Medium-term Business Plan

FY2023~2025

Tosoh Corporation
August 10, 2022

Disclaimer

≪**Note**≫

This presentation contains information and medium-term plans and forecasts based on data available at the present time of creation. As such, Tosoh Corporation makes no guarantees regarding forward-looking plans or forecasts as the operating environment is subject to risks and uncertainties that may result in substantial changes in the future.

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Agenda

I. Summary of FY2020 – 2022 Medium-term Business Plan (MTBP)

II. Medium-to Long-term Management Policies (~FY2031)

III. Overview of FY2023 – 2025 MTBP

(Ref.) Tosoh Products' Contribution to Society

I. Summary of FY2020~2022 Medium-term Business Plan (MTBP)

Performance: Results

✓ Record-high sales and profits were achieved, partly due to improved market conditions for Chlor-alkali

		FY2022		
		Target	Actual	Variance
Net Sales		890.0	918.6	28.6
Operating Income		110.0	144.0	34.0
Operating Income Ratio		over 10%	15.7%	Achieved
ROE		over 10%	16.3%	Achieved
Dollar	¥/$	110*1	112*2	2
Euro	¥/ €	125*1	131*2	6
Naphtha	¥/ kl	46,000	56,875	10,875
Benzene	$/ T	600-700	994	344
PVC	$/ T	800-900	1,373	523
VCM	$/ T	650-750	1,208	508
Liquid caustic soda	$/ T	350-450	515	115
MDI(monomeric)	$/ T	2,150-2,350	2,585	335
MDI(polymeric)	$/ T	1,250-1,450	2,463	1,113

[1] The assumed exchange rate when targets were established.
[2] The average exchange rate during the period under review.

Performance: By Business Group

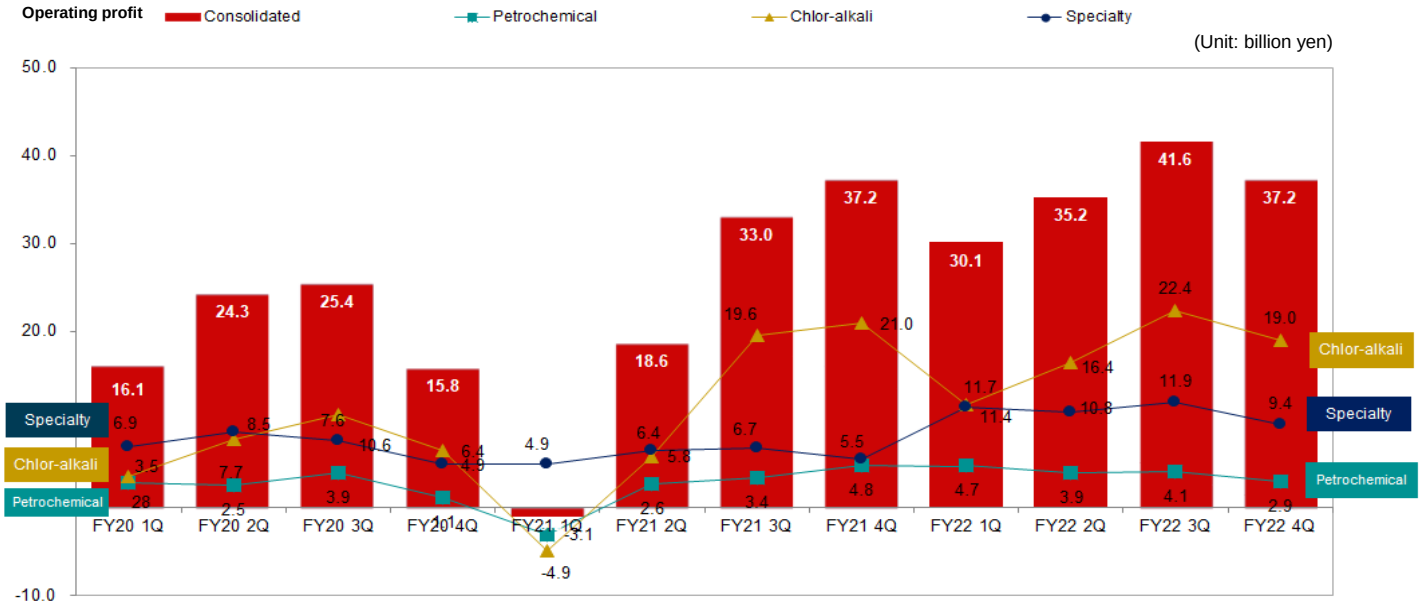
- ✓ Petrochemical Group: Targets achieved due to rising raw materials and fuel prices reflected in selling prices.
- ✓ Chlor-alkali Group : Market prices soared as global supply dipped due to environmental regulations in China restricting exports and natural disasters in the U.S., etc. As a result, sales and profits increased significantly.
- ✓ Specialty Group: Profit targets achieved due to the recovery of the bioscience business and improving markets for bromine and flame retardants.

(Unit: billion yen)

		FY2022		
		Target	Actual	Variance
Net Sales	Petrochemical	175.0	177.2	2.2
	Chlor-alkali	319.0	361.6	42.6
	Specialty	239.0	226.2	△12.8
	Engineering/Ancillary	157.0	153.6	△3.4
	Total	890.0	918.6	28.6
Operating Income	Petrochemical	15.0 8.6%	15.7 8.8%	0.7 0.3%
	Chlor-alkali	41.0 12.9%	69.5 19.2%	28.5 6.4%
	Specialty	43.0 18.0%	43.5 19.2%	0.5 1.3%
	Engineering/Ancillary	11.0 7.0%	15.3 10.0%	4.3 3.0%
	Total	110.0 12.4%	144.0 15.7%	34.0 3.3%

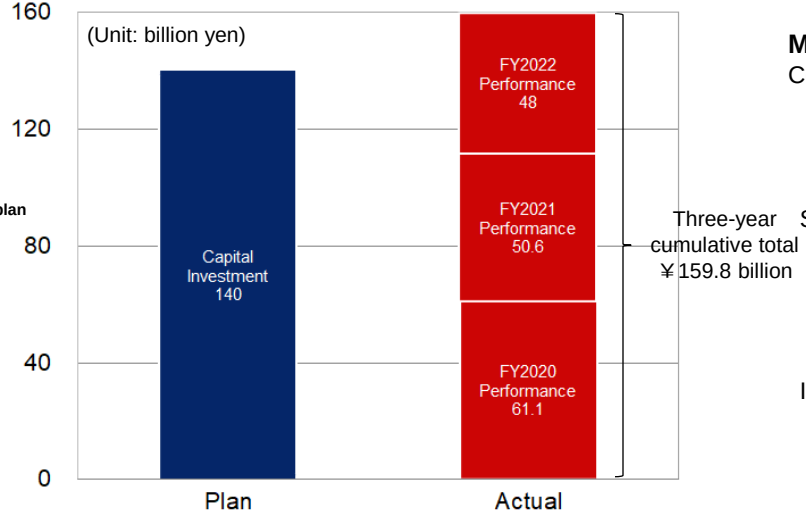
Performance: Trends

- ✓ Business conditions deteriorated in the fourth quarter of FY2020 and profits fell into the red in the first quarter of FY2021 due to the impact of COVID-19.
- ✓ Chlor-alkali Group: FY2021 profits significantly increased due to soaring market prices of vinyl chloride and urethane raw materials.
- ✓ Specialty Group: Sales were low in FY2021 due to the impact of COVID-19 but started to recover in FY2022.



Performance: Investments

- ✓ Capital investment: Cumulative three-year investment exceeded budget by 20 billion yen.
- ✓ M&A: Search and bidding primarily on bio-related fields did not lead to successful bids.



FY2020 – 2022 3-year investment plan

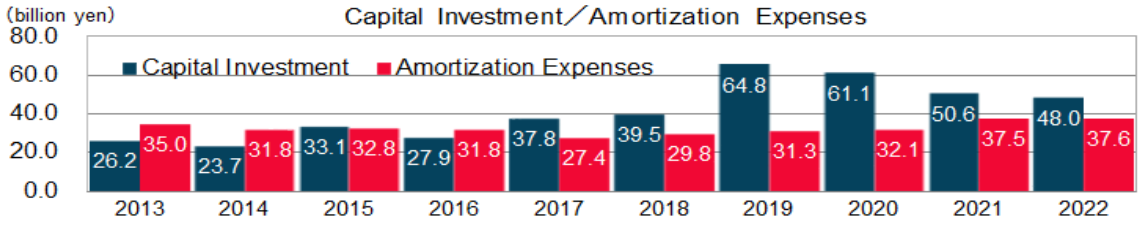
Three-year cumulative total ¥159.8 billion

Major Investment Projects:

Commodity (35 billion yen):
- Improved the efficiency of power generation facilities
- Boiler biomass co-firing power generation
- Calcium hypochlorite (scrap & build)

Specialty (65 billion yen):
- Chloroprene rubber (debottlenecking)
- Liquid chromatography A1c columns and reagents (automation)
- Bromine (scrap & build)
- Silica glass materials and fabricated quartzware (expansion)

Infrastructure:
- Establishment of general logistics warehouse
- Renewal of ethylene and VCM shipping vessels
- Establishment and renovation of Tokyo Research Center's research building



R&D

(New research building in Nanyo)

(New research building in Yokkaichi)

✓ Focused on maintenance and expansion of R&D

➢ Renewal and expansion of research infrastructure

Renovated buildings and facilities at all research bases (Total investment of over 20 billion yen)

- Completed reconstruction of research buildings at the Nanyo and Yokkaichi Complexes.
- Started reconstruction of the Tokyo Research Center

➢ Advancement of open innovation

Establishment of collaborative courses with the University of Tokyo related to zeolite and zirconia

- Zeolite: Established in June 2019, aiming to construct an innovative synthesis process, etc.
- Zirconia: Established in July 2020, aiming to improve zirconia features that will overturn the concept of ceramics

➢ Full-scale development of material informatics (MI) technology

Established MI team consisting of dedicated staff and started full-scale technology development

- Distributed electronic lab notebooks to all researchers for more efficient accumulation of experimental data

➢ Acquisition of advanced technology

Invested in funds and gathered information to acquire innovative technologies

- Conducted joint research on promising projects

R&D: Results

SARS-CoV-2 diagnostics reagents

Developed and launched antibody test reagents against SARS-CoV-2's nucleocapsid protein or spike protein by using Tosoh's automated chemiluminescence enzyme immunoassay analyzers(AIA-CL). Tosoh has also completed the development and launch of an antigen test reagent for the same virus.
This enables simultaneous antigen/antibody detection for SARS-CoV-2 with the same device.

TRCReady SARS-CoV-2 detection kit

Automated TRCR real-time molecular analyzer TRCReady-80

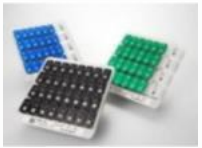
A novel ovarian cancer marker "TFPI2" (AIA-series reagent)

Developed the novel AIA-series reagent for the measuring TFPI2, used as an aid in the diagnosis of ovarian cancer. This reagent is effective in distinguishing between ovarian benign tumor (especially endometriosis)and malignant ovarian cancer. Measurement is possible in about 20 minutes using Tosoh automated enzyme immunoassay AIA analyzers.

The SARS-CoV-2 antigen and antibody detection reagents (jointly developed with Yokohama City University and Kanto Chemical Co., Inc.)

Developed and launched a reagent to detect antibodies to SARS-CoV-2's nucleocapsid protein and spike protein by using Tosoh's automated chemiluminescence enzyme immunoassay analyzers. Tosoh has also completed the development and launch of an antigen test reagent for the same virus.
This enables antigen/antibody detection for SARS-CoV-2 with the same device.

AIA®-CL2400



Antibody reagent

Antigen reagent

* TRCReady, AIA and AIA-CL are registered trademarks of Tosoh Corporation in Japan, Europe, China, India, etc.

R&D: Results

Self-doped conducting polymer (Selftron®)

Selftron exhibits the highest conductivity among all the world's self-doped conductive polymers. Since it is soluble, it can be applied to enable electrical conductivity to materials and substrates (conductive resins, conductive fibers, etc.)
Selftron is expected to be used in a wide range of fields and application development is ongoing. As demand is rapidly increasing due to the introduction of 5G and the shift to electric vehicles, this product contributes to the miniaturization and high capacitance of capacitors.

High-performance aldehyde scavenger (Emidelete®)

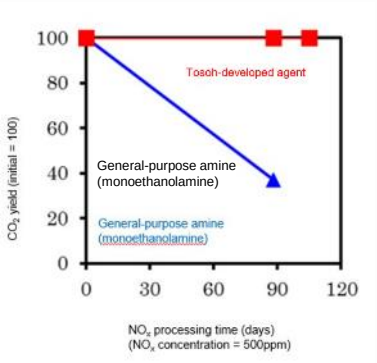
Emidelete captures aldehydes, the causative agent of sick building syndrome, with high efficiency and at high speed. It is also excellent in capturing acetaldehyde, which has been difficult to capture in the past. It can also capture unpleasant odors such as amines, ammonia, and hydrogen sulfide.

