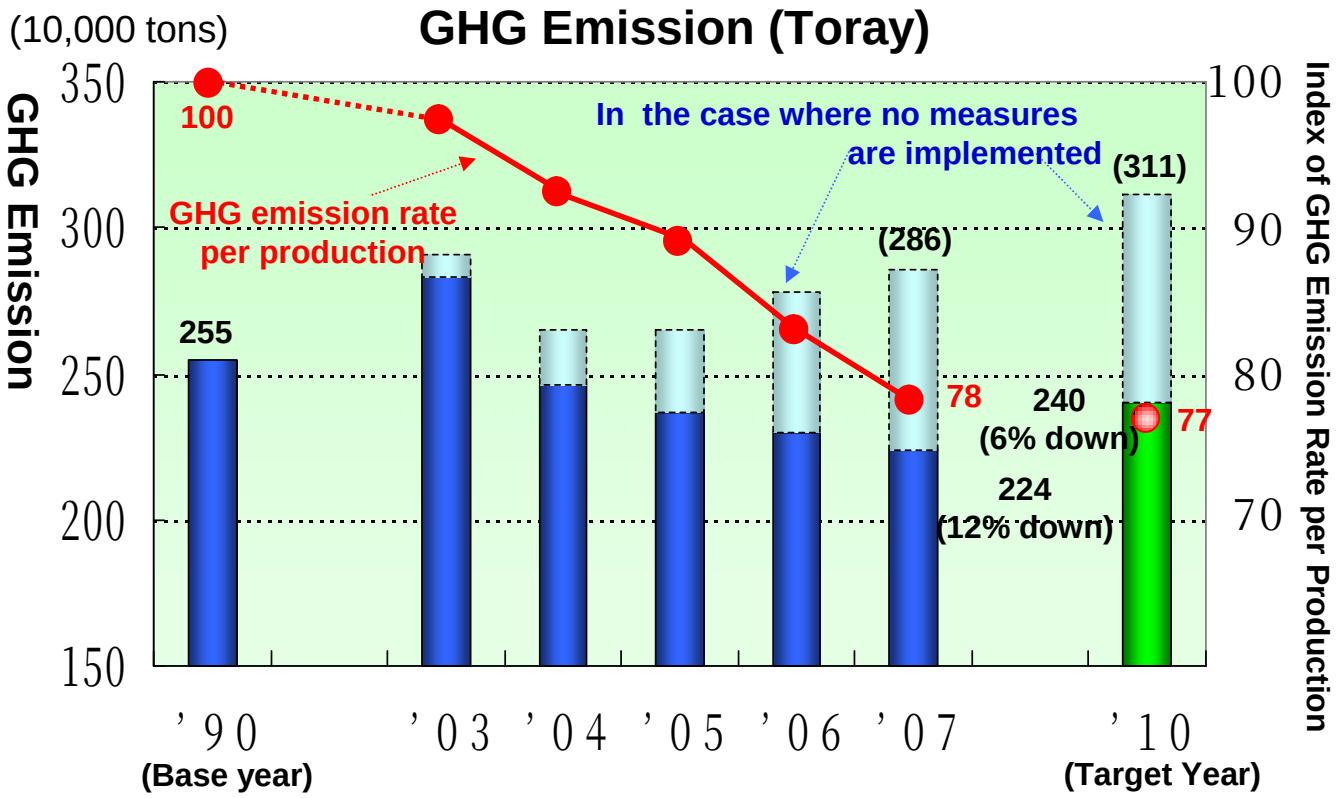
Reduction of Green House Gas (GHG) Emission

Achievements in 2007

1. 12% reduction (vs. 1990 Level)
2. 620,000 tons reduction (vs. the case where no measures are implemented)

→ 22% of the emission rate per production reduced as compared with 1990 Level



Toray Group shall control the increase in the CO_2 emission accompanying the growth of environmentally-friendly products business, such as carbon fibers and water purification, and aim at further reduction.

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Solution to Global Environmental Issues
- Environmentally-friendly Products -

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Toray Core Technologies

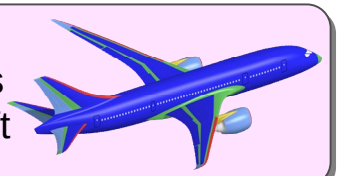
- Organic Synthetic Chemistry
- Polymer Chemistry
- Biotechnology
- Nano-technology

Measures against Global Warming

Reduction of Environmental Burdens

- Energy Saving
- New Energy Resources
- Biomass
- Water Treatment
- Air Purification
- Environmentally-friendly Products
- Recycle

Toray' Advanced Materials

- Light-weight Materials for Automobile/Aircraft 
- Fibers, Foams, Films for Houses 
- Materials for PV & Wind Power 
- Bio-based Polymer Products (Fibers, Plastics, Films) 
- Reverse Osmosis Desalination 

Carbon Fibers

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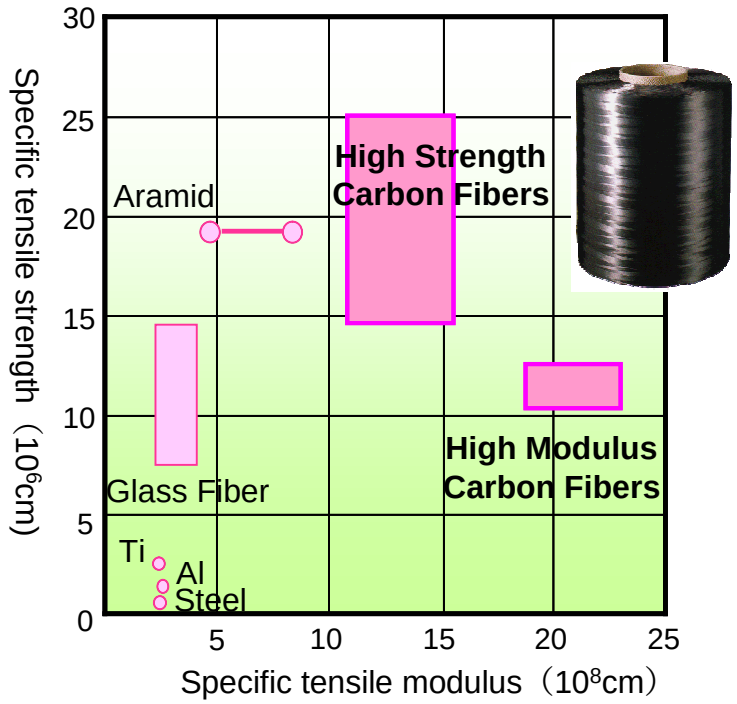
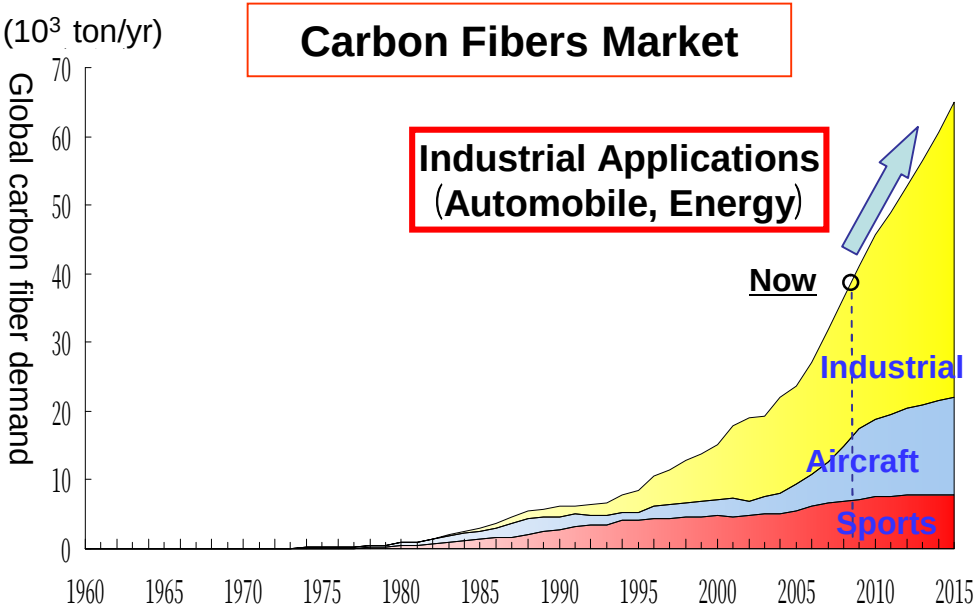
Mechanical Performance

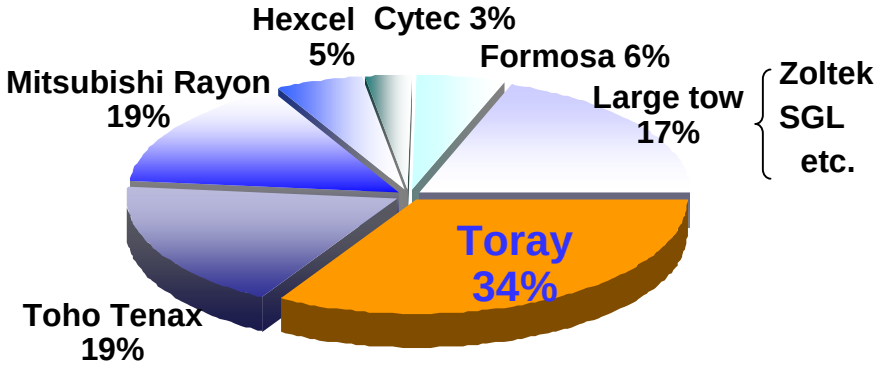


(Specific performance: Performance/ density)

Carbon Fibers Market



Global Carbon Fibers Market Share



1. **Light Weight**
   Specific Gravity: **One fourth** of Steel
2. **Strength**
   Specific Tensile Strength : **10 times** of steel
3. **High Modulus**
   Specific Tensile Modulus: **7 times** of steel
4. **Rust-free**

Contribution of Carbon Fibers to Global Warming

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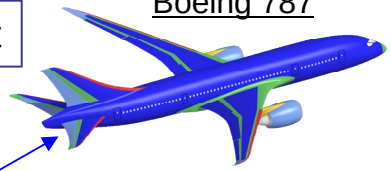
Reduction of CO_2 Emission

Light Weight

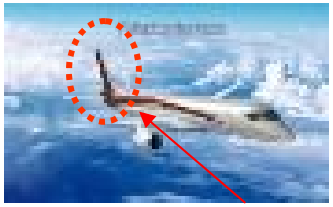
Aircraft

Boeing 787



: CFRP (50%of Structures)

MRJ



Empennage: CFRP

Automobile

Structure: CFRP

Next Generation Car : CFRP

Clean Fuel

CFRP CNG* tank

Light Weight CNG Tank with Carbon Fibers

(*)CNG; Compressed Natural Gas

* CFRP : Carbon Fiber Reinforced Plastics

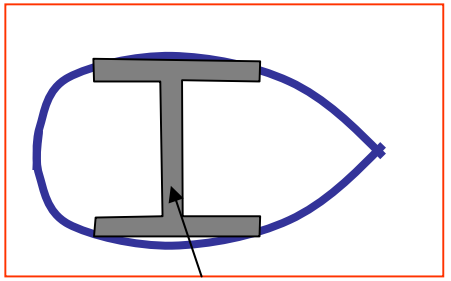
Generation of Clean Energies

Higher Efficiency

100m Blade in Diameter with Carbon Fibers

Large Scale Windmill

Cross section



CFRP

Special Function

70 MPa Tank with CFRP

Hydrogen Tank

Electrode with C/C Composites

Fuel Cell

Carbon Fibers contribute to reduce CO_2 Emission during usage and to generate Clean Energies

LCA (Life Cycle Assessment) of Airplane: "JCMA Model"

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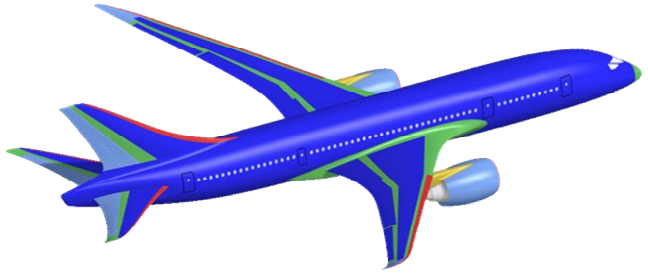
(JCMA: The Japan Carbon Fiber Manufacturers Association)

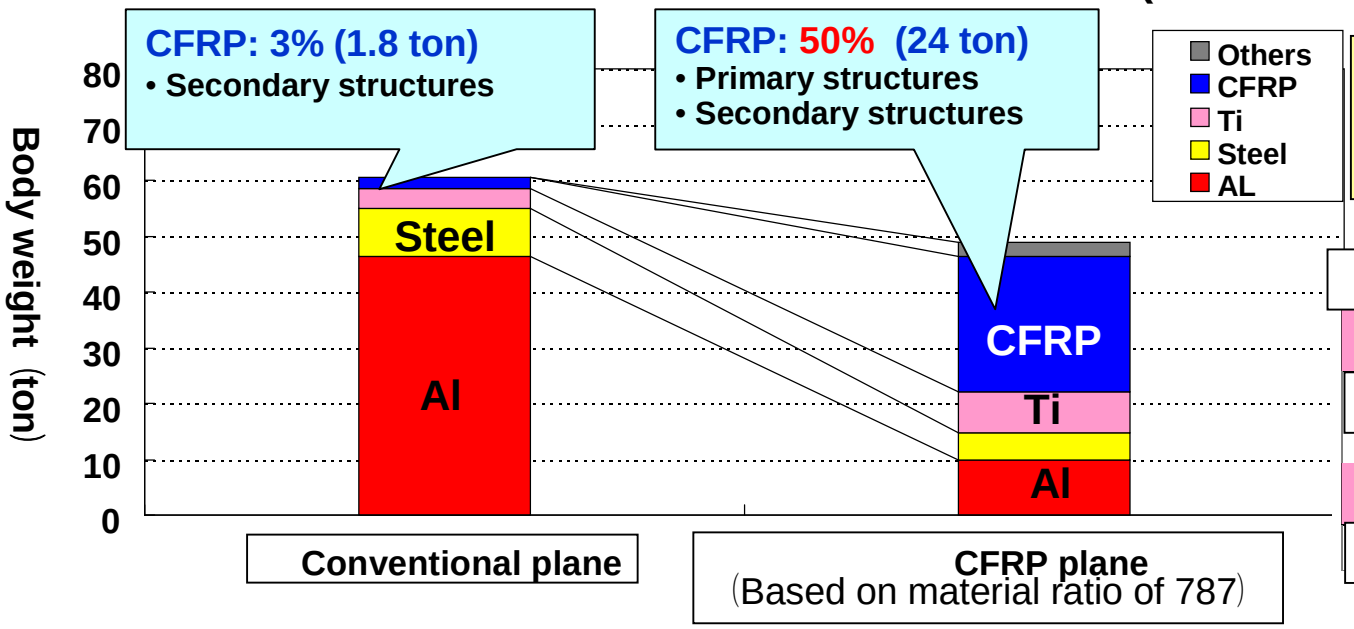
◆ Conventional and CFRP Aircraft

Boeing767-300

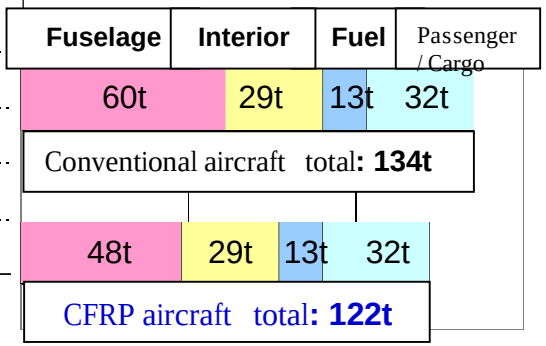
CFRP



CFRP aircraft model
(same material ratio as Boeing787)