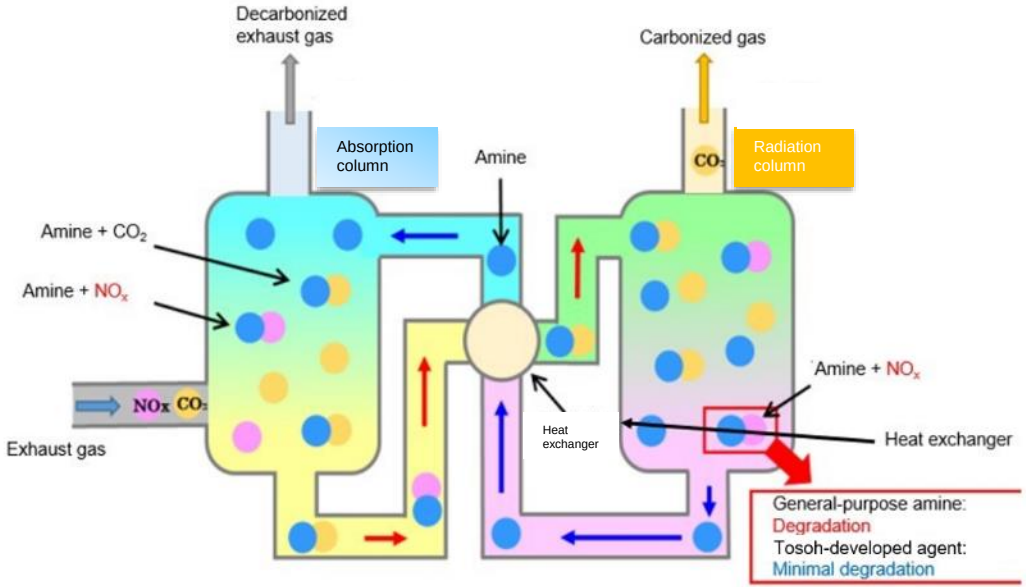
* Selftron and Emidelete are registered trademarks of Tosoh Corporation in Japan, Europe, China, etc.

R&D: Results

Amine with superior NOx resistance for use in CO2 recovery

Tosoh has developed a high-performance amine that can be used to recover CO2. Amines used in CO2 recovery are required to have both energy-saving (CO2 recovery with less energy) features and high durability (resistant to the degradation caused by NOx). This newly developed amine shows excellent values for both in laboratory evaluations.





R&D: Results

Material recycling aid for composite plastics (Melthene S)

Recycling products made of different types of plastics has always been a challenge because the plastics do not mix with each other easily. However, by adding Melthene S to control compatibility (mixing properties), recycling is made possible. Melthene S is able to suppress the deterioration of physical properties (strength, etc.) of recycled resins. It also has the effect of reducing viscosity, yellowing, fish-eye, etc. during molding.

Gallium nitride (GaN) thin film deposition technology by sputtering method

Gallium nitride (GaN) is a semiconductor used as a material for blue light-emitting diodes (LEDs). It is a compound made up of gallium (Ga) and nitrogen (N) and is a suitable material for power semiconductors (semiconductors that rectify electricity, raise and lower voltage, convert frequency, etc.). GaN-based semiconductors can reduce energy loss to about one-tenth that of silicon (Si) semiconductors.
GaN is mostly deposited through the CVD method. However, the CVD method has low raw material utilization efficiency and uses large amounts of expensive combustible gas. In addition, deposition requires high temperatures of 1,000℃ or higher, limiting the materials that can be used for deposition. On the other hand, GaN deposition by the sputtering method developed by Tosoh can be performed at room temperature using a small amount of nonflammable gas, enabling low-cost and safe deposition on a variety of materials.

Environmentally friendly zirconia that can be sintered at low temperatures (Zgaia™ series)

By redesigning the particle structure, Tosoh has developed the “Zgaia” series to its line-up of zirconia powders, which can be sintered at a lower temperature (1,250℃) than the conventional sintering temperature (1,500℃). Lower firing temperature also contributes to energy savings and reduced CO2 emissions.

Tosoh’s Zgaia 1.5Y-HT grade achieves superior bending strength (fracture toughness) than conventional products by featuring the lowest level of yttria.
The Zgaia series’ 3Y-LD grade has the same amount of yttria as before, but the yttrium ions are uniformly distributed on a nanoscale, which results in astonishing durability.

Zirconia Powder

* Melthene and Zgaia are registered trademarks of Tosoh Corporation in Japan, etc.

Safe and Stable Operation

✓ Efforts to strengthen safety

➢ Reinforcement of preventive maintenance
- In addition to ordinary maintenance, Tosoh has invested a cumulative total of 25 billion yen from FY2015 to FY2022 to reinforce preventive maintenance.

➢ Promotion of smart security
- Introduced advanced driver-assistance system and anomaly detection system, etc.

➢ Expansion of safety education
- Expanded facilities to simulate plant operations and plant accidents

➢ Reinforcement of construction system
- Developed initiatives to strengthen safety management in cooperation with partner companies

➢ Decrease in workplace accidents, abnormal incidents of plants, and other major incidents

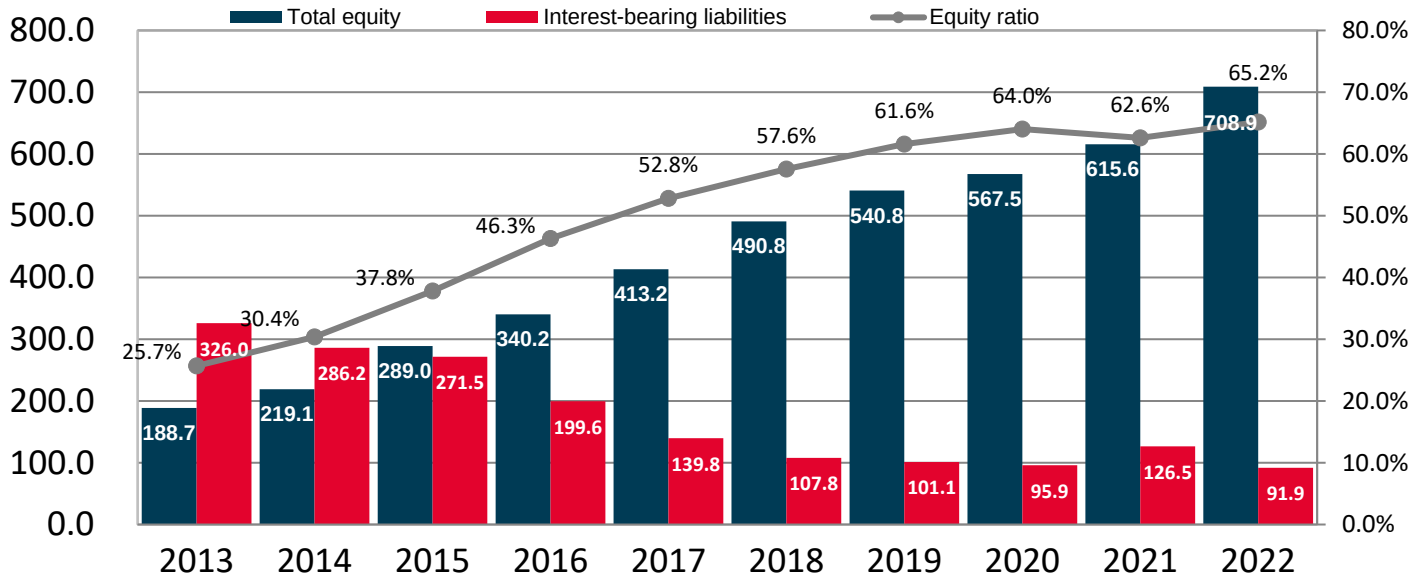
➢ Reduced opportunity losses, contributing to increased earnings in Commodity business

Financial Objectives

✓ Progress was made to strengthen the financial base and resulted in negative net debt-to-equity ratio (virtually debt-free)

Equity capital and interest-bearing debt (Unit: billion yen)

Capital adequacy ratio (%)



Net D/E ratio	1.42	1.05	0.75	0.36	0.13	0.00	0.01	-0.01	-0.04	-0.10

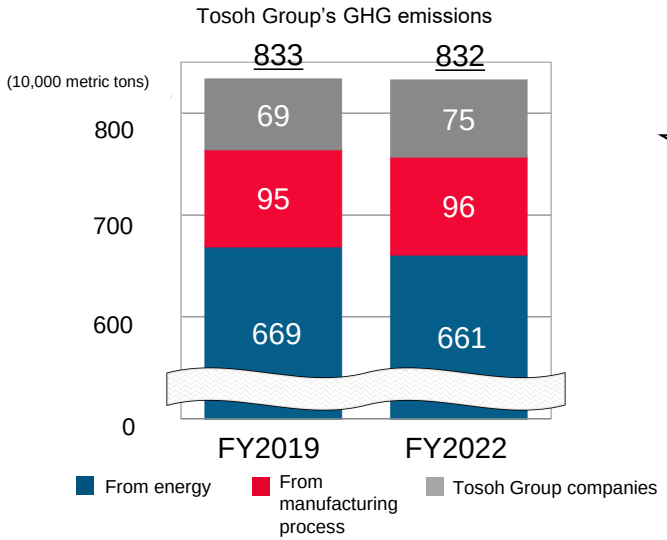
Shareholder Returns

- ✓ Continued stable dividends
- ✓ Shareholder returns with a target payout ratio of 30%
- ✓ Share repurchase (10 billion yen) to enhance shareholder returns

		FY2020	FY2021	FY2022
Dividend	Per share	56 yen	60 yen	80 yen
	Amount paid	18.2 billion yen	19.1 billion yen	25.5 billion yen
Treasury stock	Shares repurchased	6.78 million shares	-	-
	Value	10 billion yen	-	-
Dividend payout ratio		32.7%	30.3%	23.6%
Total return ratio		50.8%	30.3%	23.6%

Reduction of CO2 emissions

- ✓ 10,000 tons decrease in GHG emissions compared to FY2019
- ✓ Although 270,000 tons of GHG emissions were reduced by implementing various measures, 260,000 tons were increased due to growing production, etc.



Energy: CO2 emitted from fossil fuel combustion

Manufacturing process: CO2 emitted from chemical reactions in the manufacturing process, mainly from the thermal decomposition of limestone, which is the main raw material of cement.

FY2019 GHG emissions 8.33 million tons

Reduced due to various measures -270,000 tons

Increase in production +260,000 tons

GHG emissions in FY2022: 8.32 million tons

Capital Investment for CO2 Reduction (FY2020-2022)

- Modified caustic soda electrolyzer to be energy-saving
- Installed gas turbine for effective use of surplus by-product gas and improved efficiency of naphtha cracking furnace
- Introduced the state-of-the-art turbines and rotors to power generation facilities
- Introduced optimal load balancing system to power plant
- Increased biomass co-firing by modifying power generation boiler facilities
- Renewed cement plant facilities to increase waste acceptance

II. Medium- to Long-term Management Policies (~FY2031)

General Comments

"The first requirement for a sustainable company is to be trusted by its stakeholders."

Toward the realization of this goal, we need to…

1. Continue to earn the trust of customers, suppliers, and government through safe production and stable supply
2. Contribute to society and the common good (of humankind) through sustainable product development

As a result,

3. Continue to earn the trust of stakeholders such as shareholders, employees, customers, business partners, and local communities by generating stable earnings and increasing corporate value through growth investment.

Representative Director, President, Mamoru Kuwada

Corporate CSR Philosophy

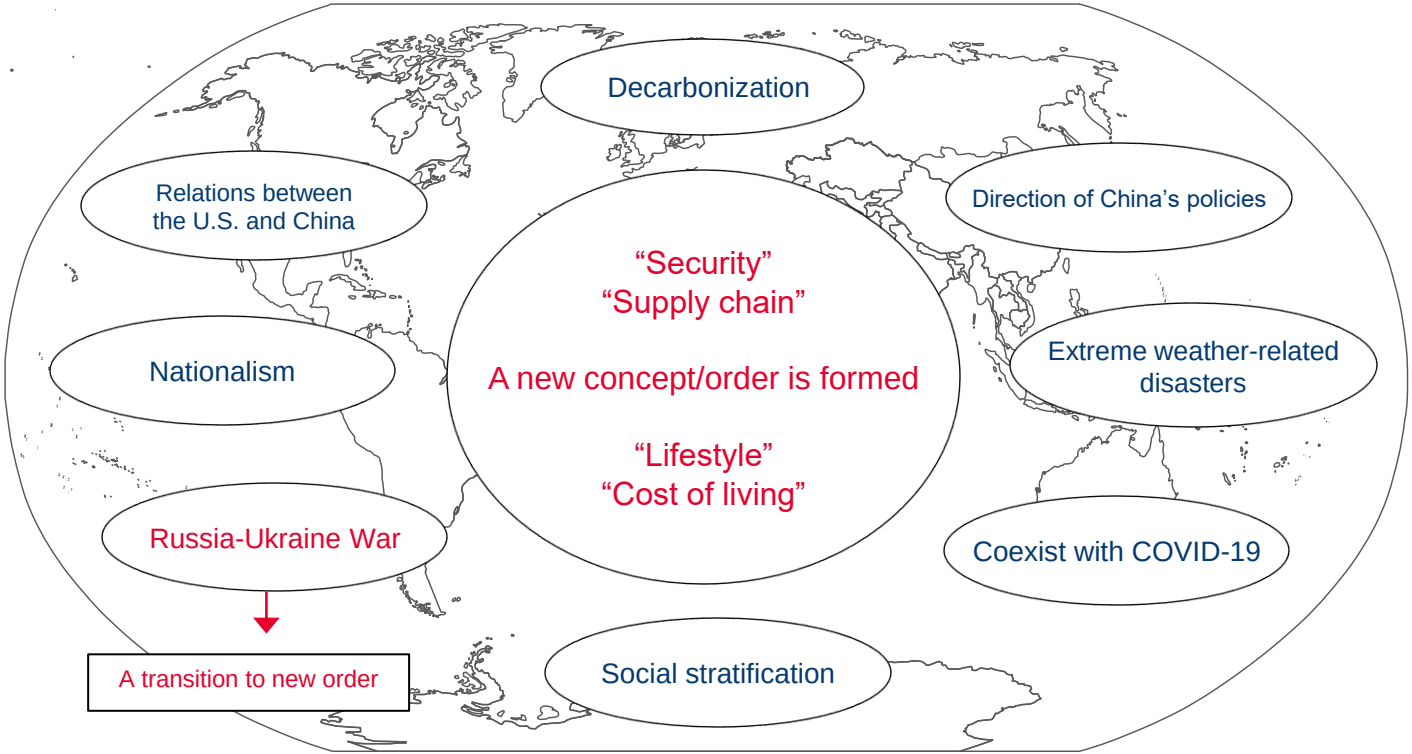
"Tosoh contributes to bettering society through the chemistry of innovation."