White Body Weight
60→48ton (▲20%)
9% Reduction in Total Weight



50% of Structures: CFRP → Structure Weight: 20% Reduction

LCA of Automobile: “JCMA Model”

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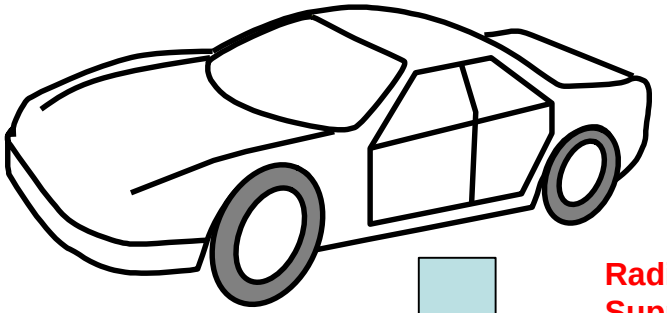
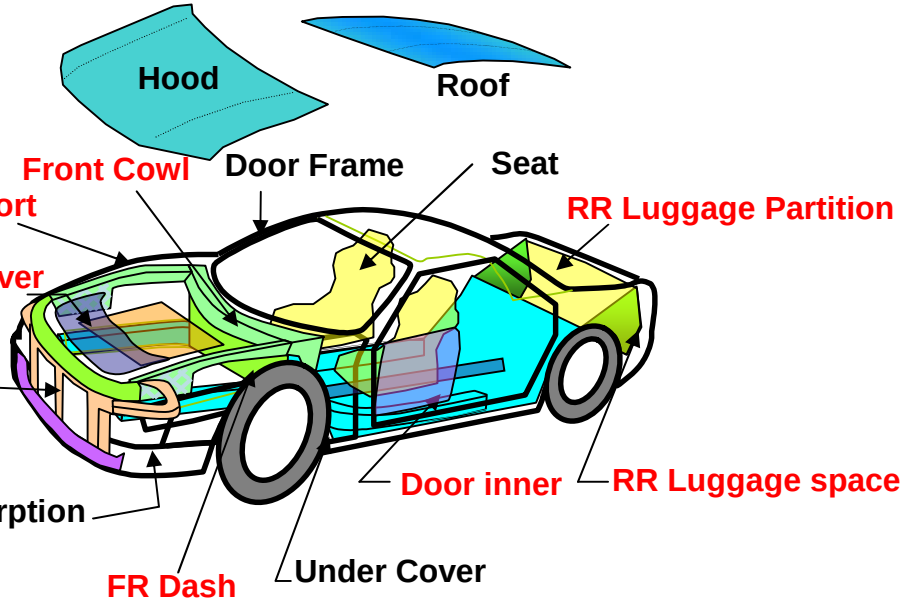
(JCMA: The Japan Carbon Fiber Manufacturers Association)

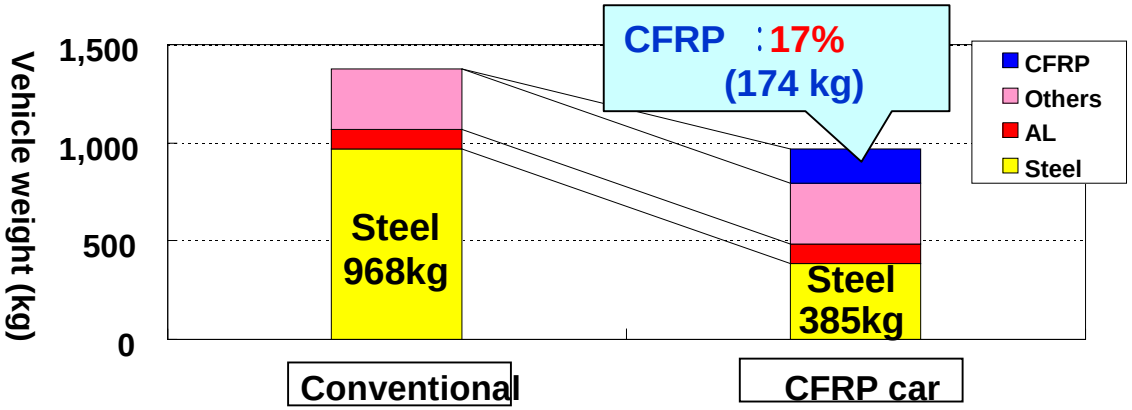
◆ Conventional and CFRP Automobile



Standard sedan

CFRP





Thermoset CFRP; Panels, Structures
(Weight: 30% of Steel)
Thermoplastic CFRP; Other Parts
(Weight: 50% of Steel)

White Body Weight
1380→970kg (▲30%)

17% of Body: CFRP ➡ Body Weight: 30% Reduction

Summary of "JCMA Model"

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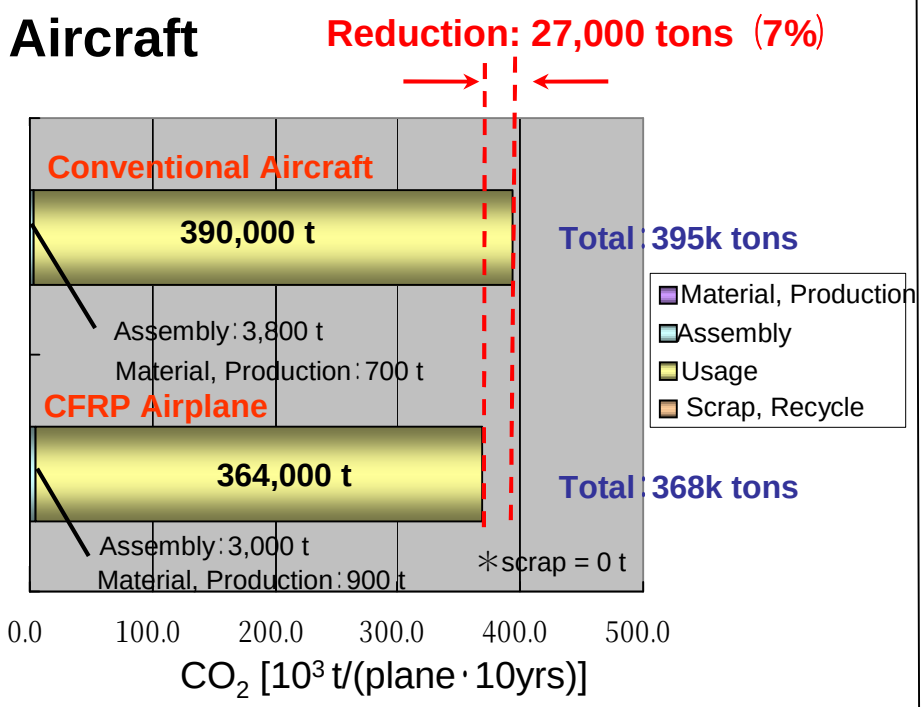
◆CO_2 Reduction by applying CFRP

Secondary effects are not included
(ex. Design, Aerodynamics, etc.)

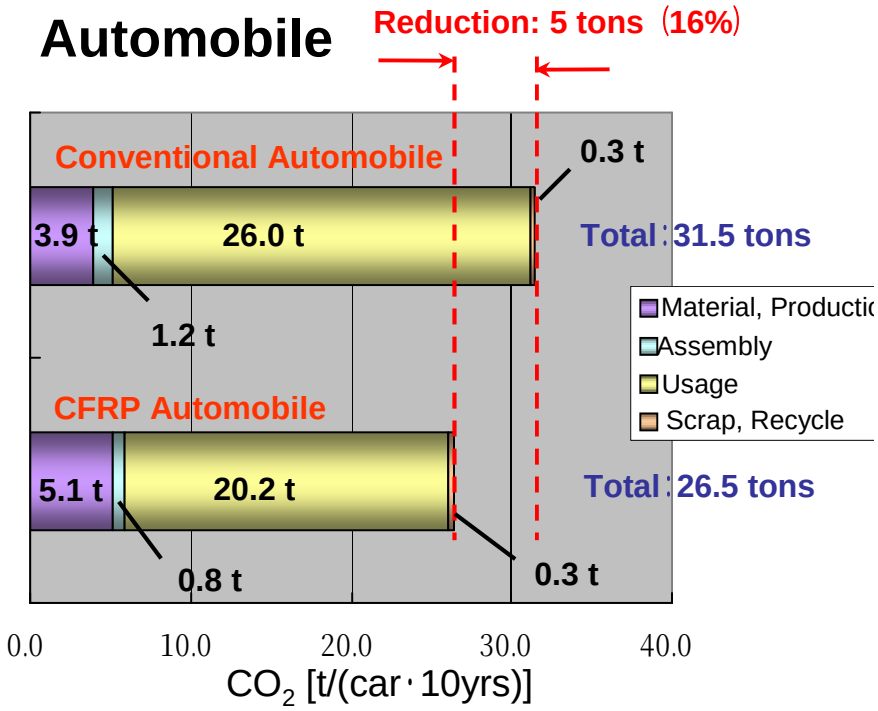
Aircraft



▲2,700 tons CO_2 Reduction /(plane・yr)

Global Passenger Jet Planes:15,000
(100 seats or more/plane)
Total CO_2 Reduction 41Million tons / year

Automobile



▲0.5 tons CO_2 Reduction/(car・yr)

Global Passenger Cars:37 Million
($50K or higher/car)
Total CO_2 Reduction 19Million tons / year

Toray's Contribution to CO_2 Abatement

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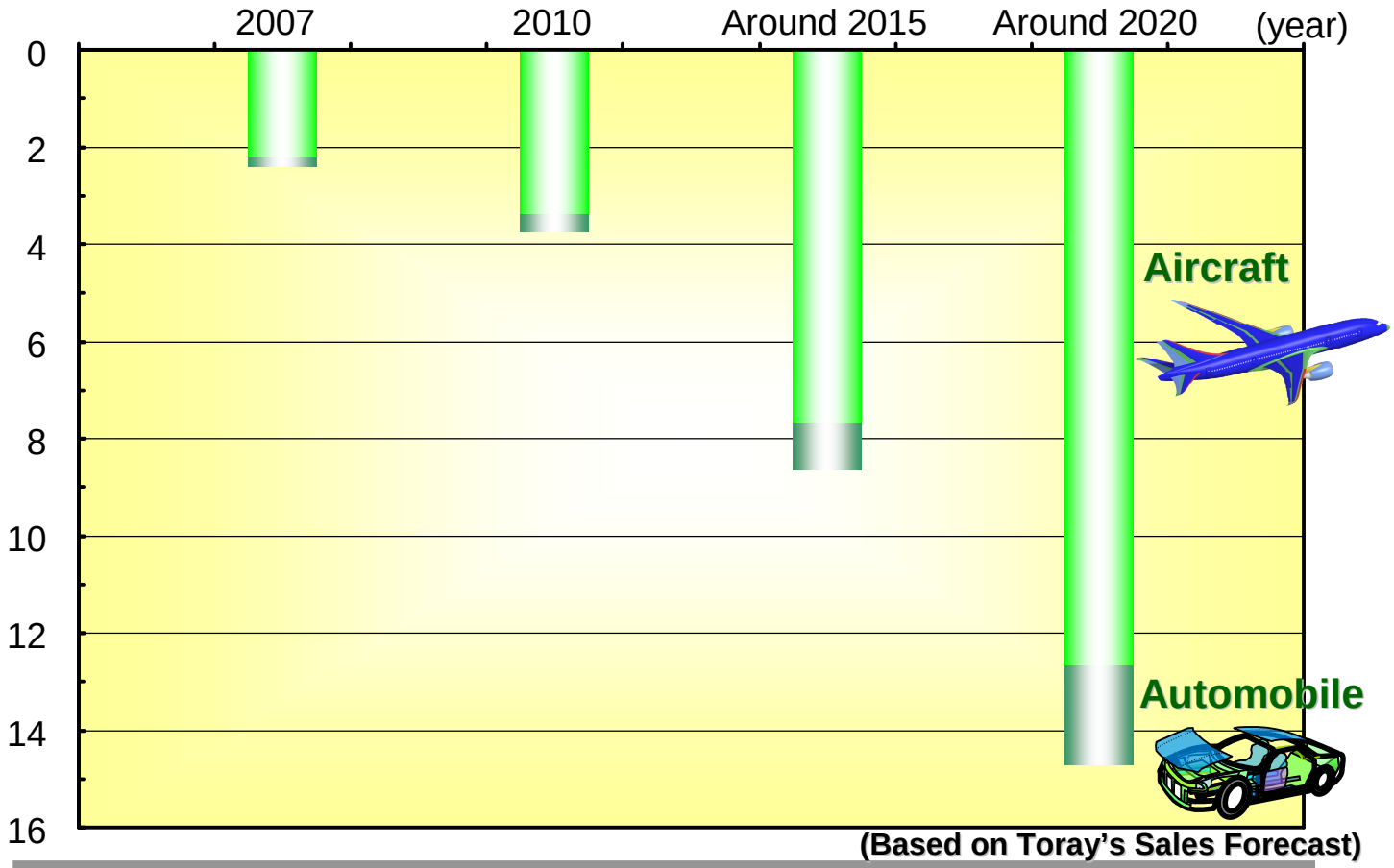
Global CO_2 Abatement by Toray Carbon Fibers (Million tons)



(Based on Toray's Sales Forecast)

< Airplane Application >
2007: 2.2 Million tons / year, 2020: 12 Million tons / year

< Automobile Application (including CNG Tank) >
2007; 0.2 Million tons / year, 2020: 2 Million tons / year

Carbon Fibers for Next Generation Car

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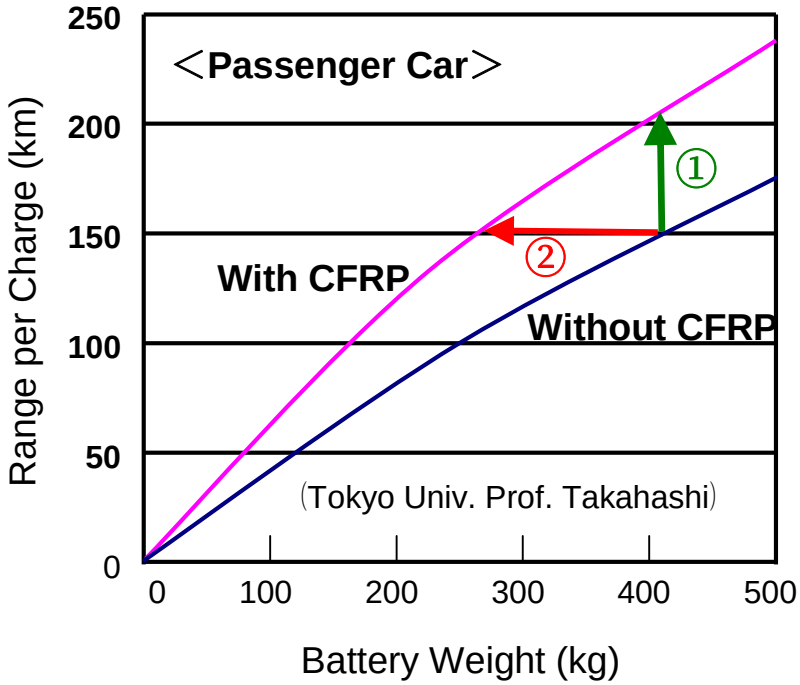
Body Weight:
30% Reduction with CFRP