With the aim of bringing this vision to fruition, we practice the following:

1. Contribute to the development of a sustainable society through our business activities
   - Resolve social issues and offer products that contribute to improving the quality of life
2. Secure safe and stable operation
   - Recognize safety as a top-priority management issue and tackle it head-on
3. Promote a free and open corporate culture
   - Cultivate an open work environment that respects human rights and diversity
4. Preserve global environment
   - Minimize environmental burden across activities in the entire value chain
5. Pursue our activities with integrity
   - Continue to be a reliable partner that is worthy of trust and respect by acting with transparency and integrity in all that we do

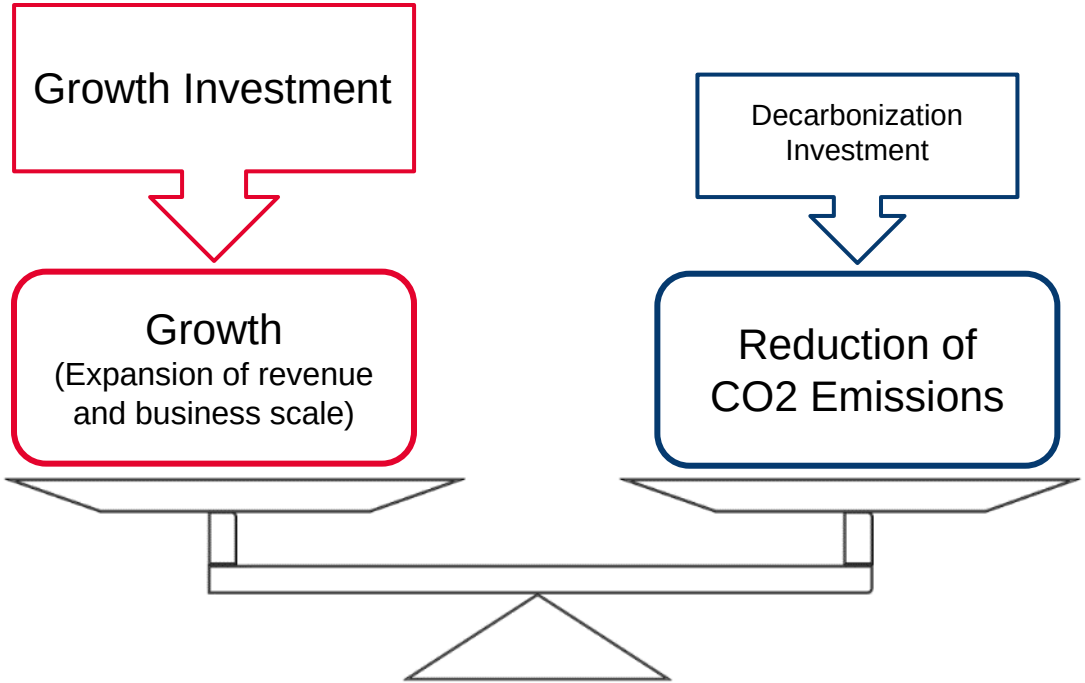
Business Environment

The world faces the need for unprecedented change



Management Challenges

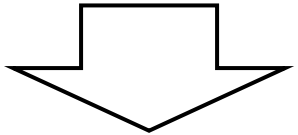
✓ The biggest management challenge is to balance growth and decarbonization.



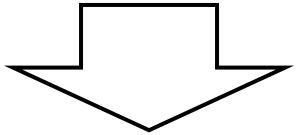
Impact of Russia-Ukraine War

✓ Energy prices will take time to stabilize as Russia-Ukraine conflict is likely to prolong

Prolonged Russia-Ukraine War



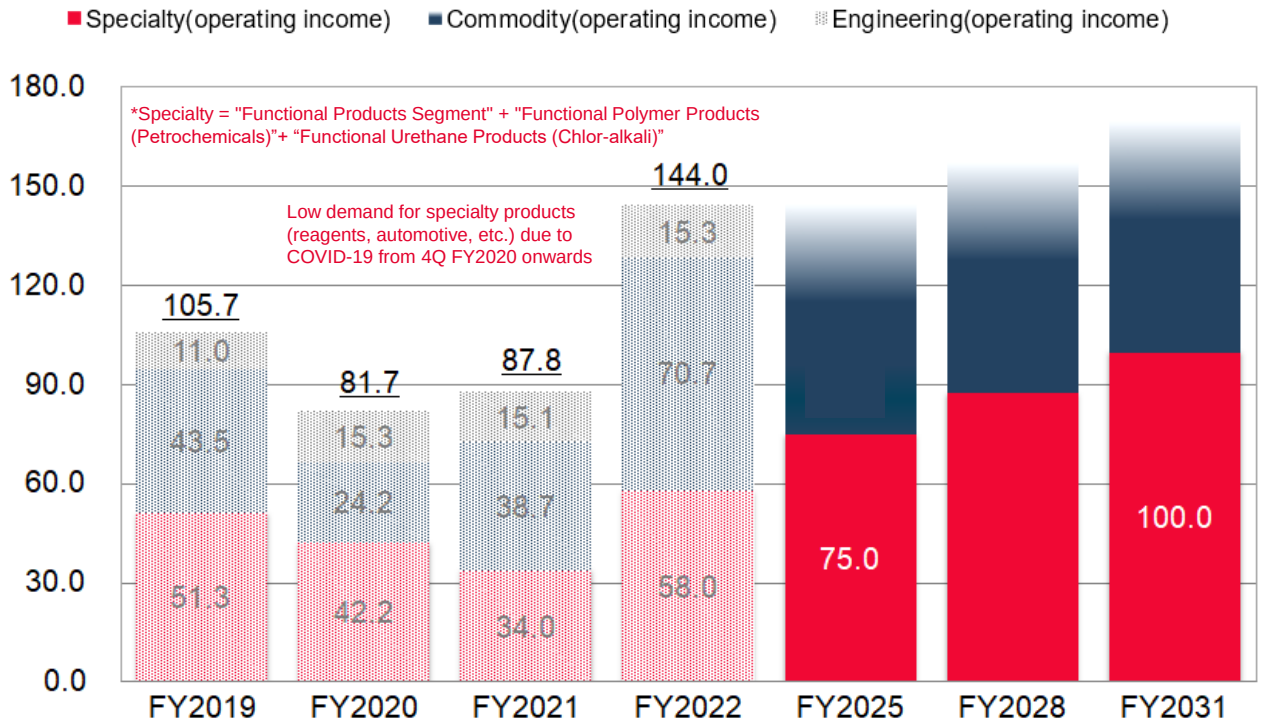
- Progress for energy diversification
- Supply chain restructured due to inflation caused by surging energy prices



Energy prices will take time to stabilize

Desired Profit Structure (～FY2031)

- ✓ Establish Commodity as a profitable business while focusing on decarbonization
- ✓ Aim to build a profit base of over ¥100 billion in Specialty



Petrochemical Group

Situation of Tosoh's naphtha cracker

- Naphtha cracker's capacity exceeds domestic demand.
- Tosoh is the only owner of a naphtha cracker in the Chukyo area and is the largest ethylene buyer in Japan
- Although Tosoh has secured demand (including in-house consumption) at present, the future is uncertain

Retention of naphtha cracker

- Decline in domestic demand for petrochemical products may lead to restructuring of domestic naphtha crackers
- Securing stable demand and transferring decarbonization costs to prices are the key prerequisites to operate crackers in the medium to long term
- Pursue the possibility of chemical recycling petrochemical products, and seek transformation into a resource-recycling ethylene center

* Chemical recycling: Conversion to chemical substances for reuse

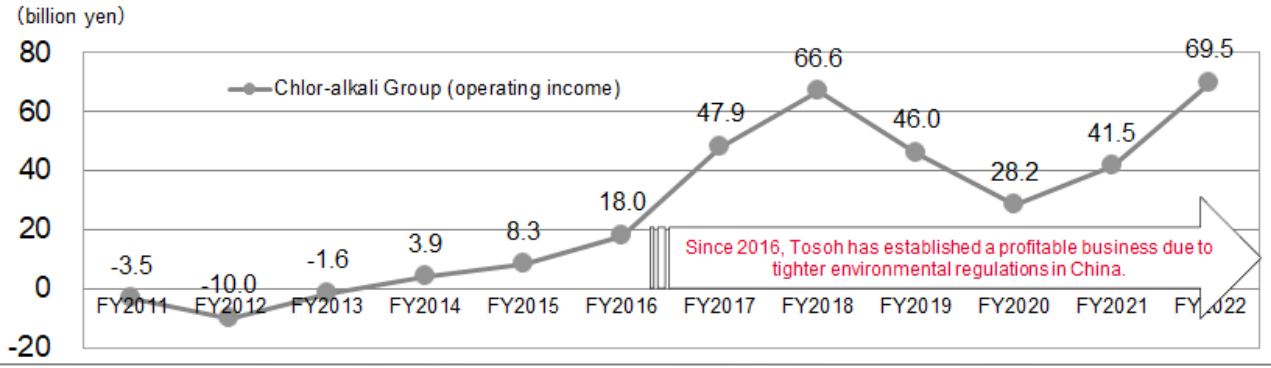
Chlor-alkali Group

Situation of electrolysis business and VCM

- Demand for both caustic soda and chlorine is increasing in line with economic growth, as both are indispensable for maintaining life in society
- Many industries have been established on the premise of a large and stable supply of caustic soda and chlorine
  *Global demand for caustic soda: 80 million dry metric tons
- No other products can substitute for caustic soda and chlorine in view of their functions and demand volume

Continue as a profitable business

- The electrolysis business is energy-intensive. A large investment to find a way to convert to energy-saving fuel resources is required in order to decarbonize
- The key to continue as a profitable business is to "pass on the cost of decarbonization to the selling price" and be on "equal footing with overseas companies in terms of taxation"



Chlor-alkali Group

Significance of having overseas manufacturing sites for caustic soda, chlorine and VCM

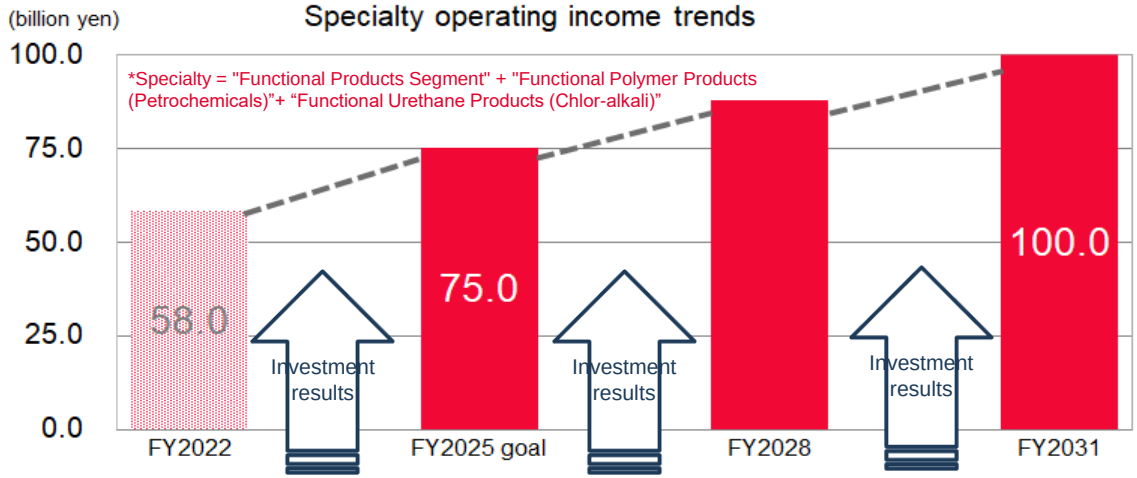
- Japan's domestic demand declines as its population shrinks
- In the backdrop of decarbonization, it is disadvantageous to have manufacturing sites only in Japan as Japan has limited resources
- It would be highly advantageous to establish manufacturing sites in regions where decarbonized energy is readily available at cheap prices and close to growth markets

Long-term outlook for chlor-alkali business

- Amid growing need for decarbonization, a shift from trading perspective to the perspective of having local production for local consumption to stabilize the supply chain is underway
- One of the options for expanding the profit base and hedging risks of the chlor-alkali business is to have a market-oriented manufacturing site overseas

Specialty Group

✓ Build a profit base of more than 100 billion yen by increasing capacity in growth areas, expanding market share, and building up profits through new businesses and M&A.



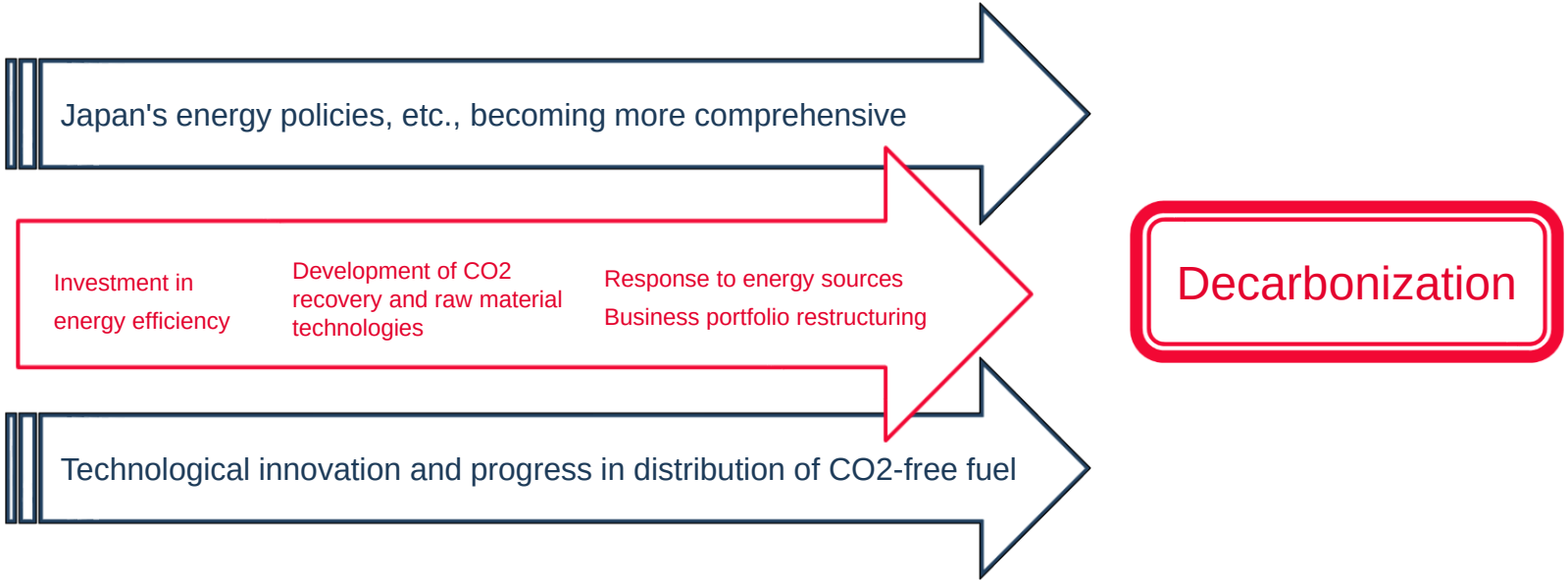
【FY2020-2022】
Capacity increase for
・Bromine
・Zirconia
・Chloroprene rubber (CR)
・Silica glass materials and fabricated quartzware (Japan)
・Quartz & sputtering targets (USA)

【FY2023-2025】
Capacity increase for
・Bromine & flame retardants
・CR
・Zirconia
・Separation media
・Silica glass materials and fabricated quartzware
・Sputtering targets (USA)
+
・New businesses
・M&A

【FY2025-2028】
・Increase capacity in growth areas
・New businesses
・M&A

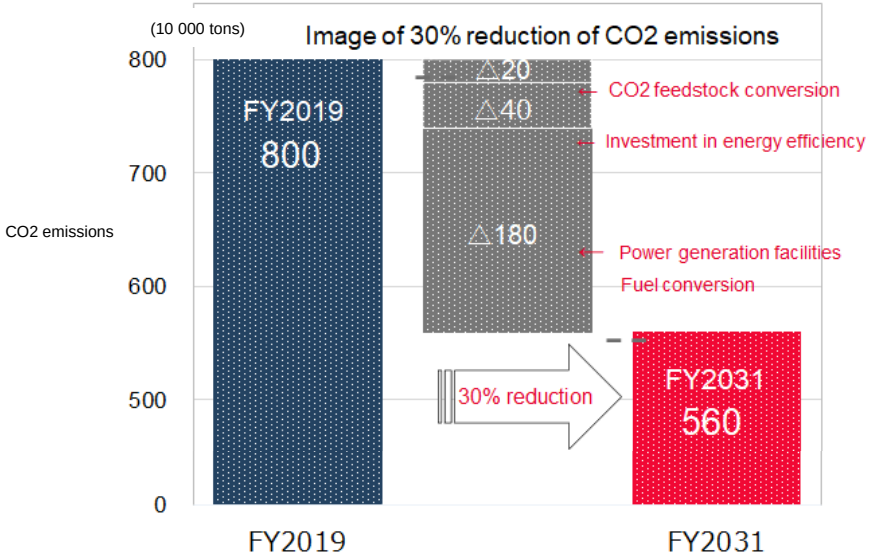
Decarbonization Policy

- ✓ Implement various measures for decarbonization in a timely manner in line with Japan's energy policies, trends in technological innovations, CO2-free fuel distribution situation, etc.
- ✓ More than 80% of Tosoh's CO2 emissions are energy-based and fuel sources to power its plants must be addressed to decarbonize



Medium-Term Targets for CO2 Reduction

- ✓ Implement specific measures to achieve a 30 percent reduction by FY2031 (compared with FY2019)
- ✓ Aim to achieve 30 percent reduction with current technologies through conversion toward biomass wood fuel for power generation facilities, and fuel diversification through introduction of a circulating fluidized bed boiler
- ✓ CO2 feedstock conversion being a mission for chemical manufacturers, Tosoh is assigning it higher priority and strengthening related initiatives



Main measures

CO2 feedstock conversion
- CO2 feedstock conversion at CO plants
- Synthesize urethane raw materials using CO2 from power plant exhaust gas

Investment in energy-saving equipment
- Introduction of state-of-the-art turbines
- Energy-saving modifications of electrolyzers
- Installation of additional gas turbine to improve energy efficiency

Conversion of fuel for power generation facilities
- Reduce use of coal in line with increased biomass co-firing in existing boilers
- Introduction of circulating fluidized bed boiler that is capable of biomass combustion

Reduction by Portfolio

Efforts for Decarbonization

Reduce CO2 emissions through increased use of woody biomass

- Increase in woody biomass co-firing in pulverized coal boilers

Pulverized coal boilers use pulverized coal to improve combustion efficiency. Woody biomass can also be used in pulverized coal boilers if it is pulverized with large amounts of sticky wood. There is a limit to the amount of woody biomass that can be mixed with coal in existing facilities.

- Replace aging pulverized coal-fired boiler with a circulating fluidized bed boiler

Any organic material can be used as fuel for a circulating fluidized bed boiler. No fuel pulverization is required. It can also be used as a woody biomass-fired boiler.

*Trees absorb CO2 in the atmosphere through photosynthesis. Burning wood as energy produces CO2, which is absorbed by the trees as they grow back if the forest is regenerated after logging. It is believed that the use of wood for energy has no effect on the concentration of CO2 in the atmosphere.

Efforts for Decarbonization

Establish a test plant with the aim of commercializing amines that can be used to recover CO2

Tosoh's development of a high-performance amine can be used to recover CO2 from combustion exhaust gas. The amine used for CO2 recovery is required to have energy-saving features (i.e. ability to recover CO2 with less energy) and have durability (i.e. resistant to the degradation induced by the combustion exhaust gas such as NOx). This newly developed amine shows excellent values for both requirements in laboratory evaluations.
A test plant has been established with the aim to develop and commercialize the amine, while developing technologies for the effective use of recovered CO2.

Joint study proposal selected by NEDO for the development of technology for producing raw materials for plastics using CO2 and/or other sources

This joint project with Mitsubishi Gas Chemical Company, Inc. aims to reduce CO2 emissions during the manufacture of polycarbonate and polyurethane by eliminating from the process the need for the conventional raw material phosgene. By removing phosgene from the process, CO2 emissions resulting from the production of phosgene would be reduced. The term of this project is from FY2022 through FY2029.

Joint study proposal selected by NEDO for R&D on energy-saving CO2 separation and capture process

The objective of this project is to develop a CO2 separation and capture system using actual exhaust gas from a thermal power plant. The project is being conducted jointly with Kyoto Institute of Technology and Tokyo Institute of Technology. The term of this project is from FY2022 through FY2023.

Effective use of wood pruned from trees at public facilities Shunan City, Yamaguchi Prefecture

Tosoh signed an agreement with Shunan City and Izumi Sangyo Co., Ltd., for the use of wood pruned from trees at public facilities in Shunan City to fuel Tosoh's in-house power generating plant. Izumi Sangyo will process wood from trees pruned into chips, which will co-fire the woody biomass with coal to fuel Tosoh's power plant.

Conclusion of a partnership agreement on the utilization of woody biomass materials and forest management

Shunan City, Tosoh Corporation, Idemitsu Kosan, Tokuyama Corporation, and Marubeni Corporation have signed a Memorandum of Understanding regarding the utilization of woody biomass materials and forest management. The agreement serves a purpose of promoting the utilization of woody biomass materials and forest management.

III. Overview of FY2023 – 2025 MTBP

Operating under Decarbonization

✓ There is an urgent need to increase Specialty profits under decarbonization

Progress in decarbonization

- Diversification of energy sources
- Strengthening of regulations of energy-intensive industries

- The global supply and demand environment for raw materials, fuels, and products is fluctuating
- New market prices are formed

Particularly uncertain market trends for Commodity products

Urgent need to increase profits in Specialty Business

Basic Policy

Business Objectives: Basics (FY2023~2025)

✓ Expand profits of Specialty business while stabilizing the foundation of our dual management

Commodity
- Achieve optimized balance of strengthening business while reducing CO2 emissions, and maintain stable supply through appropriate cost sharing and cost pass-through

Specialty
- Expand business scale by investing in businesses with comparative advantages, differentiating products and increasing capacity, while maintaining and expanding to further grow and cultivate new businesses

✓ Gather all efforts to reduce CO2 emissions and make effective use of CO2
- Promote decarbonization from all perspectives and fulfill our corporate responsibility to realize a sustainable society

✓ Invest based on solidifying financial foundation
- Business environment will change dramatically under decarbonization, and we will seize this change as an opportunity to make timely strategic investments to prepare for the future

✓ Maintain and reinforce safety as a top priority
- Safe plant operation as a top priority, and continue efforts to strengthen safety infrastructure and deepen our safety culture

Performance: Targets

✓ Counterbalance the softening of the Commodity market with Specialty, aim for new record of profits

(Unit: billion yen)		FY2022 Actual	FY2025 Target	Variance
Net Sales		918.6	1,160.0	241.4
Operating Income		144.0	150.0	6.0
Operating Income Ratio		15.7%	above 10%	—
ROE		16.3%	above 10%	—
Dollar	¥/$	112	125	13
Euro	¥/ €	131	135	4
Naphtha	¥/ kl	56,875	75,000	18,125
Benzene	$/T	994	1,000-1,100	56
Coal	$/T	152	250	98
PVC	$/T	1,373	1,300-1,400	△ 23
VCM	$/T	1,208	1,100-1,200	△ 58
Liquid caustic soda	$/T	515	450-550	△ 15
MDI(monomeric)	$/T	2,585	2,300-2,500	△ 185
MDI(polymeric)	$/T	2,463	2,050-2,250	△ 313

Performance by Business Group

- ✓ **Petrochemical Group:** Continue to maintain high cracker operation by securing profits through appropriate naphtha prices reflecting rising costs of fuel, taxes, etc.
- ✓ **Chlor-alkali Group:** Cost increases are absorbed by passing them onto product prices, and maintain high profits
- ✓ **Specialty Group:** Increase profits from semiconductor-related products

(Unit: billion yen)

		FY2022 Actual	FY2025 Target	Variance
Net Sales	Petrochemical	177.2	235	57.8
	Chlor-alkali	361.6	440	78.4
	Specialty	226.2	300	73.8
	Engineering/Ancillary	153.6	185	31.4
	Total	918.6	1,160.0	241.4