Effect of CFRP

(Assumption; Battery Weight 400kg)

- **Light Weight EV ①**
  Range per Charge: 150km → 200km (+33%)

- **Light Weight EV②**
  Battery Weight: 400kg → 250kg (▲35%)



Light weight CFRP car accelerates electric vehicle spread
① Range: +33%　② Battery Weight :▲35%

Convenience (Long Range) → Popularize Next Generation EV
Battery Weight Reduction (Lithium etc.) → Prevent Resource Exhaustion

Light weight CFRP is very important in next generation cars

Automotive & Aircraft Center

"TORAY"
Innovation by Chemistry

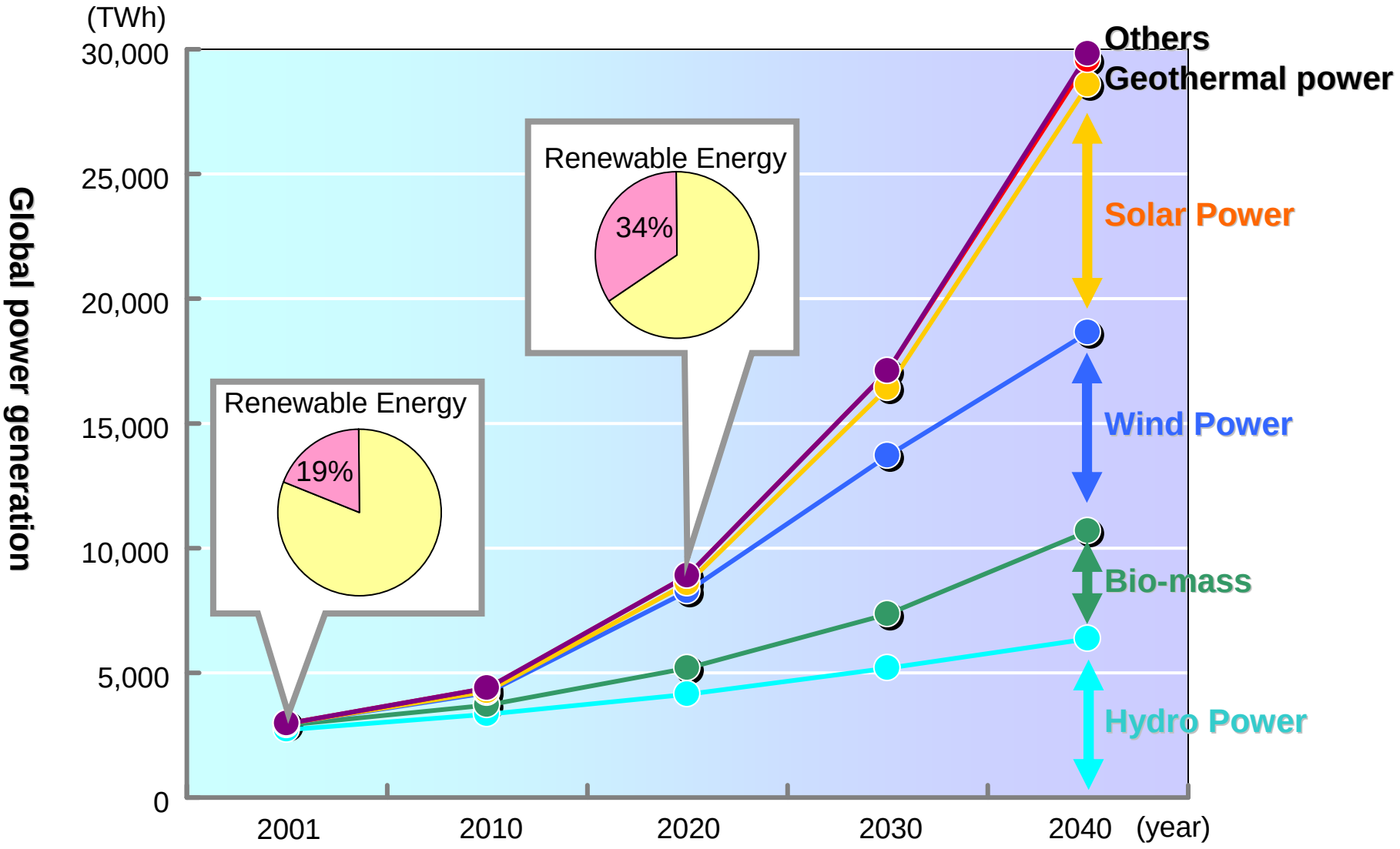
New Center started in Nagoya to develop plastics and composite technologies

A&A Center (Automotive & Aircraft Center)

Plastics Application Technology & Development Center (existing)	Automotive Center (2008, June)	Advanced Composite Center (2009, April)
<Automotive and IT application> Development of engineering plastics & Molding Technologies	<Automotive Application> ・Offering solutions ・Project management ・Evaluation and Analysis	<Automotive and Aircraft application> Development of composite materials, composite products & processing technology

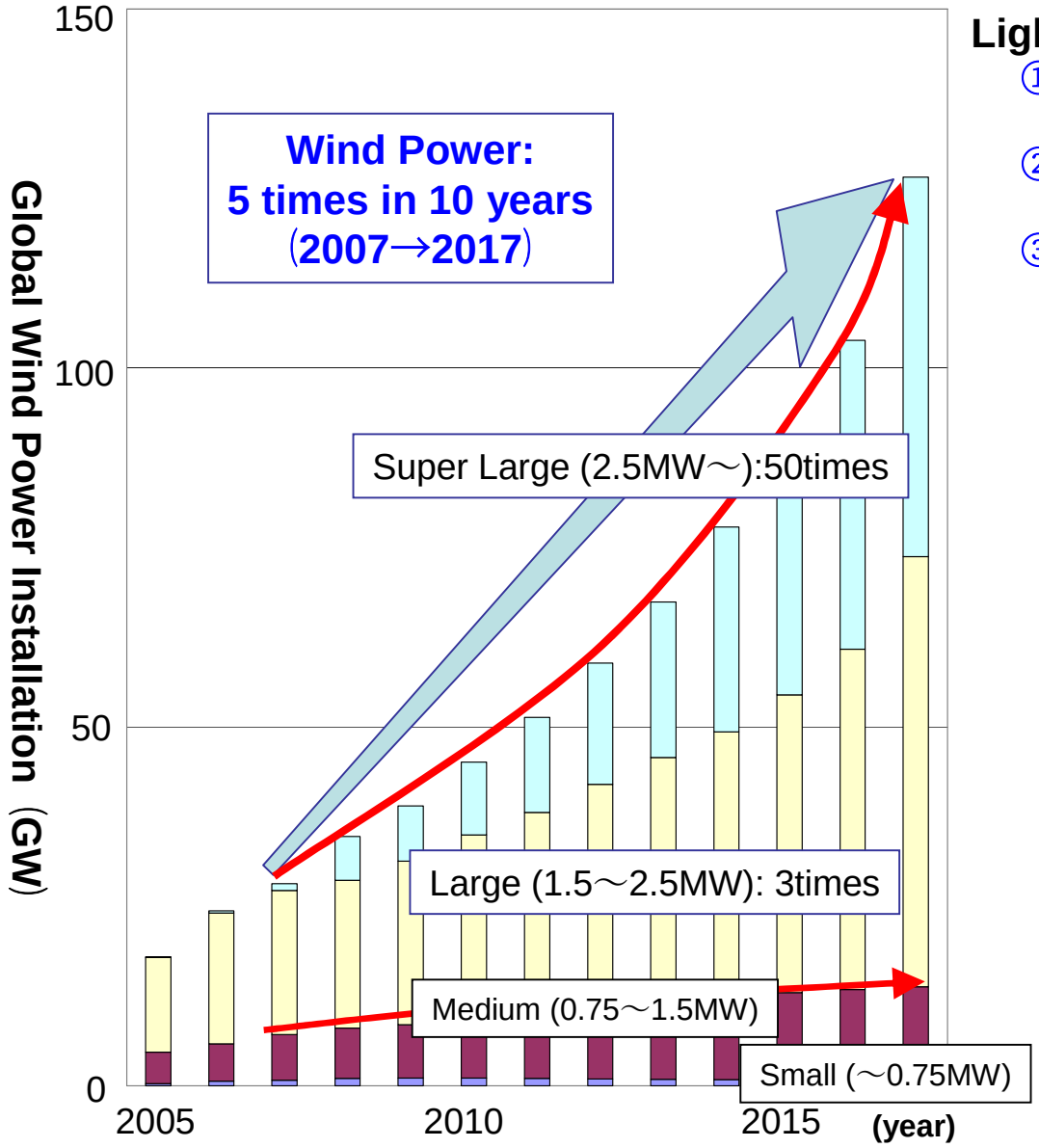
Trend of Renewable Energy

TORAY
Innovation by Chemistry



(source) European Renewable Energy Council "Renewable Energy Scenario to 2040"

Large Scale Windmill



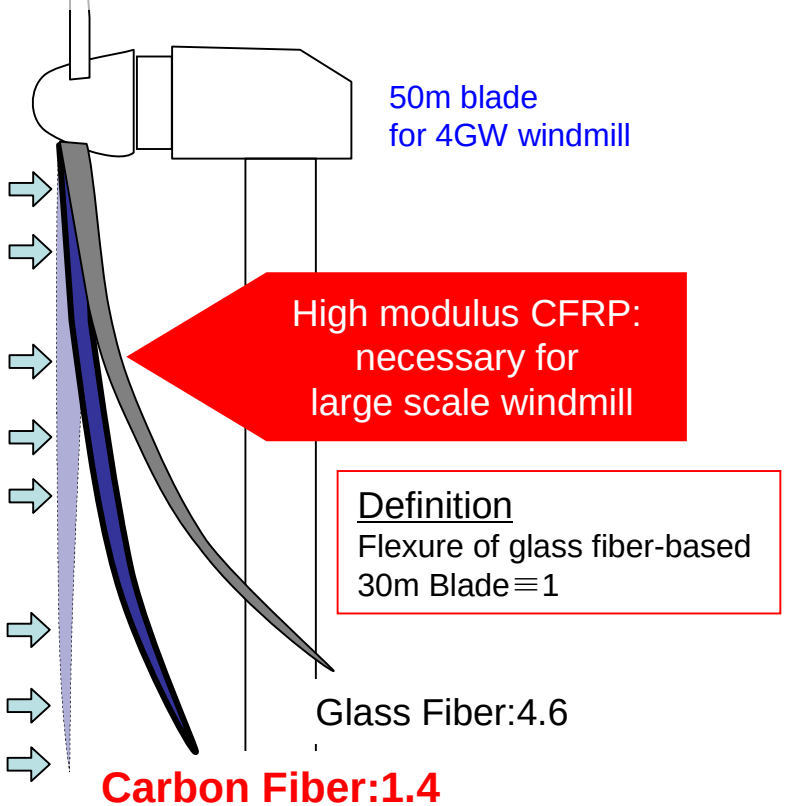
(Ref.) Composites Industry Monthly (March 2008)

Light Weight & Large Scale Blade with CFRP

① **Power Generation:**
Proportional to (Blade Length)^2

② **High Modulus CFRP:**
To prevent collision to windmill tower

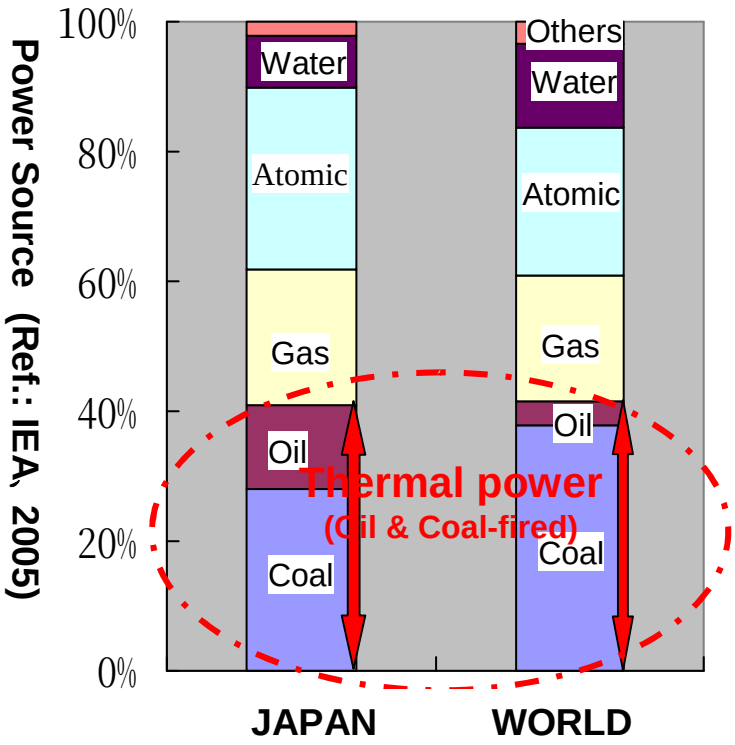
③ **Light Weight Blade: Total cost down**



Amount of carbon fibers:
3 tons/50m blade windmill

CO_2 Reduction Effect with CFRP Windmill

TORAY
Innovation by Chemistry



Change in Power Source

CFRP Large Windmill

Large CFRP windmill is the trend for future

Thermal Power
(Oil & Coal-fired)
(860 g-CO_2/kWh)

Wind Power
(10 g-CO_2/kWh)

Reduction; ▲850 g-CO_2 /kWh

Electricity Production

2007		2020 (year)	
116TWh	→	3,090 TWh	(All Windmill)
		2,570 TWh	(Large Windmill)

Annual Reduction of CO_2 Emission

2007		2020 (year)	
0.1 Bt	→	2.6Bt	(All Windmill)
		2.2Bt	(Large Windmill)
		<CFRP Windmill : around 1/4 >	