% is operating margin

Operating Income	Petrochemical	15.7	8.9%	15	6.4%	△0.7	-2.5%
	Chlor-alkali	69.5	19.2%	55	12.5%	△14.5	-6.7%
	Specialty	43.5	19.2%	61	20.3%	17.5	1.1%
	Engineering/Ancillary	15.3	10.0%	19	10.3%	3.7	0.3%
	Total	144.0	15.7%	150.0	12.9%	6.0	-2.7%

Specialty's Operating Income	58	75	17

*Specialty = "Functional Products Segment" + "Functional Polymer Products (Petrochemicals)"+ "Functional Urethane Products (Chlor-alkali)"

Cash Flow

✓ Strong demand of funding, including for investment in CO2 reduction

FY2023~2025 3-year cumulative cash-in

Operating cash flow
260～320 billion yen

FY2023~2025 3-year cumulative cash-out

Capital investment
200 billion yen

Dividend
77 billion yen*3

M&A

Decarbonization measures

Share buybacks

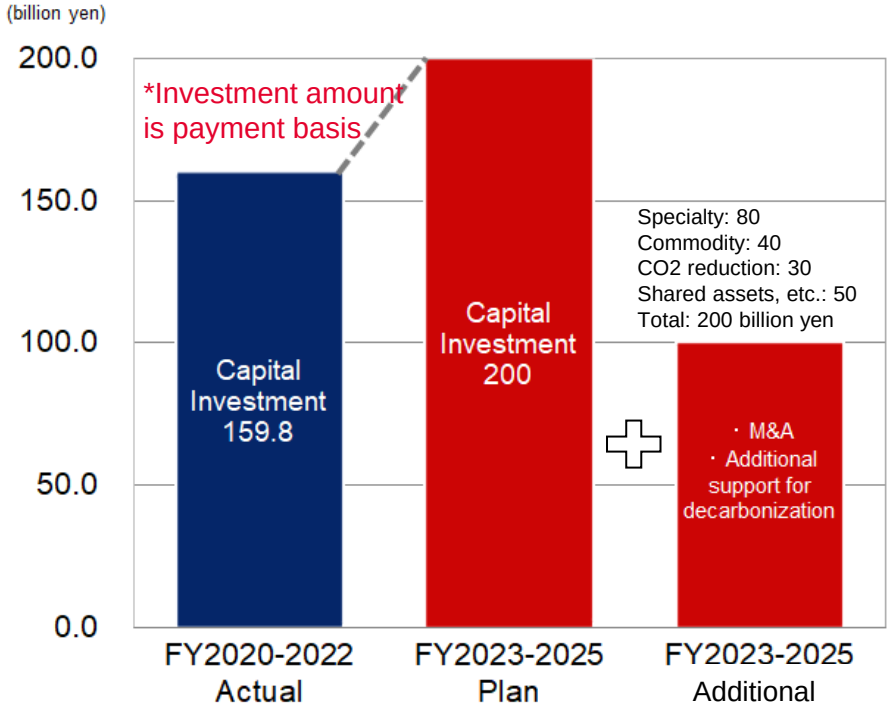
(Unit: billion yen)

	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022
Operation	115.7	115.4	77.5	99.9	95.1	108.6
Investment	△ 34.7	△ 43.1	△ 63.3	△ 70.3	△ 46.4	△ 43.5
Dividends, etc.	△ 9.4	△ 18.5	△ 19.5	△ 18.2	△ 28.0*1	△ 19.7
Loan	△ 61.1	△ 33.1	△ 8.8	△ 6.3	30.5*2	△ 33.3
Total	10.5	20.7	△ 14.1	5.1	51.2	12.1

*1: Share buybacks of 10 billion yen *2: Borrowed 31 billion yen to prepare for COVID-19 contingency
*3: In the event that the amount of dividend is 80 yen per share for three years

Investment: Plan

- ✓ Active investment primarily in Specialty business
- ✓ Capital investment includes 30 billion yen for CO2 reduction
- ✓ M&A search focused on bioscience-related fields



Major Investment Projects:

Standard Investment:

- Consider methylene diphenyl diisocyanate (MDI) splitter installation overseas
- Capacity increase for:
  - Chloroprene rubber
  - Bromine and flame retardants
  - Separation and purification media
  - Zirconia powder
  - Sputtering targets
  - Silica glass materials and fabricated quartzware

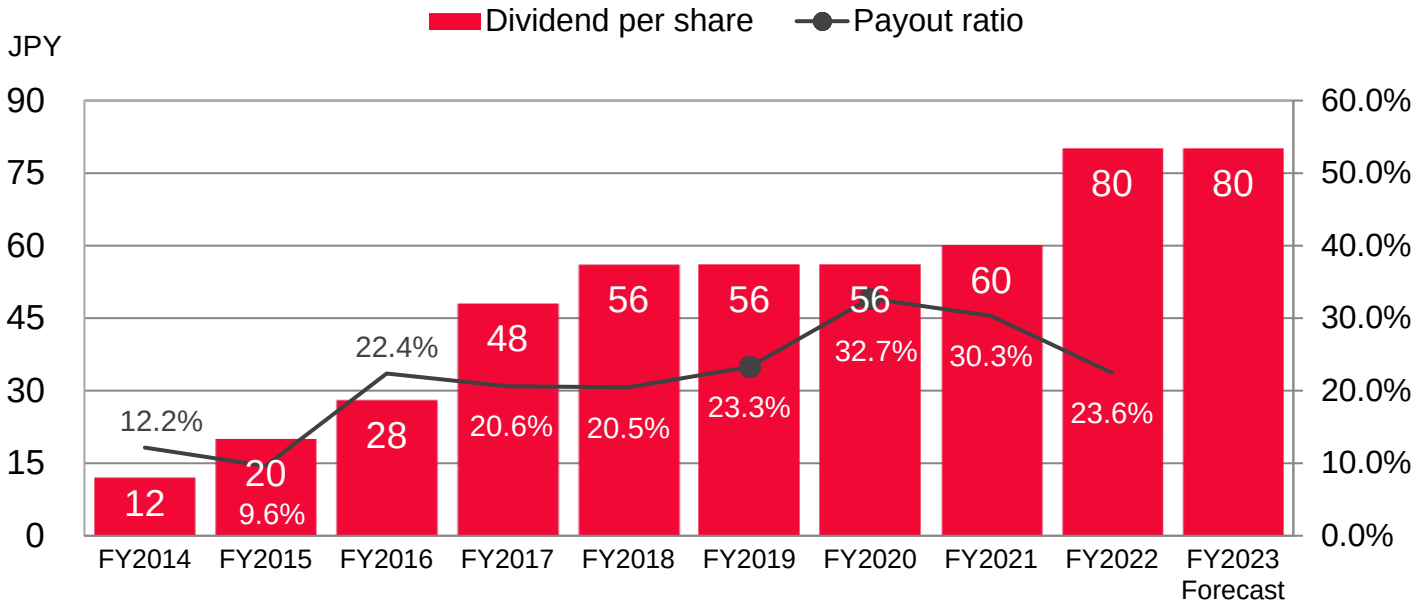
Investment in CO2 reduction

- Upgrade to circulating fluidized bed boiler
- Installation of additional gas turbine
- Installation of CO2 feedstock conversion equipment at carbon monoxide (CO) plant

Shareholder Returns

Policy:

- Continue basic policy of maintaining stable dividends and improve capital efficiency through share buybacks
- Aim for a dividend payout ratio of 30%
- Flexible implementation of share buybacks while considering the level of free cash flow and other factors



R&D

- Promote research and development with a focus on Specialty fields through an R&D structure that consists of seven research laboratories

Corporate-related research (Mainly to search for new businesses)

Advanced Materials Research Laboratory	Functional Polymers Research Laboratory	Life Science Research Laboratory
R&D of advanced materials technologies based on organic/inorganic materials fusion technologies	Creation of new polymer materials with optical, electronic, and bio-functions by integrating molecular structure, functional design, and other technologies	Creation of new materials and technologies in the health and medical fields, such as technologies for diagnostic systems and separation media for biopharmaceuticals

Business-related research (Mainly to strengthen existing businesses)

Inorganic Materials Research Laboratory	Organic Materials Research Laboratory	Polymer Materials Research Laboratory	Polyurethane Research Laboratory	Bioscience Division R&D
Development of new inorganic functional products in the electronics, environment and energy fields	Development of new organic functional products in the information-, electronics- and environment-related fields	Establishment of fundamental technologies in the field of polymers through catalysts, polymerization and control of physical properties	Creation of new functional polyurethane materials by integrating molecular design of polyurethane raw materials with processing and molding technologies	Development of new products, improvement of existing products and expanding product lineups
⇩	⇩	⇩	⇩	⇩
Advanced Materials	Organic Materials	Petrochemicals and Polymers	Urethanes	Bioscience

Initiatives to Accelerate R&D

Effective use of research infrastructure

- Renewed research infrastructure in the Nanyo and Yokkaichi Complexes during the previous medium-term business plan
- Rebuild and renovate the Tokyo Research Center, a center for advanced technology research
  - Construction to be completed in phases from FY2025~2027; JPY10 billion investment

Raising material design efficiencies through MI technologies

- Establish an MI Center in FY2023 to accelerate the accumulation of experimental data and know-how
- Enhance MI technologies through the introduction of external technologies.

Accelerating R&D

Promote open innovation

- Actively utilize knowledge and technologies of universities and external research institutions
- Strengthen development of CO_2 separation and effective CO_2 utilization technologies, plastic recycling technologies, etc. through participation in NEDO projects

Acquiring advanced technologies

- Gathering information on advanced technologies from materials- and biotech-related venture capital funds
- Dispatch research representatives to the U.S. to speed up the screening of technology information
- Seek joint research and investments in promising projects

R&D Focus on Three Critical Areas

- Invest R&D resources in life science, electronic materials, and environment & energy

Life Sciences

- Upstream products for bioprocessing (culture substrates, etc.)
- Downstream products for bioprocessing (separation columns, separation media, etc.)
- New diagnostics systems and testing reagents

Electronic Materials

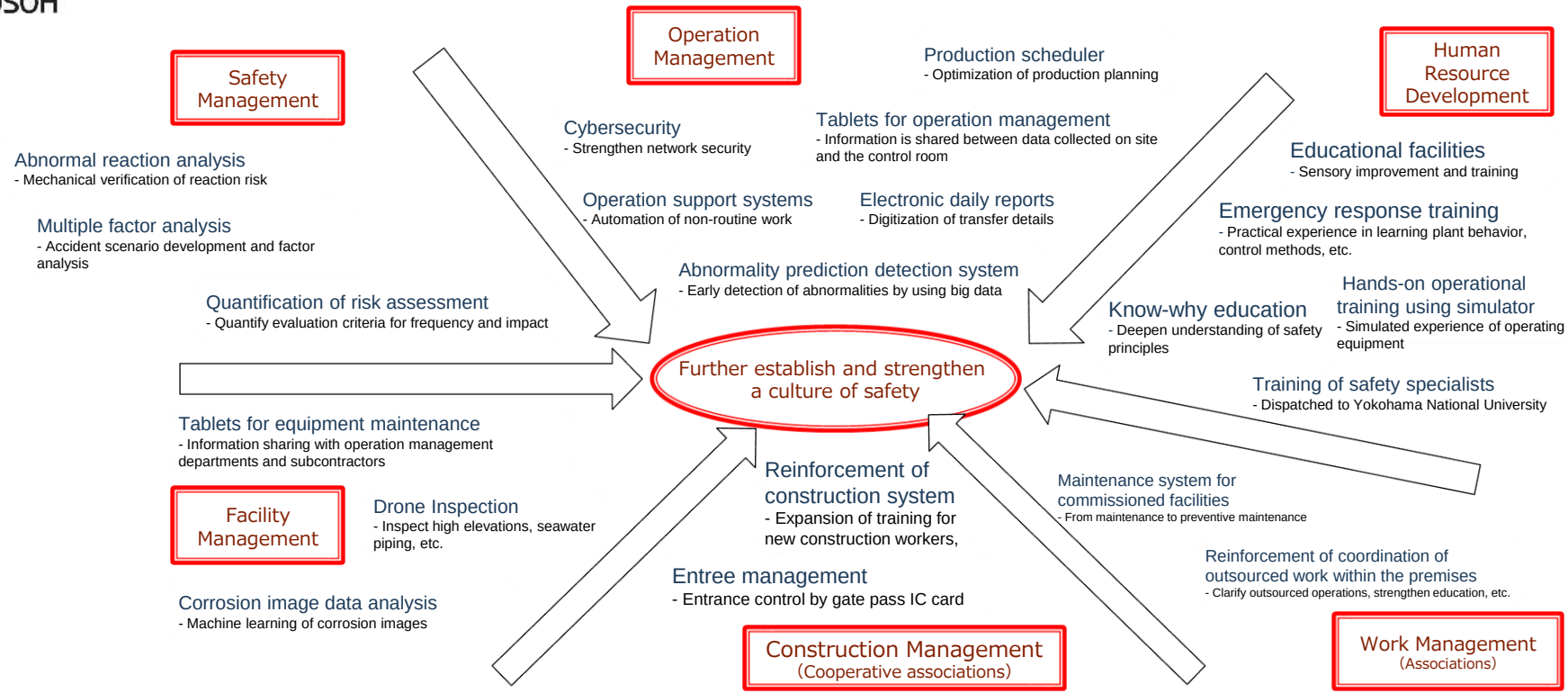
- Materials for display devices
- High-speed and high-capacity communication materials
- Semiconductor-related materials

Environment & Energy

- Technologies for CO_2 separation and recovery, and for effective use
- Waste plastic recycling technologies
- Next-generation battery materials

Plant Safety and Management Infrastructure

- Continue and develop initiatives to strengthen safety infrastructure and foster a culture of safety



Specialty Group: Bioscience Division

		Business policy	Main products
Specialty Group	Bioscience	**Diagnostics** Accelerate transition to AIA®-CL, expand diagnostics parameters, and strengthen and expand business foundation by creating new businesses	Immunoassay analyzers, molecular diagnostic analyzers, glycohemoglobin analyzers, various diagnostic reagents, etc.
		Separations Increase market share for biopharmaceuticals, expanding products into related businesses, and expand business scale by creating new businesses	Measurement instruments, analytical columns, separations and purification media, etc.