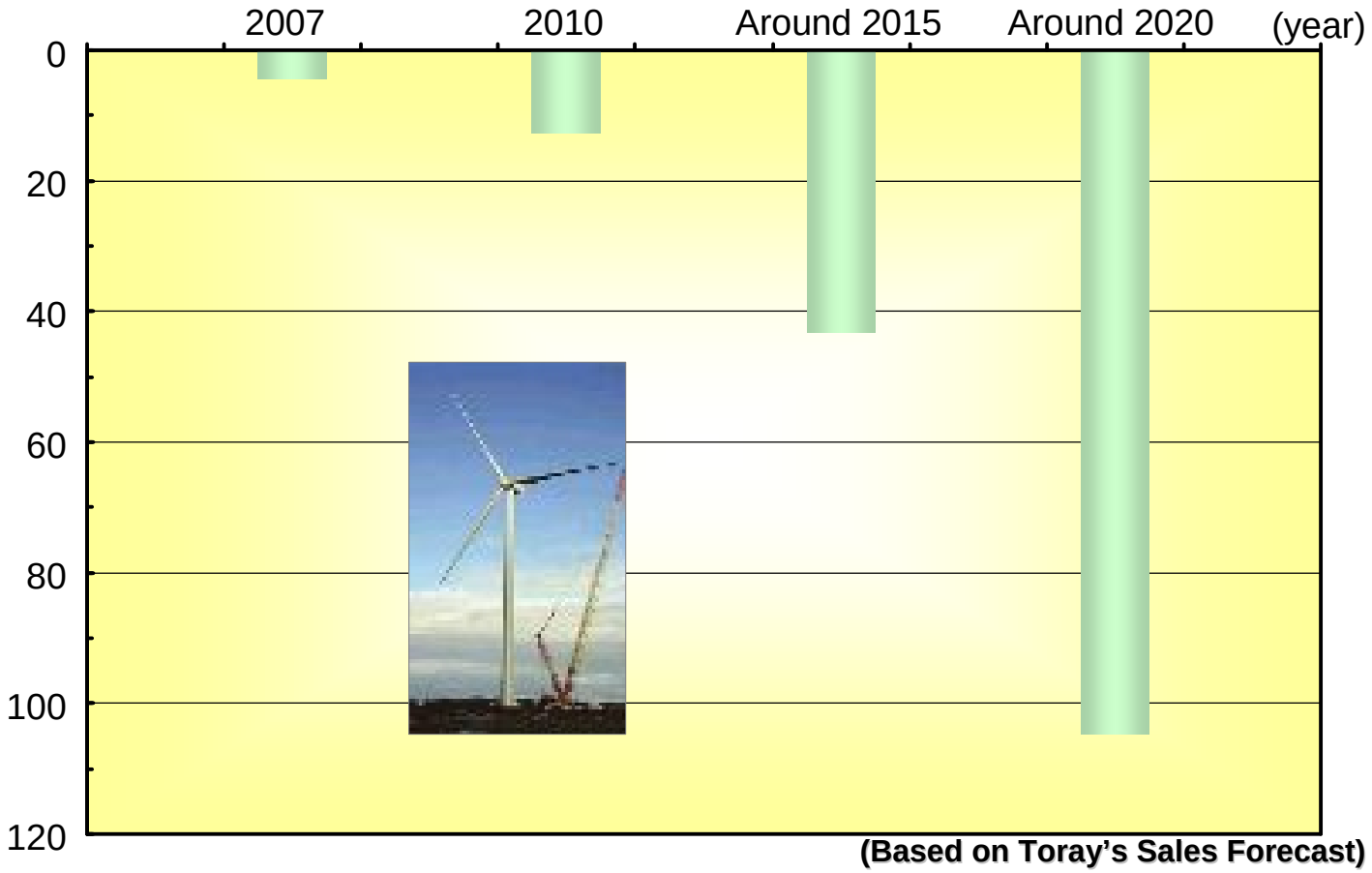
(Bt; Billion tons)

CO_2 reduction with CFRP windmill : a few billion tons in 2020

Toray's Contribution to CO_2 Abatement

'TORAY'
Innovation by Chemistry

Global CO_2 Abatement by Toray Carbon Fibers (Million tons)

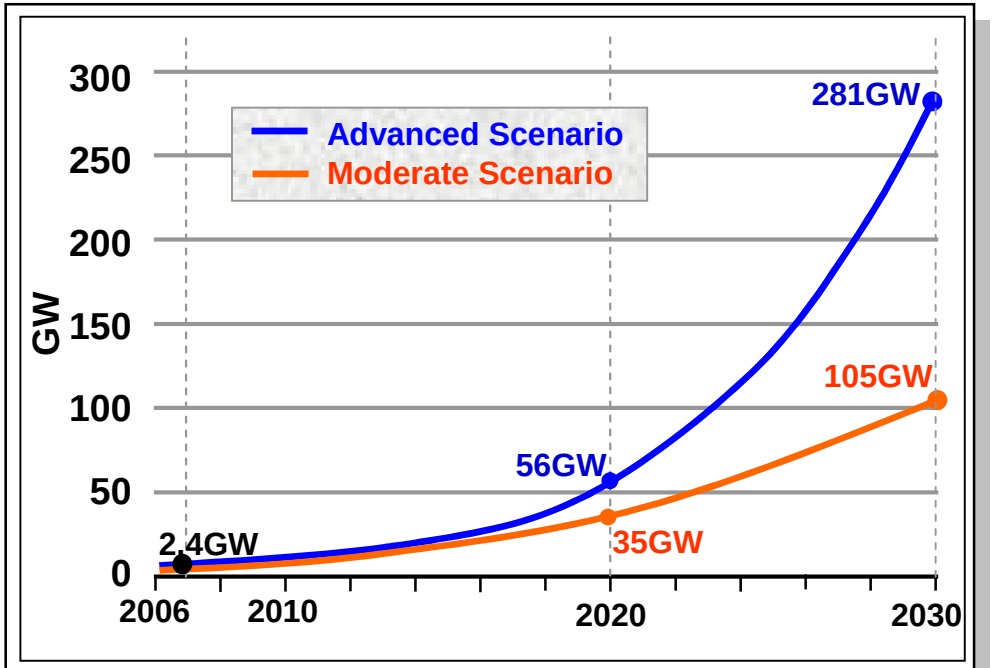


(Based on Toray's Sales Forecast)

< Windmill Application >
2007: 4.4 Million tons / year, 2020: 100 Million tons / year

Global PV Market

Global PV Market up to 2030



Electricity Production

2007	2020	2030
10TWh	362TWh (Advanced Scenario) 283TWh (Moderate Scenario)	2,646TWh (Advanced Scenario) 1,291TWh (Moderate Scenario)

(Source) EPIA & Greenpeace "Solar Generation V" (2008)

CO_2 Emission Reduction

Thermal Power
(Oil & Coal-fired)
(860 g-CO_2/kWh)

PV
(50 g-CO_2/kWh)

Reduction; ▲810 g-CO_2 /kWh

Annual Reduction of CO_2 Emission

2007	2020	2030
8Mt	290Mt (Advanced Scenario) 230Mt (Moderate Scenario)	2,100Mt (Advanced Scenario) 1,000Mt (Moderate Scenario)

(Mt; Million tons)

PV market is expected to keep growing tremendously

Toray's Approach toward PV Industry

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Innovation by Chemistry

Technology Roadmap

	2010	2020	2030
Cell	Crystalline Silicon		
	Thin Film (Silicon, CIGS, CdTe)		
	Organic, Dye-sensitized		
Solar Materials	Back Sheet Adhesive Potting Compounds	Durability Cost Reduction	
	Metallization	Fine Pitch	
	Front Sheet/ Substrates	Light Weight, Higher Efficiency	

Toray's Approach

	Keyword
Cell	Cost Light Weight Flexibility
Solar Materials	Durability Efficiency Cost
Equipment	Turn-key

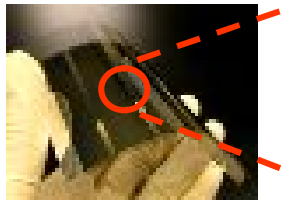
Toray's Technology

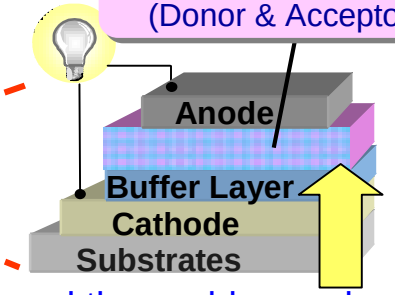
- Film Manufacturing & Film Converting
- Organic Photoelectric Conversion Layer
- Thin Film Fabrication in Nano-meter order
- Equipment for Electronics

Organic Solar Cells

Advantages

- Cost competitiveness
- Light weight
- Flexibility

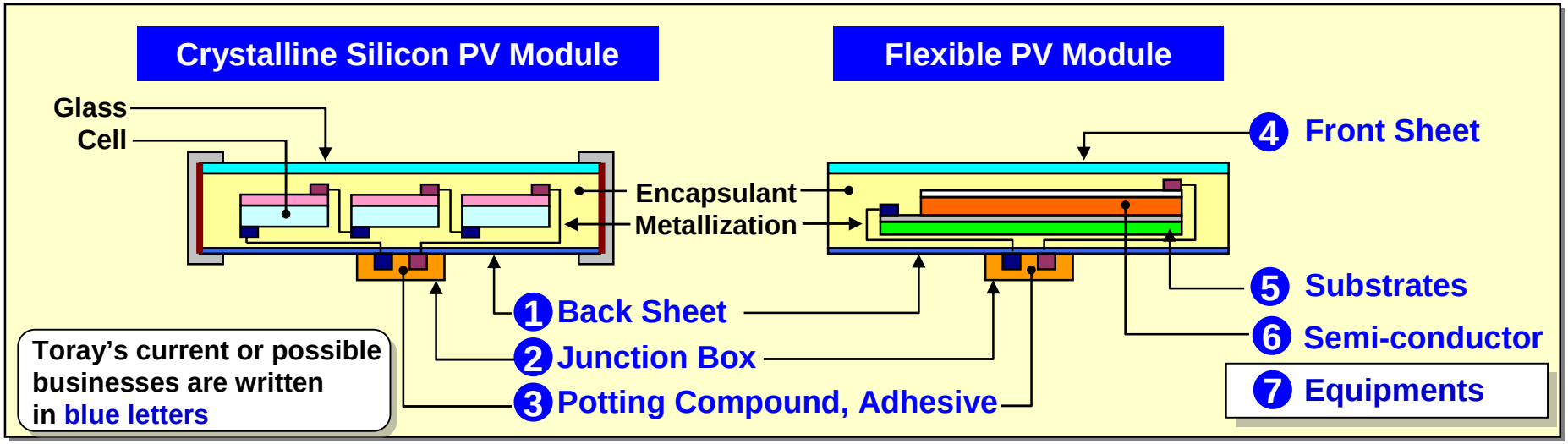




Toray has achieved the world record efficiency at 5.5%* by incorporating newly-developed donor material

※Based on the public data reported in academic conference (Former World Record:5.15%)

Toray's Business Opportunities in PV Industry



Solar Materials	Toray's Products
1 Back Sheet	"Lumirror" (PET Films) — Global Share #1
2 Junction Box	Engineering Plastics
3 Potting Compound, Adhesive	Silicone Resins (Dow Corning Toray)
4 Front Sheet	"Toyoflon" (ETFE Films) (Toray Advanced Film)
5 Substrates	"Kapton" (Polyimide Films) (DuPont-Toray)
6 Semi-conductor	Organic Semi-conductor
7 Equipments	Coater, Titler, Bonder, Inspection Device (Toray Engineering)

Back Sheet

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Innovation by Chemistry

Back Sheet

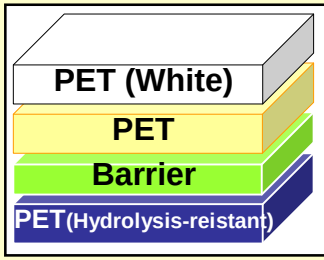
Function

Protection of Solar Cell

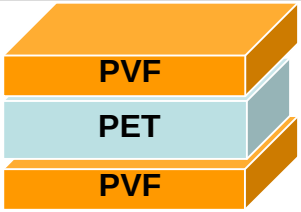
Required Properties

- **Weather resistance**
  (Hydrolysis & UV Resistance)
- **Safety (Insulation, FR)**
- **Barrier property**
- **Mechanical strength**

Examples of Back Sheet Design



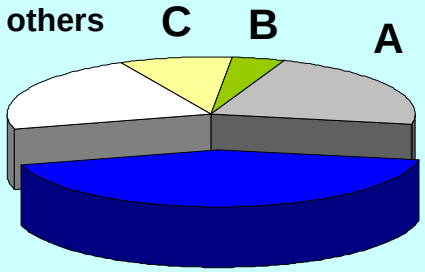
- Well-balanced in cost and performance
- Used in almost all Japanese PV manufacturers and some of EU&US PV manufacturers



- Weather-resistant PVF Films used
- Typical design in EU&US PV manufacturers

Global PET Films Share

(2008) (Toray's estimation)



Toray 43%

Global Share #1

Toray's Strength

1. **PET Films with superior hydrolysis-resistant properties**
   ⇨ **De facto standard films in PET-based back sheet**

   【Topics】 Capacity expansion of hydrolysis-resistant PET films to 12k tons (end of 2009), 24k tons (2010 or later)

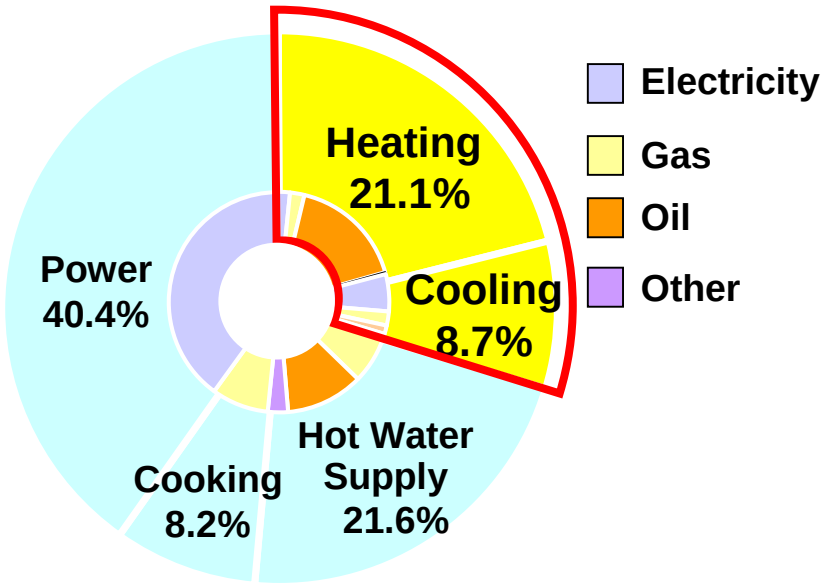
2. **Global Operations**
   Production in 4 countries (Japan, France, Korea & China), Quick response

Toray is to maintain #1 share in global PET films market for back sheet application

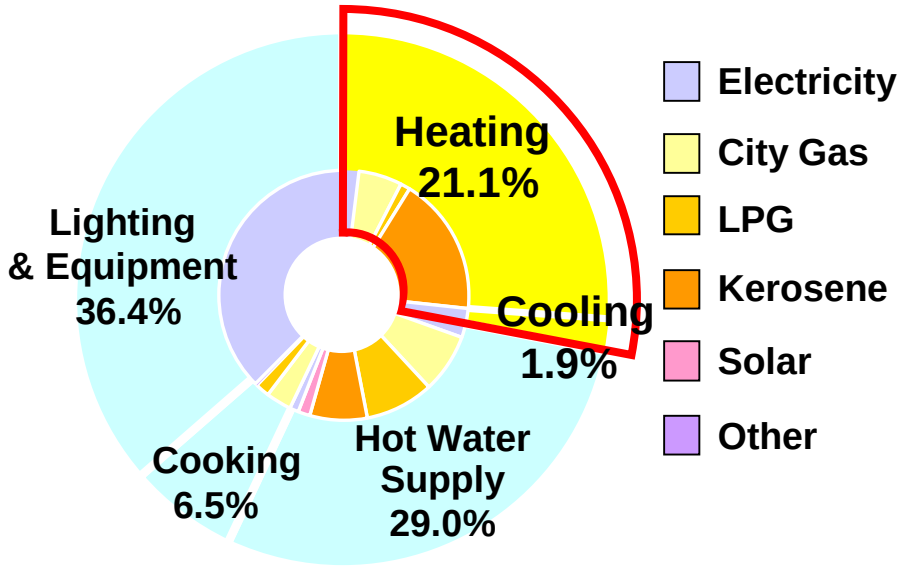
Energy Consumption in Commercial / Residential Sector

TORAY
Innovation by Chemistry

Energy Consumption in Commercial Sector



Energy Consumption in Residential Sector



Source：Ministry of Environment, 2004, Material of the 1st technical study meeting of global warming countermeasures

The energy consumed in air conditioning is larger in the commercial & residential sector

Energy-saving Effect by Insulation

		Hokkaido		Kanto region Kyusyu region	
Insulation		○	×	○	×
Heat Loss	Kcal/m²·h·℃	2.01	4.49	2.32	4.52
Energy-saving Effect	%	55	—	49	—

Key Point
Insulation of House & Building

Source：Cabinet Office, 1981, Material of the 8th Social Policy Council

Creation of Low Heat Loss Materials using Nano-technology

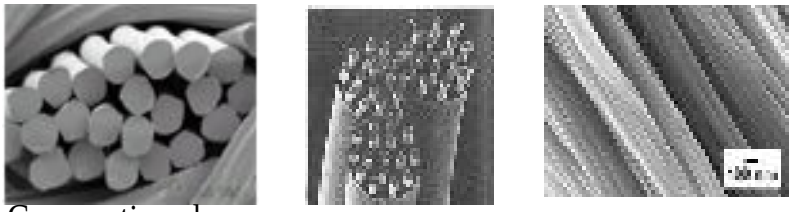
"TORAY"
Innovation by Chemistry

Utilize Toray's Ultimate technologies (fibers, resins, films)

High-performance Low Heat Loss Materials

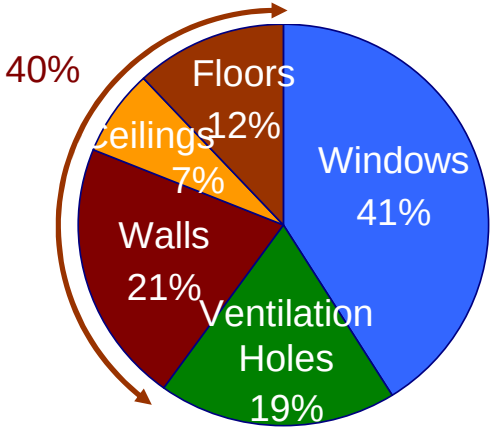
Fibers – Nanofiber Technology -

10 μm 1 μm 100nm



Conventional fiber | **Microfiber** | **Nanofiber**

【Heat Loss Rate in House】



Insulation

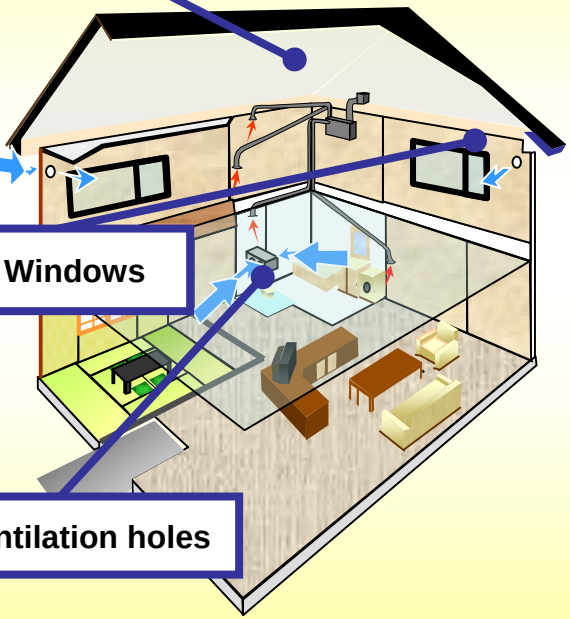
Walls, Floors, Ceilings

Thermal Barrier film

Windows

Ventilation holes

Heat-transfer Element



Expected Reduction of CO_2 Emission

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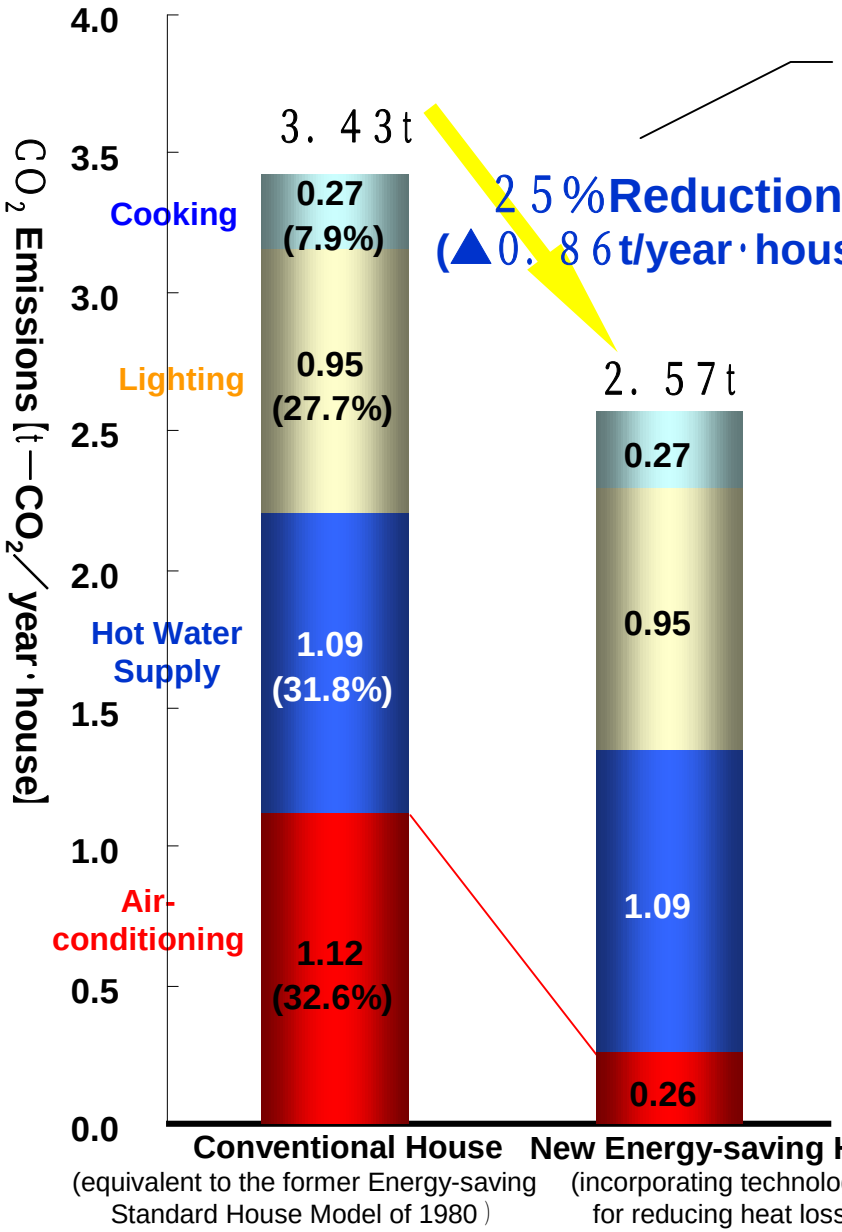

Air-conditioning Loads and CO_2 emissions were calculated by Thermal Load Analysis System for Housing, proposed by

[Assumption]
Applied in 30% of domestic houses*
(*; 50.38 Million houses)

0.86t/year·house×(50.38million houses×0.3)

The Reduction of CO_2 Emission
:13 Million tons / year

Heating set up : Temperatur22℃、Humidity no control

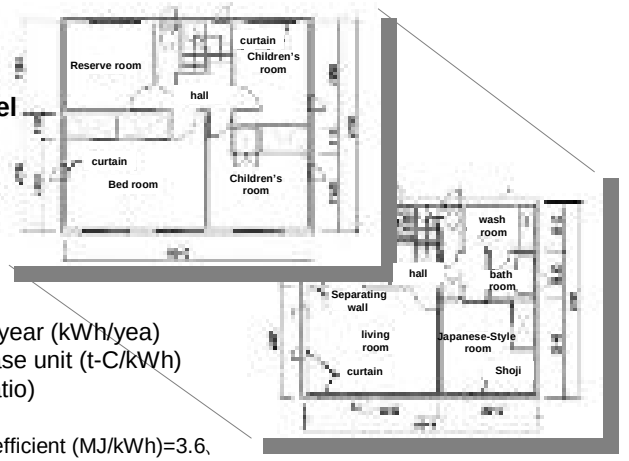

Fig1. Calculation Model (for a House)

■CO_2 emissions (t/year)
= electric power use a year (kWh/yea)
×CO_2emission base unit (t-C/kWh)
×(CO_2/C mol ratio)

■Calculation Coefficient
①electric power transfer coefficient (MJ/kWh)=3.6、
②coefficient of performance (COP)=heating2.5、
③air-conditioning 3.0(All operating energy is supplied as electric power)
④CO_2emission base unit (t-C/kWh)=0.00011(air-conditioning and heating)
⑤CO2/C mol ratio=3.664

Contents

TORAY
Innovation by Chemistry

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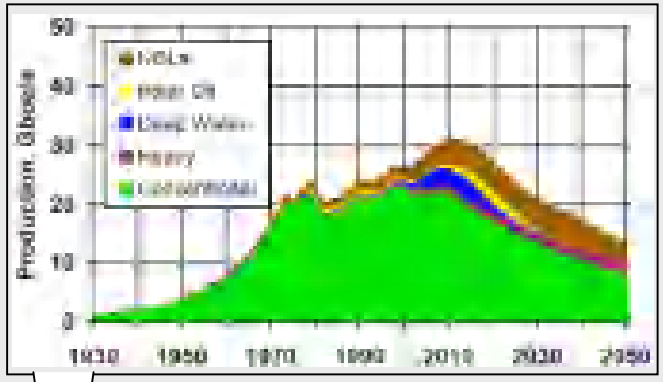
    - **Solutions to Global Environmental Issues**
      - Energy Saving, New Energy Resources
      - **Biomass**
      - Water Treatment
- Conclusion

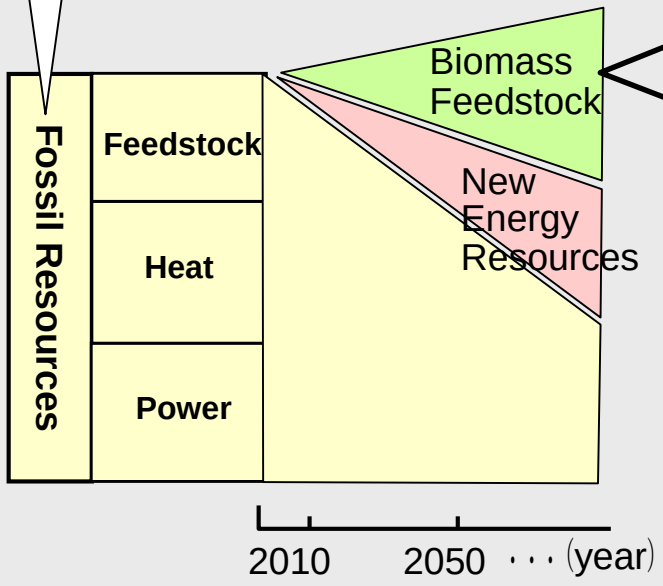
Advent of Biomass Feedstock Era

TORAY
Innovation by Chemistry

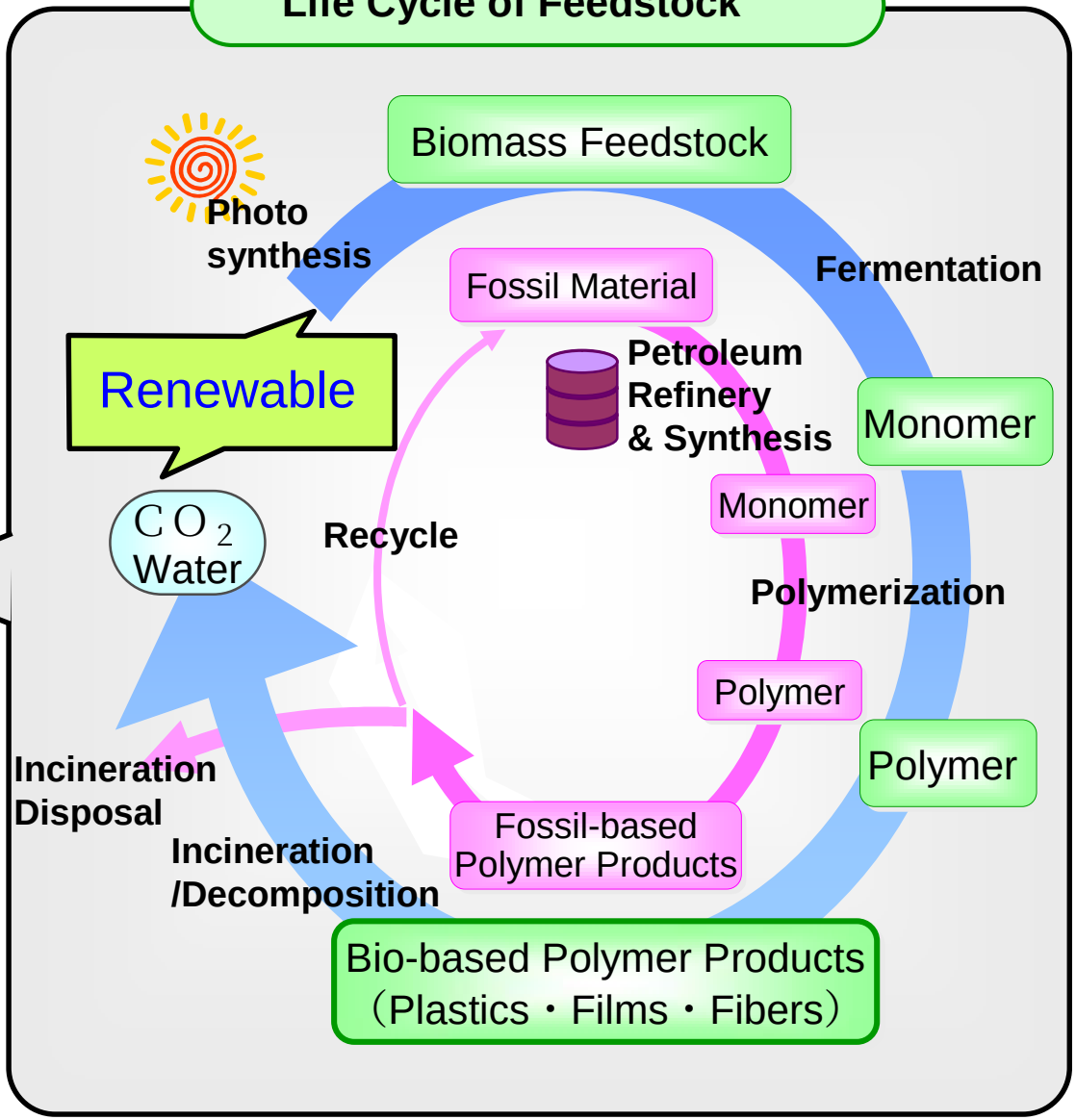
Depletion of Fossil Resources



C. J. Campbell, et al.
ASPO (2004)



Life Cycle of Feedstock



Polylactic Acid (PLA)

TORAY Innovation by Chemistry

PLA

Performance Enhancement

PLA Products

Toray's PLA Technologies

Strength improvement
- Stretching
- Stereo complex

Nano-alloy
- Compounding
- Compatibilization

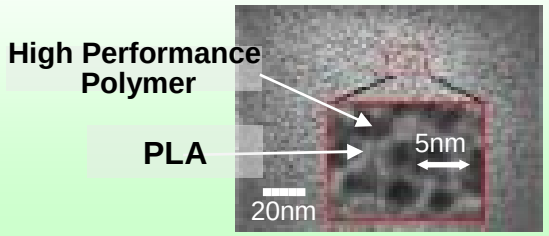
Flexibility improvement
- Elastomer design

Flame-retardant
- Non-halogenated Flame-retardant

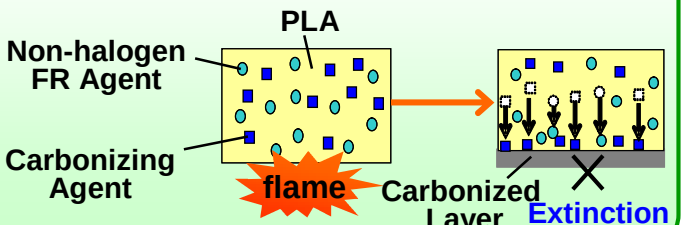
Hydrolysis-resistant
- Terminal block /Chain extension

Heat-resistant
- Plant fiber-reinforce

Nano-dispersion of High Performance Polymer
→ Significant Enhancement of Performance



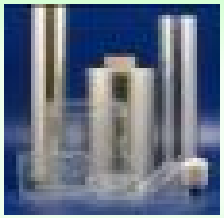
Selective Formation of Carbonized Layer on the Surface of Molded Part
→ High-level Flame Retardant



Fibers & Textiles

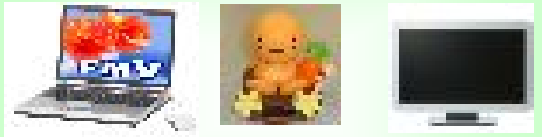
Apparel
Automobile Materials
Industrial/Agricultural Materials

Sheets & Films



Industrial/Packaging Material

Plastics



OA & Electric Appliances

Membrane-integrated Bio-process

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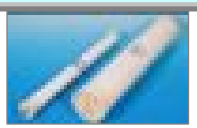
Innovation by Chemistry

Membrane-integrated Fermentation Process: Highly Efficient Bio-process

→ ・Highly efficient synthesis of polymer ingredient from non-edible biomass
・Developed by integrating Toray's original technologies

Filtration・Purification	+	Fermentation・Culture・Gene	+	Organic Synthesis
Water Filtration Membrane		Interferon β		Na Pyruvate
Artificial Kidney		DNA Chip		D-Tartaric acid
 etc.		 etc.		 etc.