Bioscience Division: Diagnostics

Business environment

- Demand recovery for molecular diagnostics and glycohemoglobin analyzers as hospitals resume operations
- Application procedures for AIA®-CL (fully-automated chemiluminescence enzyme immunoassay) delayed due to the pandemic
- Slowdown for urgent demand for the development and commercialization of coronavirus testing reagents

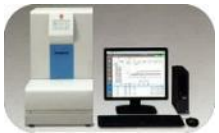
Transition to AIA-CL systems

AIA system (fluorescence method) → Improved sensitivity, accuracy and speed → AIA-CL system (chemiluminescence method)

(HPLC Analyzer)

(AIA System)

(TRCReady)



Three pillars of the diagnostics business

Immunoassay analysis
Immunoassay analyzers (AIA system) based on the principle of enzyme immunoassay method and dedicated reagents

Glycohemoglobin analysis
Advanced systems to measure glycated glycohemoglobin (A1c) found in human blood, which aids in the monitoring of associated diseases such as diabetes

Genetic testing (TRCReady)
Molecular diagnostics analyzers and dedicated reagents based on nucleic acid amplification technology (TRC method)

Measures

- Expedite the application process for AIA-CL systems in the U.S.
- Strengthen sales structure by launching and expanding diagnostic parameters of small- and mid-sized AIA-CL systems
- Expand the business by advancing the introduction of COVID-19-related molecular diagnostic systems and expanding test menu
- Expand business domains through M&A, etc.

Bioscience Division: Separations

Business environment

- Demand for TOYOPEARL® and TSKgel® PW separation and purification media continues to expand in oligonucleotide drug fields in addition to antibody drugs
- TSKgel SuperQ-5PW is the gold standard in oligonucleotide drug purification

* TSKgel PW is a separation and purification agent with smaller particle size and higher separation performance than TOYOPEARL.

Continuous Chromatography Equipment

（ProGMP150 System）

（Octave® BIO System）

Built pre-packed column manufacturing facility at U.S. subsidiary

Although it is common for users to pack separation media into columns themselves, demand for pre-packed columns is rapidly increasing among pharmaceutical manufacturers as their manufacturing facilities have a more modular facility design with single-product process technologies. We have established a base in the U.S., a major market for biopharmaceuticals, to supply such value-added products and services.

Tosoh Bioscience, Wisconsin Inc. (formerly Semba Biosciences, Inc.)

Company Profile

- Established: 2005
- Country: Wisconsin, U.S.A.
- Business: Manufacture and sales of continuous chromatography-related products

Acquisition of shares

- Date: 33.3% in 2018 → 100% acquisition in October 2021
- Objective: To acquire continuous chromatography technologies and create synergies with the separation media and columns business

* Continuous chromatography is a method of performing multiple processes in parallel and continuously by combining multiple columns and automatically controlling the flow of sample, eluent, washing solution, etc. It is effective in reducing the manufacturing cost of biopharmaceuticals.

Measures

- Debottleneck to increase capacity of separation and purification media (commercial operation begins in 2023) and to add a new production line (a third TOYOPEARL and TSKgel® purification media plant to begin commercial operation in 2025)
- Established continuous chromatography technology through Tosoh Bioscience, Wisconsin, Inc. a wholly-owned US subsidiary.
- Established a pre-packed columns manufacturing base at a US subsidiary
- Expansion of business domain through M&A, etc.

Specialty Group: Advanced Materials

		Business policy	Main products
Specialty Group	Advanced Materials	**Ceramics** Maintain top share of the global zirconia market in the fine ceramics field as the supplier that provides stable supply of high performance and high quality products.	Zirconia powder / Zirconia grinding and dispersion media / Colored zirconia / Sintered ceramics, etc.
		Zeolites Expand market share by achieving both higher functionality and lower costs	Synthetic zeolite (Zeolum, high-silica zeolite), etc.
		Electronic Materials Capture semiconductor growth demand through timely capacity expansion	Silica glass materials and fabricated quartzware, various sputtering targets, etc.
		Battery Materials Ensure stable profit growth through continuous introduction of high-functional products and diversification of raw material ores	Electrolytic manganese dioxide, etc.

Advanced Materials: Ceramics

Business environment

・Dental materials: Demand is expanding globally due to population growth, aging population, and replacement of metals.
・Decorative materials: Increased demand for high-end mobile devices and wristwatches.
・Grinding media: Growing demand for use in multilayer capacitors for automobiles

Establishment of collaboration course at The University of Tokyo

・The course aims to understand the essence of zirconia and take its functionality to the extreme by using state-of-the-art equipment, science, and technology.
・ There are many unexplored aspects in the mechanism of zirconia's functional properties. By exploring the factors that determine material properties and controlling the microstructure at an atomic level, dramatic functional improvement is expected.

[Special features of zirconia]

Mechanical Properties
Zirconia is a strong and supple ceramic. We aim to achieve mechanical properties comparable to those of metals.

Processability
Zirconia has superior processability properties. We aim to commercialize supple zirconia.

Translucency
Pursuing high translucency, we strive to develop new optical materials.

Ion Conductivity
Pursuing ultra-fast ion conductivity to develop new clean energy sources.

Zirconia: Non-brittle ceramics (sintered)

・ Zirconia ceramics is a type of fine ceramics that are made by adding an appropriate amount of yttria as a stabilizer to zirconia to stabilize its crystal structure, thereby solving the "brittleness" that is one of the main drawbacks of ceramics. As a non-brittle ceramic, zirconia is used in dental, decorative, and grinding applications.


Zirconia powder

Features of Fine Ceramics

- ✓ Harder than metal
- ✓ Scratch-resistant
- ✓ Rustproof
- ✓ Resistant to corrosion
- ✓ Does not deteriorate under ultraviolet rays
- ✓ Does not conduct electricity
- ✓ Shines when polished.

x Brittle

☑ Zirconia is a fine ceramic that solves the issue of brittleness

Measures

- Maintain a strong competitive advantage through stable supply of high-performance and high-quality products
- Considering expansion of zirconia powder production

Advanced Materials: High-silica Zeolite (1/2)

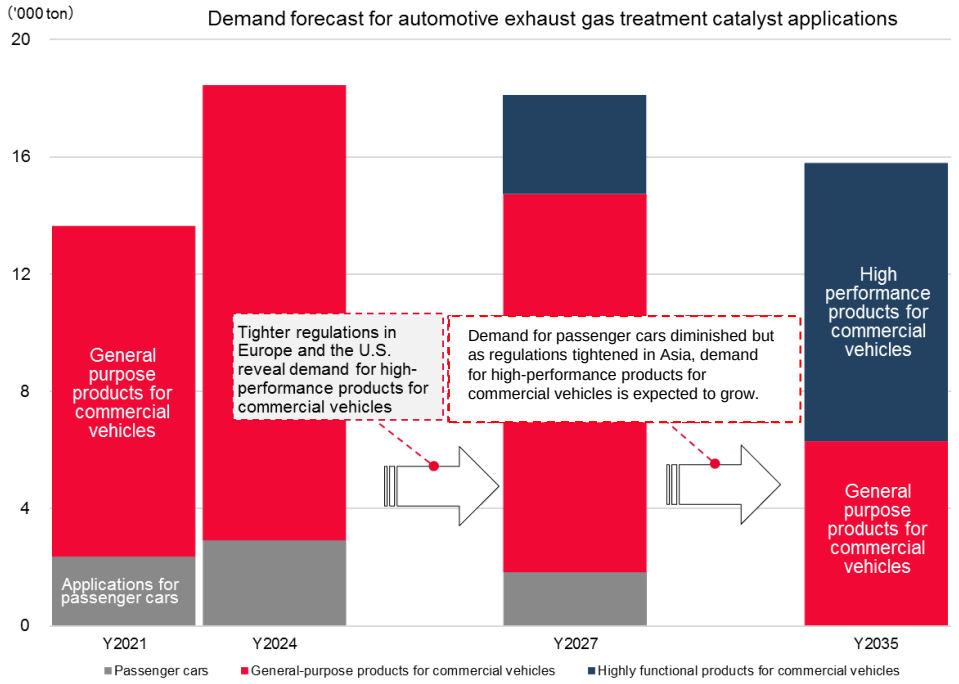
Business environment

Automotive Catalysts Field

・Electrification of commercial vehicles (long-haul heavy-duty trucks, etc.) poses many challenges.
・Emission regulations will continue to be tightened in many countries.
・Although demand for passenger cars declined, demand for commercial vehicles (in China, India, etc.) is expected to increase, so the total demand in 2035 is expected to remain at the same level as today.

Petrochemical Catalysts & Environmental Field

・Demand declined due to the pandemic but is on a recovery trend.



Advanced Materials: High-silica Zeolite (2/2)

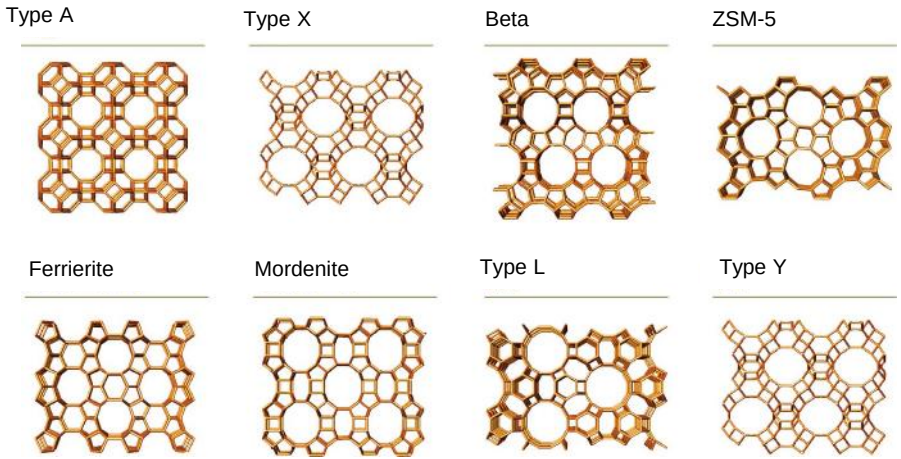
Zeolites

Zeolites are microporous aluminosilicate crystals that are widely utilized in adsorption, ion exchange and catalytic processes due to the regular pore structures with channels and cavities, ion-exchange properties and solid acidities.

Measures

- Expand market share by introducing new products that meet the upcoming tightening regulations for vehicle emission control.
- Development of new applications (post-automotive applications)

Crystal structure of Tosoh zeolites



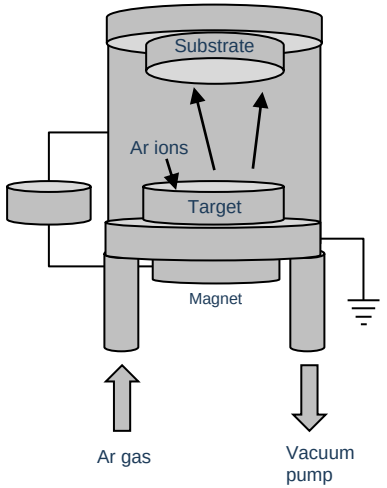
AMD: Electronic Materials (Silica Glass, Thin-film Materials) (1/2)

Business environment

- Semiconductor market is projected to grow as supply shortage continues and semiconductor-related investment remains high
- Demand for silica glass and target products for semiconductor manufacturing is growing

Sputtering target business bases (Tosoh Group companies)

Company name	Established	Location	Business
Tosoh Speciality Materials Corporation	1994	Yamagata, Japan	Manufacturing
Tosoh SMD (Shanghai) Co., Ltd.	2011	China	Sales & Manufacturing
Tosoh SMD, Inc.	1988	U.S.	Sales & Manufacturing
Tosoh SMD Korea, Ltd.	1995	South Korea	Sales & Manufacturing
Tosoh SMD Taiwan, Ltd	1997	Taiwan	Sales



Thin film deposition by sputtering

Argon (Ar) gas is introduced into a vacuum chamber and high voltage is applied to form Ar plasma (a mixture of Ar ions and electrons). The Ar ions in the plasma collide with the target (the material of the thin film) and ejects atoms on the target surface to form a metallic thin film of nanometer scale on the substrate.