Toray's Bio-based Polymer

Non-edible Biomass

	Polymer	Brand name
1,3-propanediol	PTT	Fitty
Lactic acid	PLA	Ecodear
Dimer acid	Flexible Co-polyester	
Sebacic acid	Nylon610	Amilan
Modified cellulose	Thermoplastic Cellulose	Foresse

Biomass conversion technology

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      - ・Biomass
      - ・**Water Treatment**
- Conclusion

Current Situation of Water Stress

TORAY
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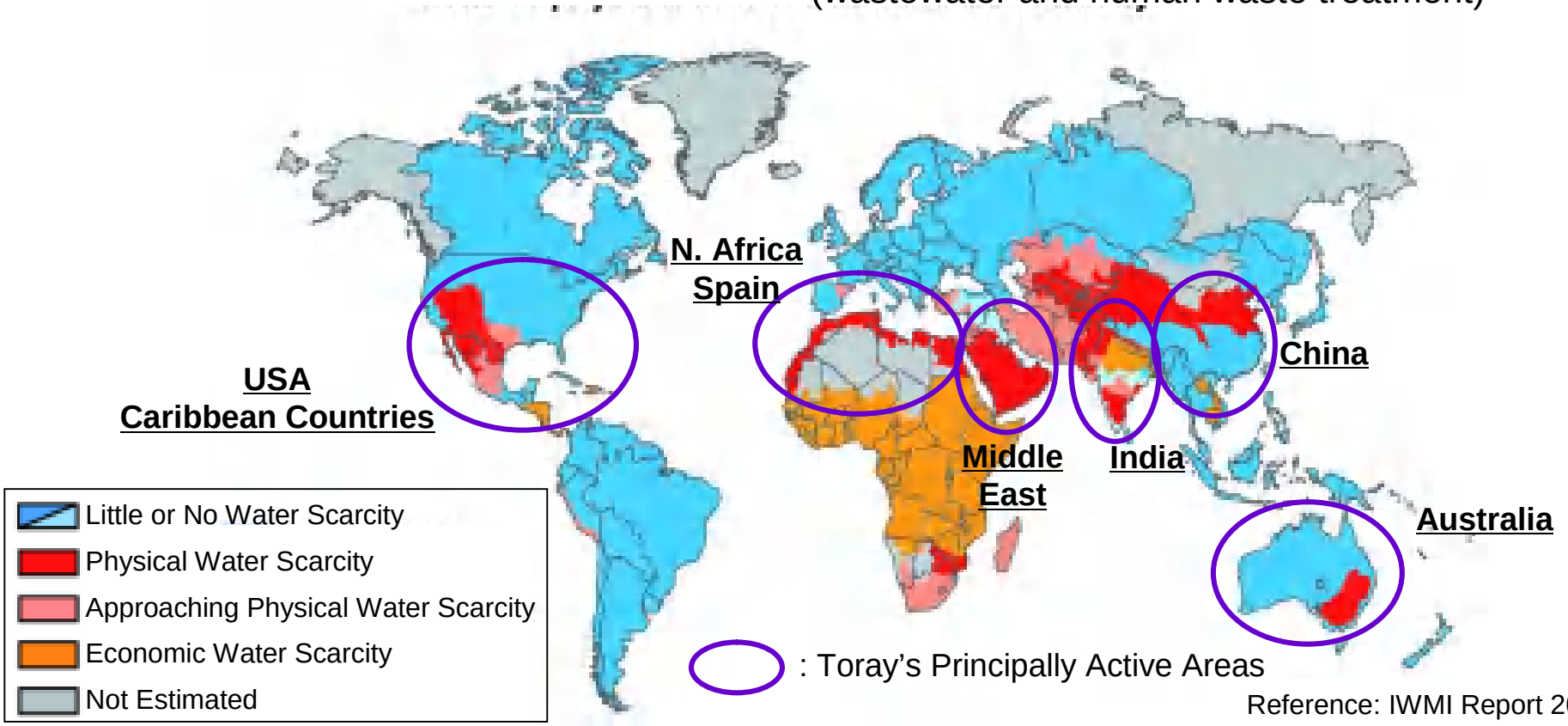
◆ **World population ; 6.5 billion**

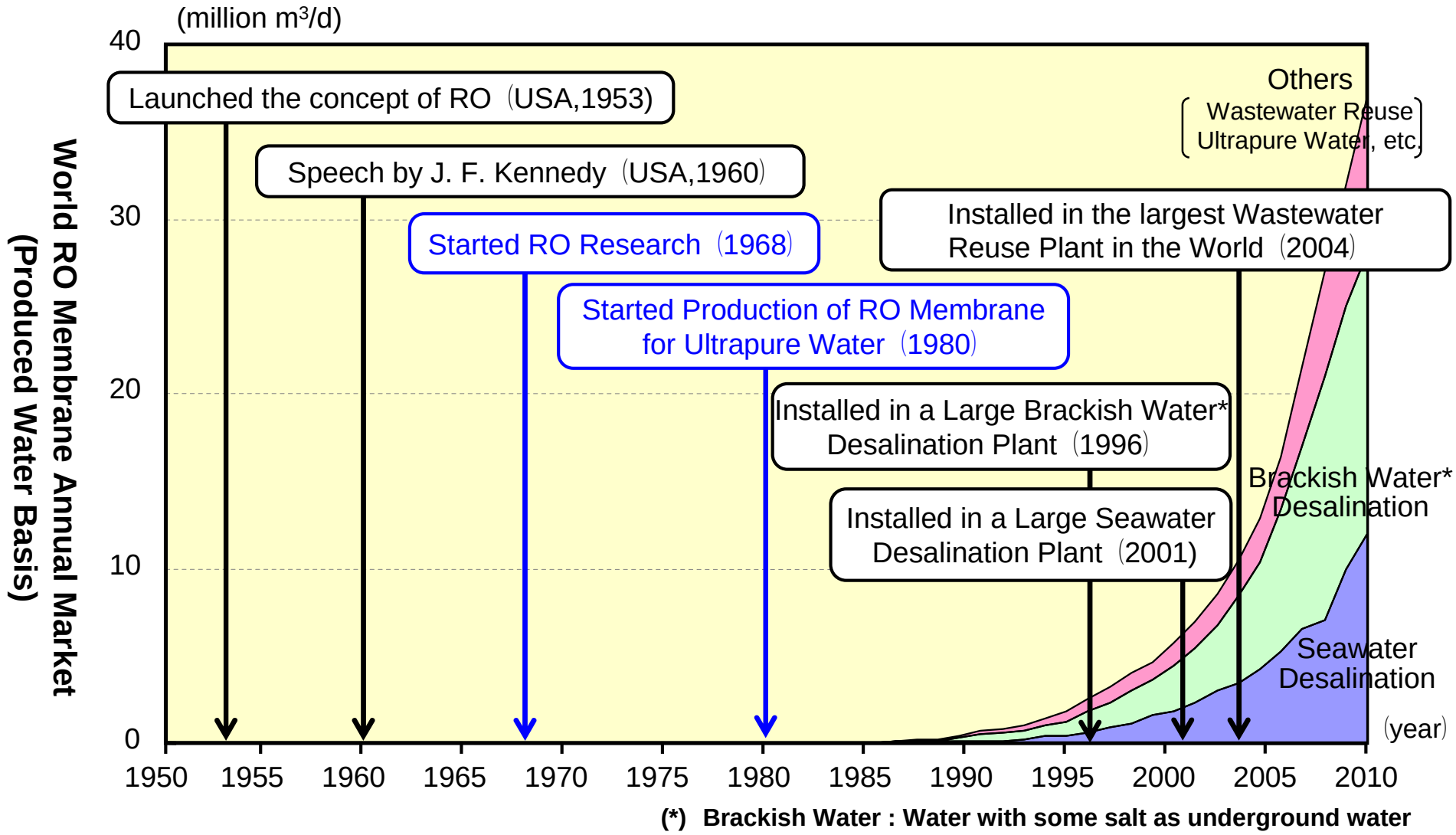
- ➢**1.1 billion people cannot access safe drinking water** (including daily life water)
- ➢**2.4 billion people do not have sanitary accommodations**
  (wastewater and human waste treatment)



Reference: IWMI Report 2006

★Global "Water Shortage" is the keenest issue, and it is expected to be even more serious

History of Toray's RO Membrane Business



(*) Brackish Water : Water with some salt as underground water

**Toray started R & D for RO membranes 40 years ago,
and has developed various types of Membranes, MF, UF, NF as wall as RO.**

Separation Targets and Membrane Types

'TORAY'
Innovation by Chemistry

Size	0.001μm	0.01μm	0.1μm	1μm	10μm
Separation Targets	Ions, Small Molecules	Large Polymers	Colloids	Clays	
	Trihalomethane, Monovalent Ions	Agricultural & Organic Materials, Multivalent Ions		Bacteria	Coliform, Cryptosporidium
Types	Semi-permeable Membrane		Low Pressure Membrane		
	Reverse Osmosis (RO)	Nano-filtration (NF)	Ultra-filtration (UF)	Micro-filtration (MF)	
Toray' Membrane Products	Ultrapure Water Seawater Desalination Wastewater Reclamation	Softening Removal of Toxic Matter	Municipal Drinking Water Reuse of Wastewater Pre-treatment for Seawater Desalination		Sewage Treatment
					
	RO membrane / NF membrane		UF membrane / MF membrane		MBR

Globalization of Toray's Water Treatment Business

'TORAY' Innovation by Chemistry

Examples of Project Orders

RO for Seawater Desalination

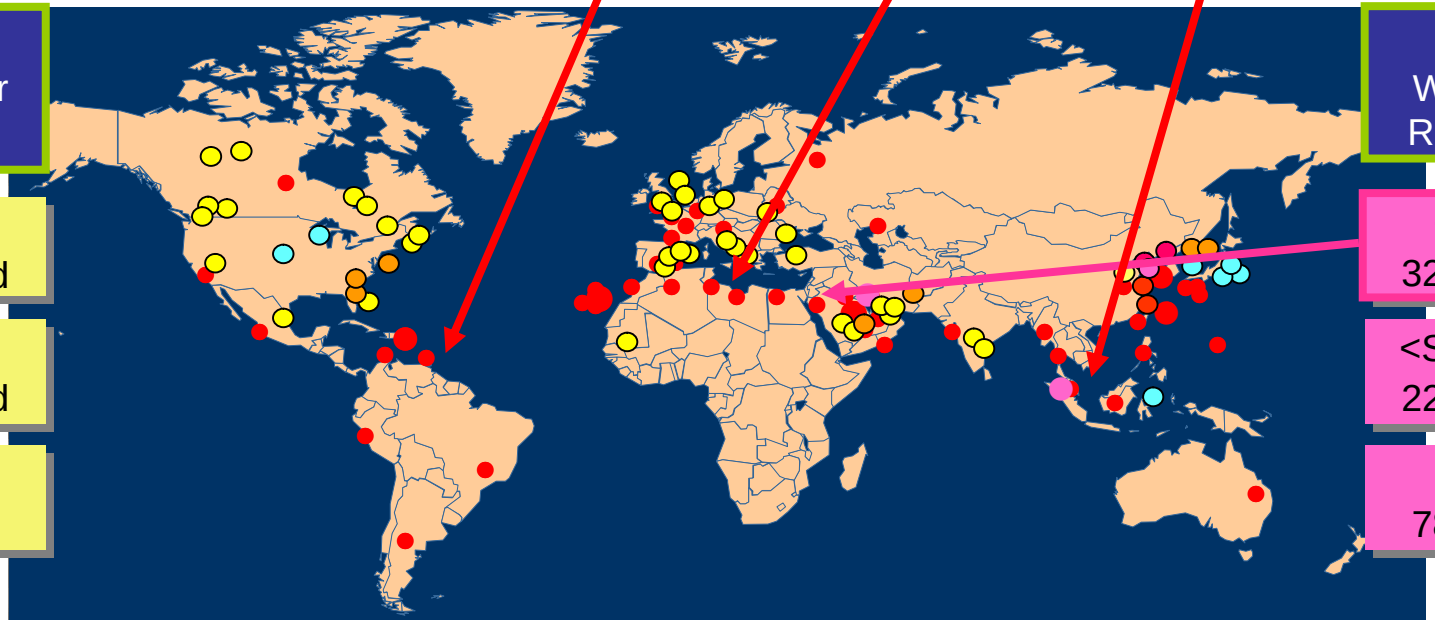
<Israel> 93,000 m³/d

<Saudi> 150,000 m³/d

<Trinidad > 136,000 m³/d

<Algeria> 200,000 m³/d

<Singapore > 136,000 m³/d



MBR for Wastewater Treatment

<UAE> 45,000 m³/d

<Saudi> 30,000 m³/d

<China> 6,500 m³/d

RO for Wastewater Reclamation

<Kuwait> 320,000 m³/d

<Singapore > 228,000 m³/d

<China > 78,000 m³/d

MF/UF for River Water Clarification

<Japan > 88,000 m³/d

<Korea > 30,000 m³/d

RO for Brackish Water Desalination

<KSA > 120,000 m³/d

<Iran > 100,000 m³/d

◆Total shipment of RO: 18 million m³/d
(equivalent to daily life water for 76 million people)

Advantage of RO Membrane Desalination Process

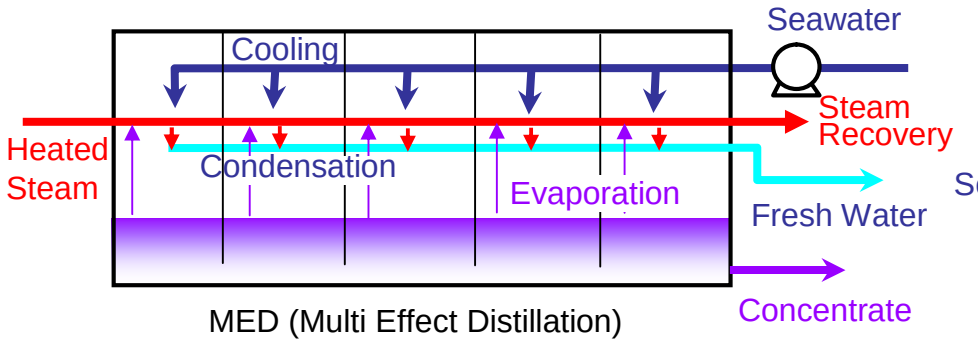
'TORAY'
Innovation by Chemistry

Thermal Process

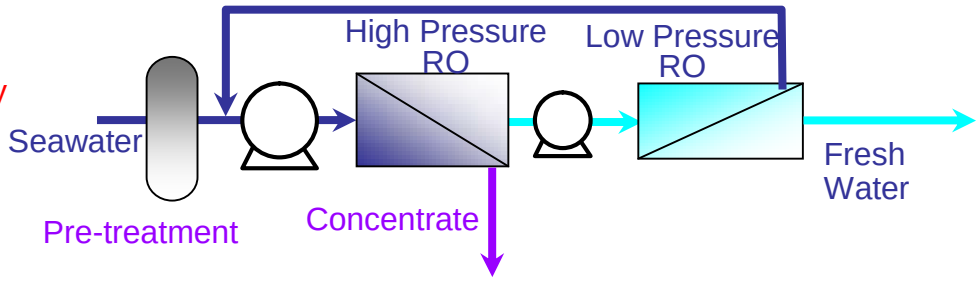
- Heated steam and/or evaporated seawater is condensed.
- Popular process in the Middle East

RO Process

- Pressurized water permeates across RO membranes.
- Multi-staging is applicable as required.