Advanced Materials: Electronic Materials (Silica Glass, Thin-film Materials) (2/2)

Silica glass and fabricated quartz bases (Tosoh Group companies)

Company name	Established	Location	Business
Tosoh SGM Corporation	1982	Yamaguchi, Japan	Manufacturing (Raw materials)
Tosoh Quartz Corporation	1936	Yamagata, Japan	Sales & Manufacturing (Finished products)
Tosoh Quartz, Inc.	1976	U.S.	Sales & Manufacturing (Finished products)
Tosoh Quartz Co., Ltd.	1999	Taiwan	Sales & Manufacturing (Finished products)
Tosoh Quartz Korea Co., Ltd	2019	South Korea	Sales & Manufacturing (Finished products)

Special features of silica glass

High transparency

Exhibits excellent transmission characteristics over a wide range of light, from ultraviolet to infrared rays, as well as visible light.

High purity

Made entirely of silicon dioxide and contains virtually no metallic impurities

Heat resistant

Can be used at temperatures as high as 1000°C. Resistant to thermal expansion and rapid temperature changes.

Excellent chemical inertness

Extremely chemically stable with excellent chemical resistance

Silica glass is the best material for semiconductor manufacturing jigs

Measures

- Timely capacity expansion
  - Silica glass: Intermittently increasing capacity and plan for large-scale capacity expansion
  - Fabricated quartzware: Continuing upfront investment, including automation

  Targets: Decision on large-scale expansion in the U.S.
- Development and launch of new targets

Specialty Group: Organic Chemicals

		Business Policy	Main products
Specialty Group	Organic Materials Division	**Bromine and flame retardants** Develop business based on supplying raw materials of superior quality and meet growth demand through increased capacity	Bromine/hydrobromic acid/brominated flame retardants, etc.
		Ethyleneamines Stabilize earnings by increasing the value-added of low-amine products and strengthening the cost competitiveness of derivatives	Ethyleneamine/urethane foam catalyst, etc.
		Eco products Expand business domain by leveraging our position as a supplier that provides superior quality raw materials to increase market share and launch new products	Heavy metal treatment agents/hydrocarbon cleaning agents/non-halogen non-flammable cleaning agents
		Organic Materials Develop new revenue sources by developing and launching new products and expanding their applications	Conductive polymer (Selftron®)/aldehyde scavenger (Emidelete®)

Organic Chemicals: Bromine and Flame Retardants

Business environment

Bromine

- Demand is expected to increase mainly for flame retardants, but overseas suppliers are restricting supply due to environmental issues, etc. Market is expected to stabilize and rise.

Flame retardants

- Demand for electronic circuit board applications is expected to increase due to a shift to automotive electronics, but supply and demand are expected to be tight due to a shortage of bromine.

Supply and demand environment for bromine

Applications

Flame retardants, sterilization in water treatment, specific gravity adjustment in oil drilling, pharmaceutical intermediates, brominated butyl rubber, etc.

Manufacturing methods

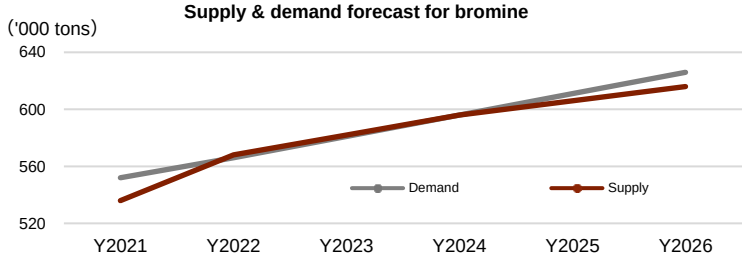
Overseas manufacturers extract bromine from salt lakes (such as the Dead Sea) and brine (underground salt springs). Tosoh manufactures through extraction from sea water.

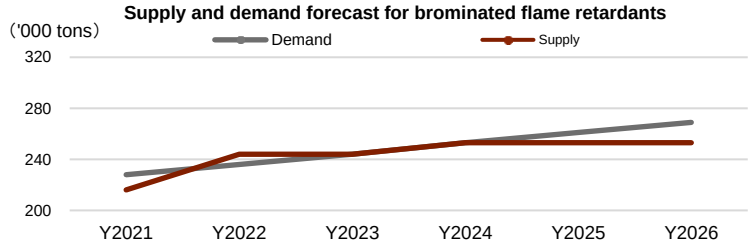
Demand

Global demand is expected to be slightly less than 600,000 tons, growing at an annual rate of 3%.

Supply

Overseas manufacturers are finding it difficult to increase production due to lower water levels in salt lakes and lower concentration of brine amidst stricter environmental regulations.





Measures

Bromine

- Capacity expansion (30% increase, to be completed in early 2023)
- Further capacity expansion (to capture growth in demand for flame retardants)

Flame retardants

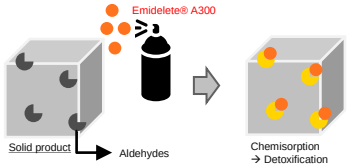
- Capacity expansion in line with increase in bromine capacity

Organic Chemicals New Products: Selftron® / Emidelete®

Business environment

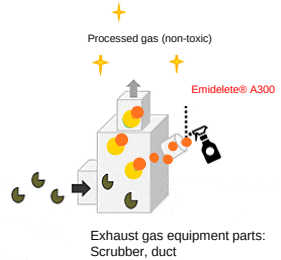
Selftron (conductive polymer)
The capacitor market is expanding due to the increasing functionality of mobile devices and the increasing use of electrical components in automobiles.
Emidelete (aldehyde scavenger)
Demand grew as a result of improved living environments due to the COVID-19 pandemic and increased awareness of hygiene

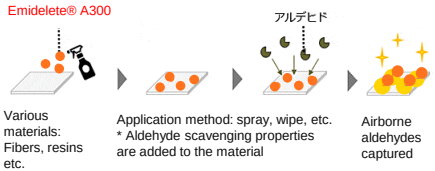
Emidelete: Use application example



EG1) Prevents the release of aldehydes, the causative agent of sick building syndrome, when applied to the source of aldehydes.

EG2) Aldehydes in exhaust gas are captured by spraying Emidelete into scrubbers and ducts.





EG3) When applied to or penetrated into fibers and other materials, it itself becomes an aldehyde catcher material, capturing surrounding aldehydes.

Selftron adopted by major capacitor manufacturers

Major capacitor manufacturers have decided to adopt the product. Capacitors are becoming larger and smaller by forming minute pits in the electrode film and increasing the surface area. Selftron, which is soluble, can penetrate pits without gaps, contributing to the capacitor's large capacity and miniaturization.

Selftron use applications:
1) Capacitor cathode
2) Anti-static display films
3) Next generation telecommunication electromagnetic shields
4) Solar cells: Hole transport layer
5) Wearables: Conductive fibers, electrodes
6) Conductive Auxiliaries: Composites with CNTs and silver nanowires

Measures

Selftron
Build a business foundation by focusing on applications on tantalum capacitors (for mobile terminal applications, etc.)

Emidelete
Marketing activities will focus on three main fields: filters, deodorizers/softeners, and in-vehicle applications.

Chlor-alkali Group

		Business policy	Main products
Chlor-alkali Group	Chlor-alkali	Secure stable earnings by strengthening the domestic business base and expand earnings through overseas development	Caustic soda / Vinyl chloride monomer & polymer / Hydrochloric acid / Baking soda / Calcium hypochlorite, etc.
	Cement	Reduce costs and make contributions to society through increased waste acceptance	Ordinary portland cement
	Urethane	MDI Stabilize earnings through diversification of sales destinations, and develop innovative manufacturing processes that utilizes CO2	Monomeric/polymeric MDI, etc.
		Functional Urethanes Expand revenue base through capacity expansion and increasing competitive advantage in our high-performance products	HDI / Polyurethane resins for adhesives / Polyurethane elastomers (thermoplastic and thermosetting) / Polycarbonate diols, etc.

Chlor-alkali Group: Electrolysis and Vinyl Chloride Business

Business environment

- Demand for caustic soda grew mainly in India and Southeast Asia, but plans for capacity expansion were limited and global demand remained firm.
- Energy saving and CO2 reduction measures are necessary.

PT. Standard Toyo Polymer: PVC debottleneck capacity increase

Company Profile
- Established: 1975
- Country: Indonesia
- Business activities: Manufacture and sales of polyvinyl chloride (PVC) resin

Capacity Expansion
- Production capacity: 93,000 → 113,000 tons/year
- Commercial operation: February 2023 (scheduled)

Supply and Demand Environment
- Indonesia is one of the leading countries with top demand for PVC in the Southeast Asia, with domestic demand of approximately 650,000 tones (annual growth rate of 5%). All PVC produced by Statomer is sold domestically.

Mabuhay Vinyl Corporation: Electrolysis debottleneck capacity increase

Company Profile
- Established: 1965
- Country: Philippines
- Business activities: Production and sales of caustic soda and chlorine

Capacity Expansion
- Production capacity: 19,000 → 32,000 dry metric tons of caustic soda/year
- Commercial operation: Scheduled for November 2023

Supply and demand environment
- There is only one domestic electrolysis manufacturer in the Philippines, which is Mabuhay Vinyl Corporation. Domestic demand for caustic soda in the Philippines is approximately 85,000t (annual growth rate of 5%). Shortage of supply is covered by relying on imports.

Measures

- Establish sales expansion system for hydrochloric acid and caustic soda at Tohoku Tosoh Chemical Co., Ltd. due to increased demand for semiconductors
- Large investments to reduce CO2 emissions at the Nanyo and Yokkaichi Complexes; also considering supply of CO2-free caustic soda
- Appropriate cost sharing and cost pass-through for decarbonization
- Continued consideration of establishing new overseas manufacturing bases

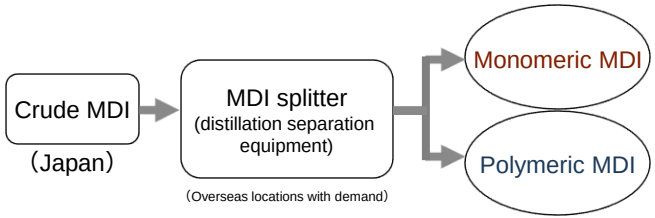
Chlor-alkali Group: Urethane Raw Material Business

Business environment

MDI
- Despite strong demand, market conditions are expected to weaken due to competitors' increased capacity.

Functional Urethanes
- Demand for HDI paint curing agents and polyurethane elastomers is expected to recover.

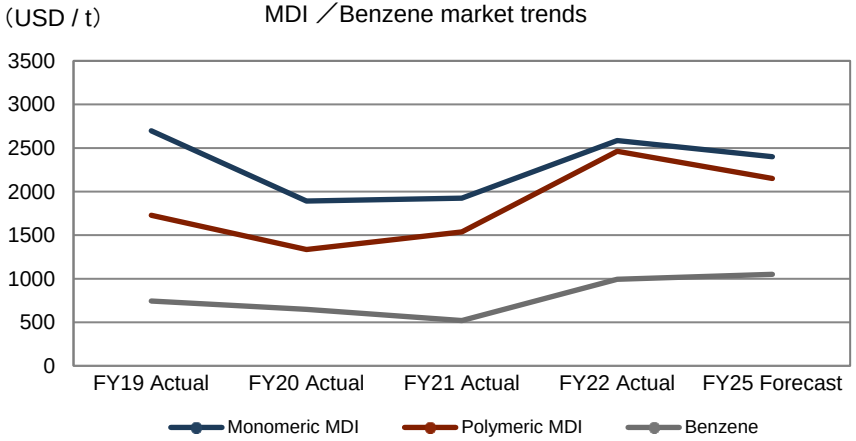
Newly install MDI splitters (distillation separation equipment) in overseas locations with demand



Monomeric MDI is highly reactive and requires frozen storage for long-term quality retention. Bulk supply to remote areas is difficult.

Bulk supply of monomeric MDI is possible by installing splitters at locations with MDI demand, which makes it beneficial in acquiring large-lot customers.

MDI ／Benzene market trends



Measures

MDI
- Expand sales in Southeast Asia and India and set up new overseas splitters at such locations

Functional Urethanes
- Expand capacity for HDI derivatives
- Expand capacity for polyurethane elastomers
- Enter the market for high-value-added isocyanates

Petrochemical Group

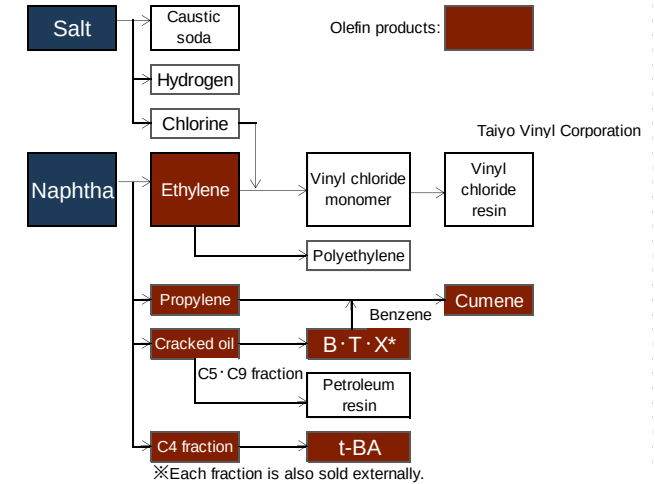
		Business policy	Main products
Petrochemical Group	Olefins	Maintain stable and high operation rate of naphtha cracker by expanding the number of customers for sales or by expanding for self-consumption, and start considering chemical recycling of petrochemical products.	Ethylene/propylene/cumene /C4 and C5 fractions, etc.
	Polymer	Polyethylene Expand earnings by product differentiation, high value-added product development and increasing sales base prices	Low-density and high-density polyethylene/EVA (ethylene vinyl acetate copolymer)/adhesive polymers, etc.
		Functional Polymers Expand market share by increasing production capacity in growth areas and expanding market applications	Synthetic rubber (CR, CSM) /paste PVC/PPS/ petroleum resin, etc.