MED (Multi Effect Distillation)



Advantage of RO Desalination Process

1. Low Capital Cost	0.5 - 0.9 times of thermal process
2. Less Seawater (Higher Recovery Ratio)	Less than 1/4 of thermal process
3. Less Energy Consumption	Less than 1/5 of thermal process

Energy Consumptions and CO_2 Emission 【Estimated by TORAY】

	Thermal Process	RO Process
Energy Consumption [kWh/m³]	52 - 64	4 - 6
CO_2 Emission [kg/m³]	12 - 15	2.2 - 3.3

Approx. 80 % reduction of CO_2 emission

Advancement of RO Membrane Technology and Cost Reduction

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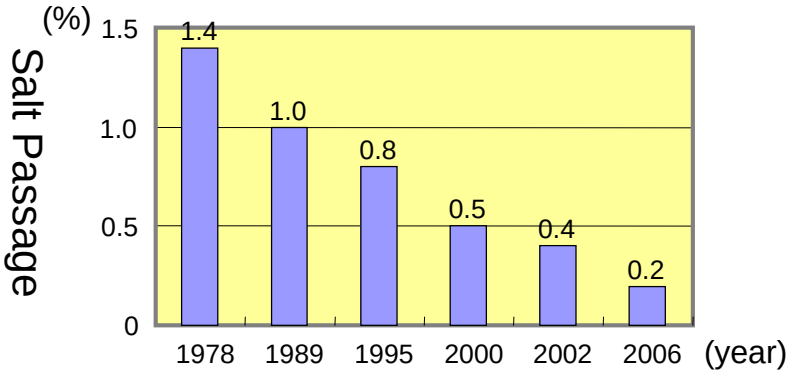
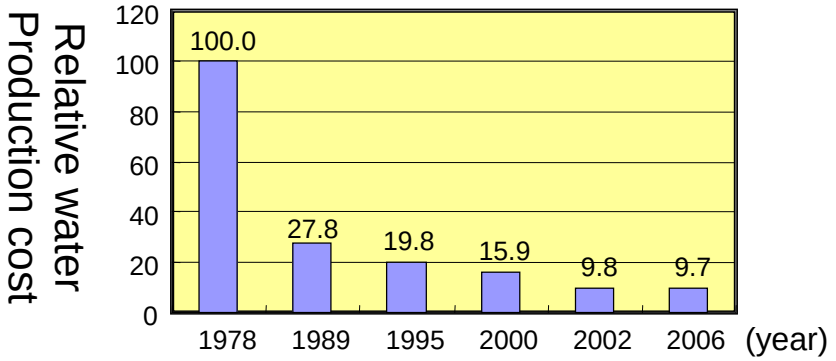
Innovation by Chemistry

1. Performance Improvement of RO Membranes - Salt Passage -

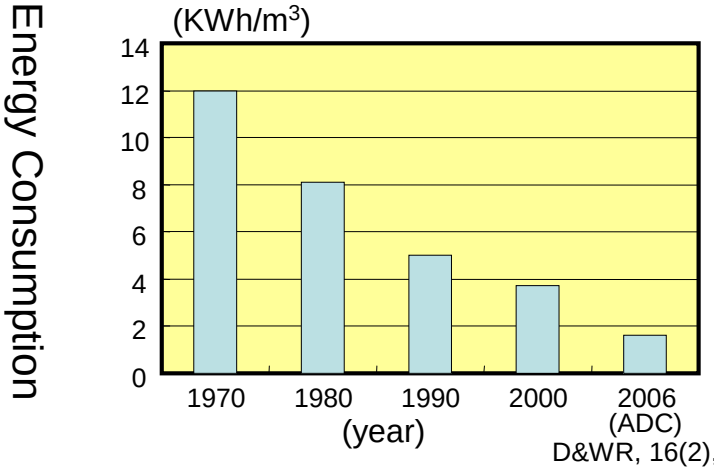


IDA news Water, 15 , 9-10 (2006).

2. Trend of Water Production Cost

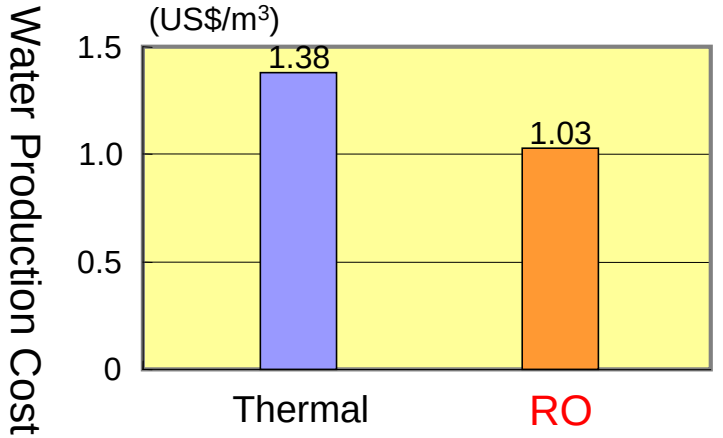


3. Energy Consumption for RO Desalination



D&WR, 16(2), 10-22 (2006).

4. Comparison of Water Production Cost - Thermal Process v.s. RO Process -



Global Water Intelligence , August (2006).

RO systems has been widely used as key technology of desalination in water stress area with the advancement of technology and cost reduction

Reduction of Energy Consumption by RO Membrane Technology

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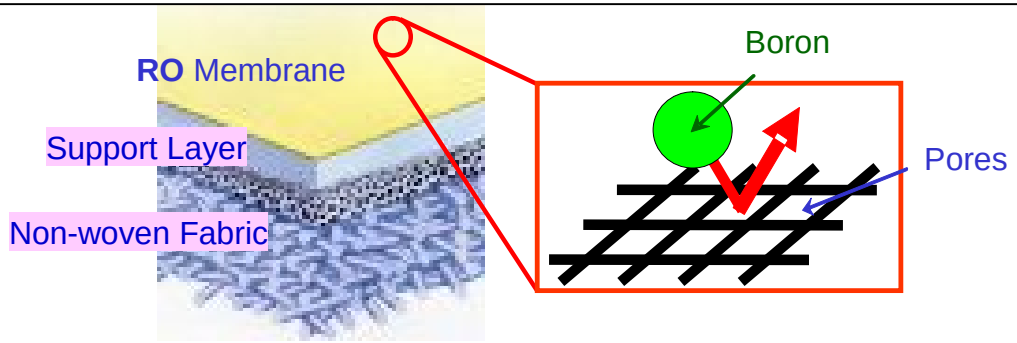
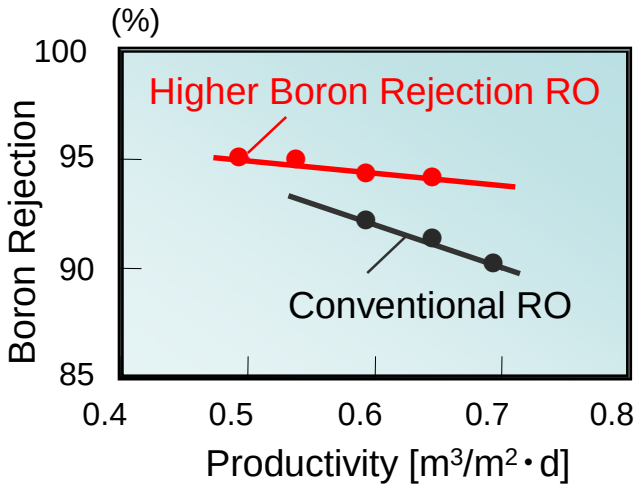
1. High Performance RO Membrane with Higher Boron Rejection and Energy Saving

Sub-nanometer(1/10 nanometer) pore sizes of RO membranes for seawater desalination was highly controlled utilizing Toray's original polymer design technology.

Polymer design for optimized pore size
→ ***High Productivity*** and ***Higher Boron Rejection*** are achieved.





2.【New Product】16-inch RO Membrane Element

Innovative auto-winding production realized
"Stable Element Quality" and "Large Membrane Area"

- Unit Cost ($/m^2) Reduction of Elements
- Reduction of CAPEX and OPEX (Approx.15-20% Reduction)
- Smaller Footprint (Approx. 15% Reduction)

Left: 16-inch (New)
Right: 8-inch (Conventional)

Energy consumption and CO_2 Eemission can be reduced
by Toray's "High Performance RO Membrane Technology" and "Element Production Technology".

Toray's Contribution to CO_2 Abatement

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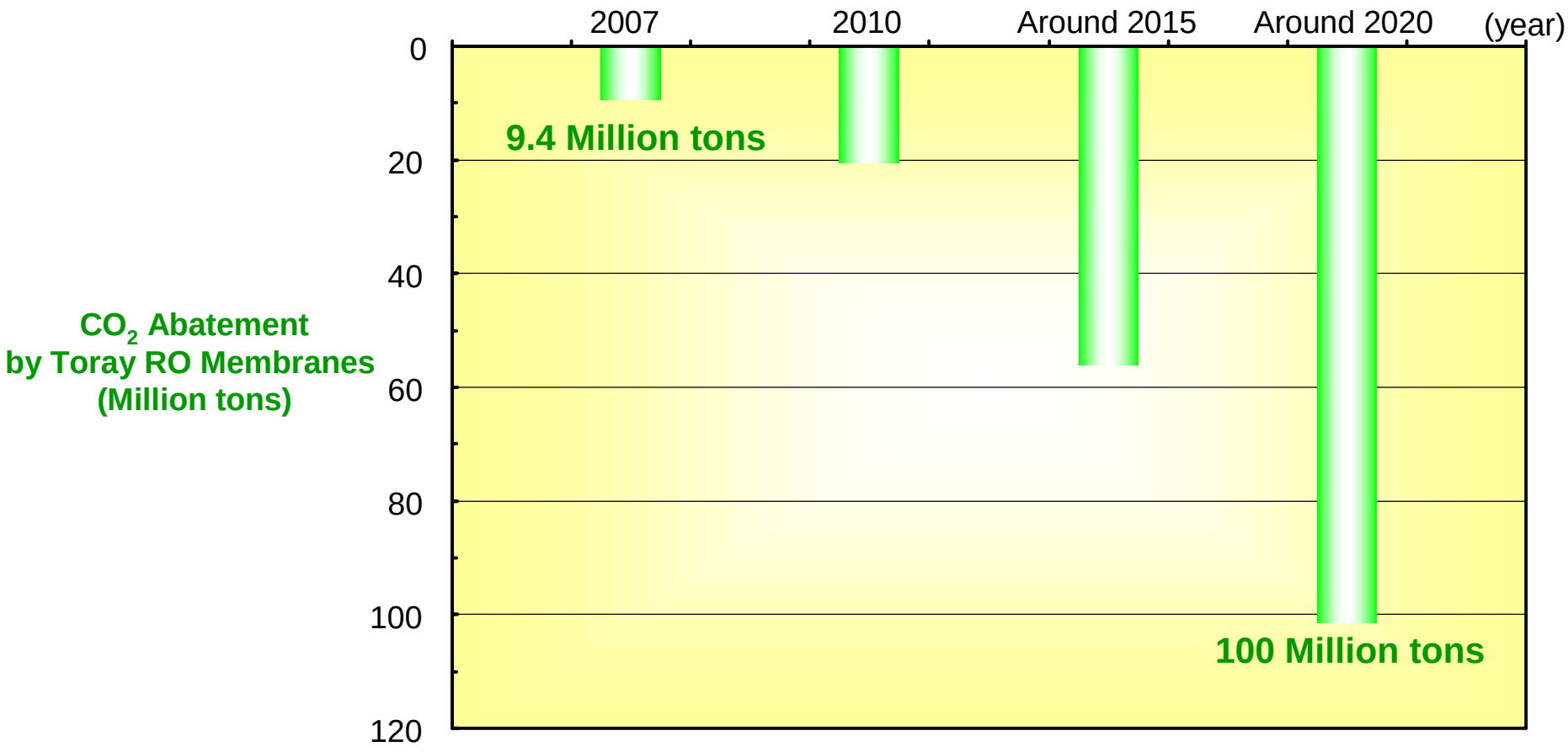

Premise

- Reduction of CO_2 Emission can be achieved, by changing from "Thermal Process" to "RO Process" for Seawater Desalination and Ultrapure Water Production.
- RO membranes under operations are added on the condition of 5-year RO Element Life.
- Assumed the same increase rate between 2015 to 2020 with that between 2010 to 2015.

Contents

Project “EcoChallenge”

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Toray Group’s initiatives are to proactively save resources and preserve global environment towards the realization of a sustainable low-carbon society.

	Fiber & Textiles	Films	Plastics Chemicals	Carbon Fiber Composite Materials	IT-related Products	Water Treatment /Environment
Energy Saving			Light Weight Materials for Automobiles / Airplane		Advanced EL Materials	Water Treatment by Membrane Technology
	Energy-Saving Building Materials (Insulation/Heat Shield/Heat Exchange Materials)					
	High-efficient Manufacturing Process, Energy-Saving Fabrication Technology, Modernizing of in-house Power Generation					
New Energy Resources		Battery Materials		Wind Power Generation		
		Materials for PV				
		Materials for Lithium-Ion Battery / Fuel Cell				
Biomass (Bio-Chemicals)	Nonfood Biomass-origin Polymer Products					Membrane Bioreactor
	Cellulose Fiber (Solvent-Free)		Chemical Process With Membranes			
Water Treatment/ Air Purification/ Environmentally-friendly Products	Heat Resistant Bag Filter			CNG/H_2Tank	Waterless Printing Plate	Water Treatment/ Modules/ Systems
	Eco-Process of artificial Suede	Film for Coating Alternative			BM Resin	
	Halogen-free Flame Retardant Agents					Air Filter
Recycle	PET, N6, PBT, ABS, PPS		DMSO	CFRP		

Life Cycle Management (LCA, Eco-Efficiency Analysis)

Roadmap of Project "EcoChallenge"

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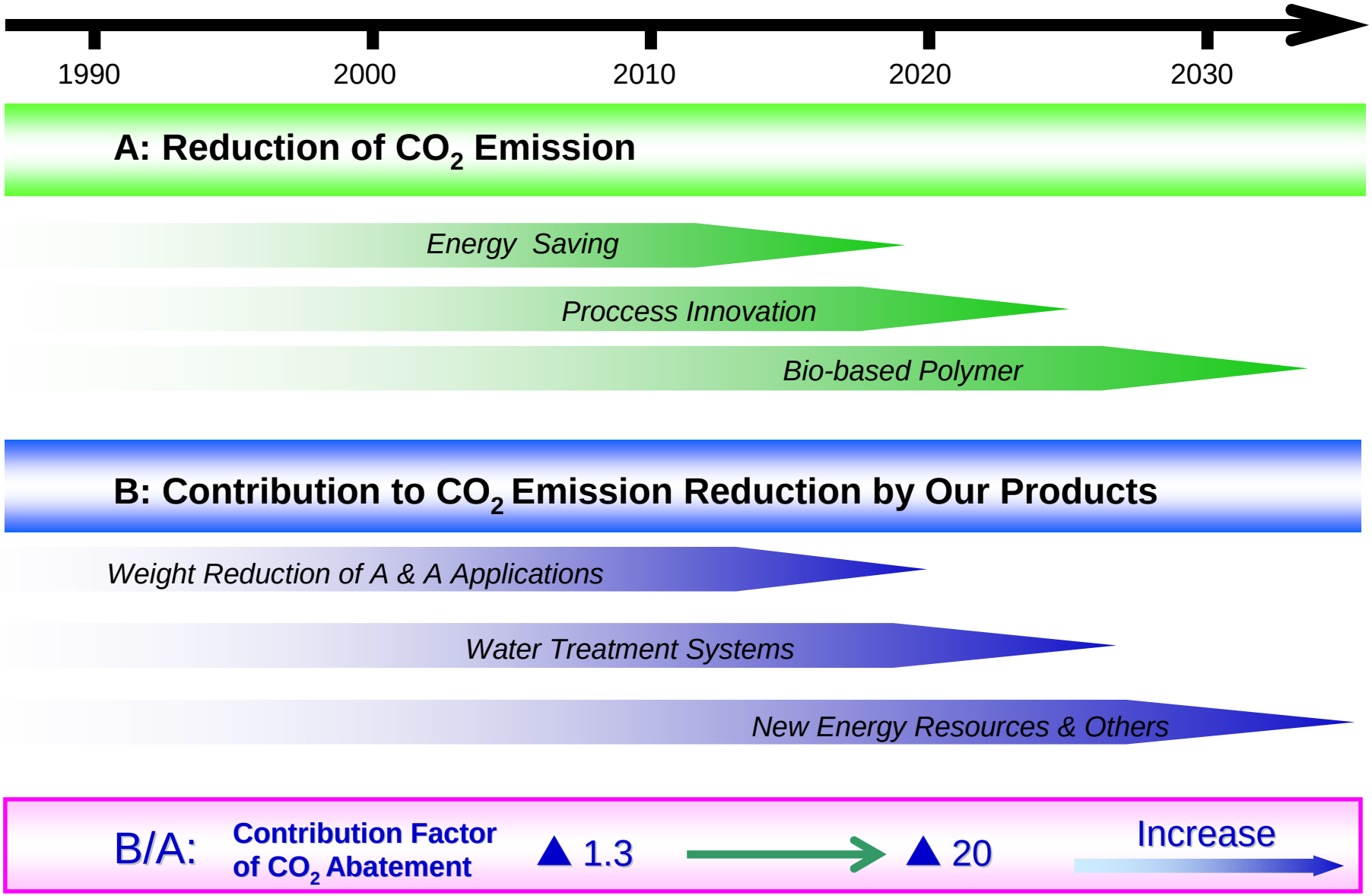

Toray's Contribution to CO_2 Abatement

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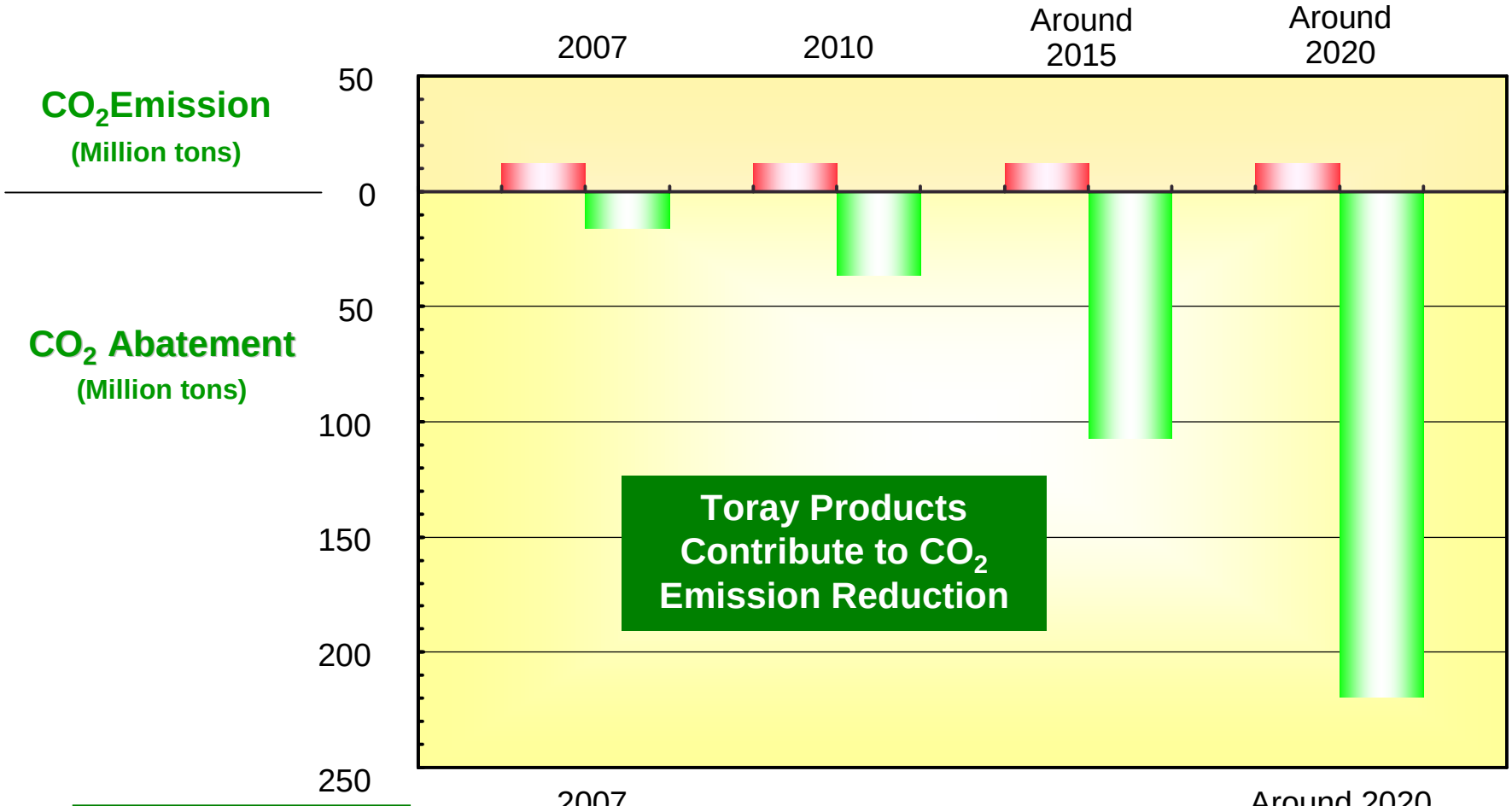

	2007	Around 2020
Contribution Factor of CO_2Abatement	1.3	20
Amount of CO_2Abatement	16Million tons	220Million tons

Expansion Plan of Environmentally-friendly Business

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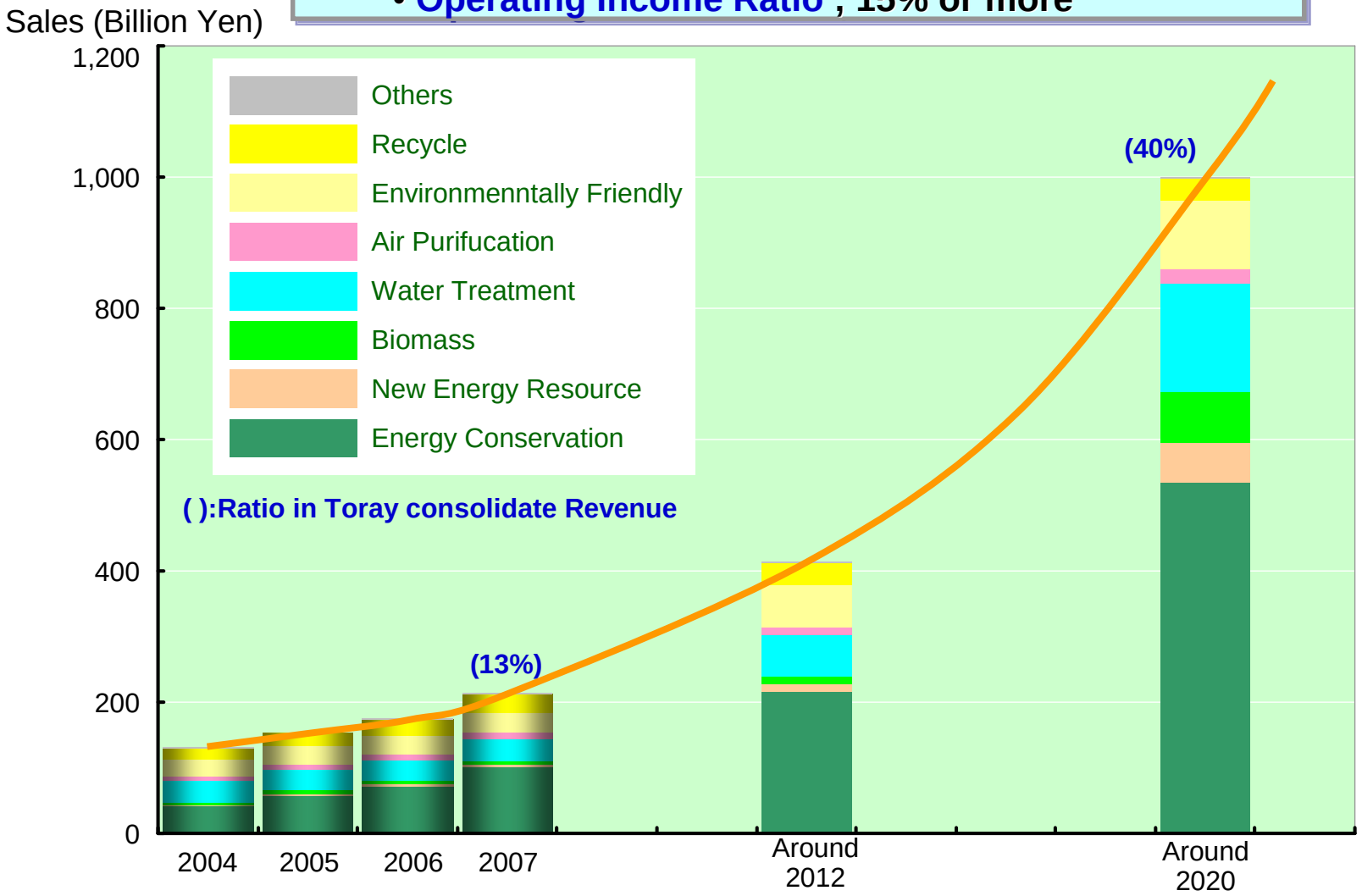
Goal of Environmental Business

- **Sales; 1 Trillion Yen (US$10Billion) (Around2020)**
- **Operating Income Ratio ; 15% or more**



Toray New Business Strategies
focused on Global Environment

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Management Policy

Toray Group consistently strives to make a contribution to society through the environment.

- To build a sustainable low-carbon society -

- **Reduction of CO_2 emission in production**
- **Reduction of CO_2 emission by our products**

Target (around 2020)

- **Reduction of CO_2 Emission**
  Contribution Factor of CO_2 Abatement; 20times
  CO_2 Emission Reduction; 220 Million tons a year
- **Sales of Environmentally-friendly Products Business**
  1 Trillion Yen (US$10 Billion) (40% of Toray's consolidated Revenue)

- **Global Environment Strategic Planning Dept.** to be established soon.
- Toray shifts corporate resources to global environment issues and promotes Toray New Business Strategy.

Dow Jones Sustainability World Index (DJSI World)

A leading global SRI (Socially Responsible Investment) index. The index is reviewed in September every year (among 2,500 companies around the world on economic, environment, and social criteria of which the top 10% of superior companies are selected). DJSI world 2008/2009, which took effect on September 22, 2008, includes 320 companies all over the world, of which 36 companies are Japanese including Toray. In Chemicals sector, in which Toray is allocated, 9 companies have been selected as index components of DJSI world 2008/2009. Toray is the only Japanese company selected from Chemicals sector for the second consecutive year.

KLD Global Climate 100 Index (GC100)

A world-leading SRI research institute, KLD Research & Analytics, Inc., selects 100 companies worldwide that are leaders in providing solutions to global warming and offsetting the long-term effects of climate change, which is the world's first global index. The index allocates to development corporations and large users of renewable energy, clean technology and alternative fuels and provides investment strategies to investors on investments to companies in the area of new energy development and users. GC100 was launched on July 1, 2005, and currently includes 16 Japanese companies (including Toray), 54 companies in North America, 26 in Europe, and 4 corporations in Asia.

Morningstar Socially Responsible Investment Index

Almost 3,600 listed companies are reviewed on ①governance / accountability, ②market (customers / suppliers), ③employment, ④social responsibility, and ⑤environment criteria. While existing SRI criteria is mainly based on companies' commitments to ethical or responsibility issues, this index emphasizes more on active posture of companies, that is, "creativity" is the key criteria to be selected as index components (150 companies).

Toray Receives 2008 Humanitarian Award from the United Nations Association of New York

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Toray receives the 2008 Humanitarian Award from the United Nations Association of New York (UNA-NY) in recognition of its Environmentally Friendly Business activities as well as its CSR activities targeting sustainable social growth.

Humanitarian Award from the United Nations Association of New York

UNA-NY has been selecting one Millennium Development Goal (of the eight 21st Century goals) each year as the theme for the award and the scope of the award was also expanded to include businesses, individuals and organizations in the given field. Past recipients include UNICEF and GE Foundation.
The 2008 Humanitarian Award was themed around Climate Change. The scope of the award covered overall efforts combating environmental issues and the other recipients this year were Mr. Ban Ki-moon, Secretary-General of the United Nations, and Mr. Olafur Ragnar Grimsson, President of Iceland.

Background for winning the Award

Environmentally friendly business activities including its involvement in such areas as, seawater desalination, water treatment and carbon fiber composite materials businesses as well as for its CSR activities targeting climate change prevention and sustainable social growth.

President Sakakibara is shown with United Nations Secretary-General Mr.Ban Ki-moon,who was also an award recipient.

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.


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