Petrochemical Group: Olefins Business

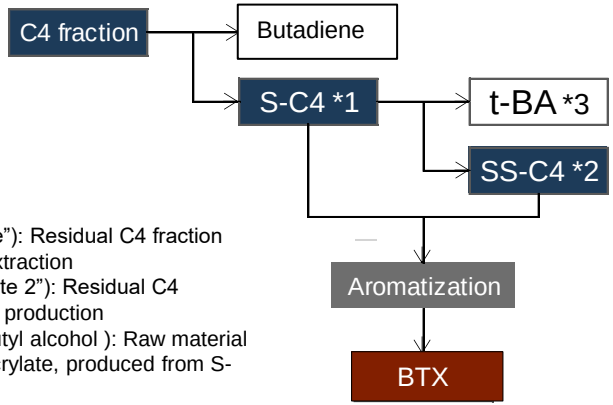
Business environment

- Domestic naphtha crackers may be restructured in the future due to declining domestic demand for petrochemical products
- We are the only naphtha cracker owner in the Chukyo area and the largest ethylene buyer in Japan
- Rising need to consider measures to save energy and reduce CO2 emissions

Product flow at Yokkaichi Complex



*BTX refers to: Benzene, Toluene, Xylene



*1 S-C4 (“raffinate”): Residual C4 fraction after butadiene extraction
*2 SS-C4 (“raffinate 2”): Residual C4 fraction after t-BA production
*3 t-BA(tertiary-butyl alcohol): Raw material for methyl methacrylate, produced from S-C4 fraction

Measures

- Maintain high naphtha cracker utilization by diversifying sales destinations and adding value to each distillate
- Installation of additional gas turbine to improve energy efficiencies and cost competitiveness
- Appropriate cost sharing and cost pass-through for decarbonization

Petrochemical Group: Polyethylene Business

Business environment

- Demand growth slowdown due to environmental issues (de-plasticization)
- Excess supply continues due to new capacity expansion in North America and Asia
- Demand for EVA increasing steadily for solar cell encapsulant applications

EVA (ethylene vinyl acetate co-polymer) for solar cell encapsulation materials

EVA is used as an encapsulant for solar panels to fix and bond solar cells. High transparency, flexibility, and weather resistance are required for encapsulants.

Polyethylene resins responding to environmental needs

Mono-materialization

Mono-material products are easy to recycle, and only PE resin is used to achieve the functions required by customers.

Contribution to Recycling

The addition of Melthene-S enables recycling of dissimilar plastic products.

Conversion to Paper Use

Paperization of food packaging is progressing due to de-plasticization. Development of high-performance polyethylene for paper packaging materials.

Thin Film

Promoting thin-film intravenous bag. Thinner bags reduce sterilization time.

HDPE (high-density polyethylene) for high-purity containers

High purity is required for storage and transportation containers for high purity chemicals used in semiconductor manufacturing. We have developed an ultra-clean HDPE with reduced impurities through a polymerization process using our proprietary highly active catalyst.

(ultra-clean chemical containers)

Melthene® M ～Actively expanding to overseas markets with easy-to-peel applications

Lidding films for packaging containers to store food like pudding and instant ramen noodles require an adhesive (easy-to-peel agent) that can be kept firmly sealed during transportation and storage while being easily peeled off during use.

* Melthene M has excellent adhesion and can be used to seal various base materials at low temperatures. Easy-to-peel lids are commonplace in Japan, but recognition overseas is still low.

Measures

- Further shift and expand sales of functional products that are not affected by de-plasticization
- Respond to environmental needs (recycling, thinner films, mono-materials)
- Increase sales price base (pass on higher costs other than naphtha)

* Melthene is a registered trademark of Tosoh Corporation in Japan, China, Europe, etc.

Petrochemical Group: Synthetic Rubber Business

Business environment

Chloroprene Rubber (CR)

- Advanced manufacturing know-how is a barrier to entry; limited number of suppliers
- Demand from emerging countries drives market expansion
- Surgical glove applications have been growing steadily in recent years.

Chlorosulfonated polyethylene (CSM)

We are the world's only supplier of CSM that is for the manufacture of high-end applications (DuPont withdrew from the market in 2009)

Cellulose nanofiber (CNF) composite chloroprene rubber (CR)

In collaboration with Bando Chemical Industries, Ltd., the project named: “Development of low-cost manufacturing technology for CNF composite CR targeting transmission belts" was selected by Japan’s New Energy and Industrial Technology Development Organization to be a subsidized project.

Plant-derived CNF is a biomass-derived high-performance material that is one-fifth the weight of steel yet five times as strong. It is expected to be used as a reinforcing fiber for resin and rubber.

*Cellulose nanofiber is created by defibrating plant-derived cellulose to the nano level

Substitution of surgical glove material from natural rubber to CR

Natural rubber medical gloves are increasingly being replaced with synthetic rubber as natural rubber is prone to cause allergies. Surgical gloves, for which a comfortable fit is important, are also increasingly being replaced with CR gloves.

Chlorosulfonated polyethylene (CSM) characteristics

CSM is a well-balanced synthetic rubber. It is mainly used in automotive rubber parts, in cover materials for various hoses, and in electric wire coatings.

Comparison of rubber properties

		CSM	CR	EPDM	NBR	SBR	IIR	NR
Physical Properties	Tensile strength	○	○	△	○	△	○	○
	Abrasion resistance	◎	○	△	○	○	○	○
	Compression	○	◎	○	◎	○	△	◎
	Gas retention	○	○	△	○	△	◎	△
Deterioration Resistance	Weather resistance	◎	○	◎	△	△	○	△
	Ozone resistance	◎	○	◎	×	×	○	×
	Heat resistance	◎	○	◎	△	△	○	△
	Flame retardancy	○	○	×	×	×	×	×
	Color stability	◎	×	◎	○	○	○	○
Chemical resistance	Hydrochloric acid	◎	△	◎	△	△	○	△
	Nitric acid	◎	×	○	×	×	×	×
	Sulfuric acid	◎	◎	◎	◎	○	○	○
	Alkali	◎	◎	◎	○	○	◎	○
	Oil resistance	○	○	×	◎	×	×	×

◎ Excellent ○Good △Fair ×Inferior

Measures

CR

- Expand applications and sales of CNF composite materials
- Expansion of new production line (to capture demand in emerging countries)

CSM

- Full-scale consideration of BCP response and increasing earnings through expansion of new production lines

References

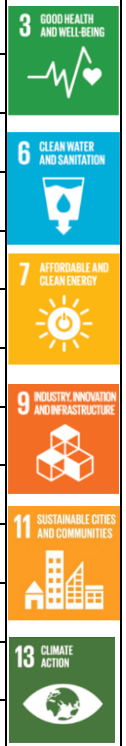
Tosoh Products' Contribution to Society: Energy-Saving, Greenhouse Gas Reduction

Product name	Application	Notes	Related SDGs
MDI (urethane raw material)	Thermal insulation	MDI is one of the main raw materials used in the manufacture of urethane foam. By trapping air and heat-insulating gases in the foam, a heat-insulating effect can be achieved.	
TOYOCAT® (urethane foaming catalyst)		TOYOCAT is a foaming catalyst for urethane foaming agents with low global warming potential (next-generation chlorofluorocarbon HFO) compatible foaming catalyst. It is used for spray application of urethane heat insulators, etc.	
PVC (polyvinyl chloride resin)	Sash (window frame)	PVC resin has high thermal insulation properties (resin does not conduct heat well) and excellent weather and water resistance.	
Caustic soda	Aluminum parts	In the production of aluminum, large amounts of caustic soda are used to melt bauxite and extract its alumina content. Aluminum contributes to the lightweighting of automobiles.	
	LiB (lithium-ion battery) cathode materials	High quality caustic soda is used in the production of cathode materials for lithium-ion batteries (secondary batteries that can be charged and discharged).	
	Energy-saving electrolyzer technology license	Developed energy-saving electrolyzers in 1995 and licensed the technology domestically and internationally. CO2 emissions from electrolysis plants have been significantly reduced on a global scale.	
Synthetic silica	Fuel-efficient tires	The use of silica as a reinforcing filler in fuel-efficient tires improves rolling resistance performance (which affects fuel economy) and wet grip performance (grip on wet surfaces).	
Petroleum resin		Petroleum resins can be blended into fuel-efficient tires to provide wet grip performance without deteriorating rolling resistance performance.	
EVA (ethylene-vinyl acetate copolymer)	Solar panels (solar cell encapsulation materials)	EVA has excellent weather resistance, adhesiveness, and light transmittance, and is used as a raw material for film to protect and encapsulate solar cell cells.	
Diethyl zinc	Solar panels (transparent conductive films)	Diethylzinc is used as a raw material for zinc oxide films (transparent conductive films) in thin film solar cells.	
CF3I (trifluoromethane iodide)	Etching agent, fire extinguishing agent	Demand for CF3I increased as a substitute for CFC as an etching agent and halon as a fire extinguishing agent. Global warming potential is "CF3I:CO2:CFC:Halon" = "0.4:1:6,290:12,400".	
Cement	Recycled waste utilized in cement production	Recycle waste and by-products from various industries and municipalities safely and in large quantities as raw materials for cement and alternative fuels for cement production.	

* TOYOCAT is a registered trademark of Tosoh Corporation in Japan, China, Europe, etc.

Tosoh Products' Contribution to Society: Infrastructure

Product Name	Application	Notes	Related SDGs
Portland cement	Civil engineering and construction work	Portland cement is used in construction projects, and is the most highly versatile cement. About 70% of the cement used domestically is Portland cement.	
Blast-furnace slag cement	Large-scale construction projects including construction of dams and ports	Blast furnace cement is Portland cement mixed with fine powder from blast furnace slag emitted from steel mills. It is characterized by the fact that its strength increases over time.	
Polyvinyl chloride (PVC)	Water and sewage pipes	PVC resin is excellent in durability, and a PVC pipe has strength similar to that of a new one even after several decades. Excellent chemical resistance (strong against both acid and alkali).	
	Wire coating	PVC has high electrical insulation characteristics. It also has superior weather resistance and flame retardancy, and plasticizer hardness can easily be adjusted.	
Water treatment systems	Pure water production at power plants	Systems that produce high-purity water are used at power plants. To ensure long-term safe operation at power plants, water from which impurities have been removed is circulated, and converted to steam to drive the turbines.	
	Water purification at municipal water facilities	Systems that perform water purification to remove turbidity and trace amounts of harmful substances, and installation of advanced water treatment technologies that utilize activated carbon and ozone.	
	Wastewater treatment at sewage treatment facilities	Systems that clean wastewater produced at households and factories. Removes nitrogen and phosphorous that cause eutrophication.	
Sodium hypochlorite	Sterilization of water at water supply and sewage facilities	Sterilization using chlorine components. Sodium hypochlorite is saved and used in an aqueous state. As it is a liquid, the amount used can be easily adjusted.	
Polyaluminum chloride (PAC)	Coagulation treatment of impurities at municipal water facilities	PAC is used as a flocculant (promotes the clumping of particles) in sewage water treatment.	
Light-emitting diode (LED) materials	Traffic lights	There are times when conventional traffic lights using incandescent or halogen-based light bulbs appear to be blinking due to the afternoon sun, and LED-type lights prevent that phenomenon from occurring, thus helping to reduce traffic accidents	
Calcium chloride	Snow-melting agent	Calcium chloride reacts with water and generates a large volume of heat, plus it is ideal for freeze proofing and melting snow on roads.	
Heavy metal treatment agent	Removal of heavy metals (garbage incineration)	Harmful heavy metals such as lead are found in fly ash produced from trash incinerators. Heavy metal treatment agents are used to capture these metals in the fly ash, so that they can be disposed of in a landfill.	
	Removal of heavy metals (wastewater treatment)	Harmful heavy metals in wastewater from factories and other facilities are captured using a heavy metal treatment agent, and after being precipitated with a flocculant, the supernatant is filtered and discharged.	



Tosoh Products' Contribution to Society: Construction and Residential

Product Name	Application	Notes	Related SDGs
MDI (polyurethane raw material)	Insulation	MDI is one of the main raw materials used in the manufacture of polyurethane foam. By locking in air and high thermal insulation gas, the foam can gain thermal insulation properties.	
	Waterproof paint	Applying liquid polyurethane resin to surfaces such as roofs forms a waterproof layer. It is liquid so it can also be used on complex shapes. Polyurethane resin has high elasticity and resists cracking.	
HDI (polyurethane-based non-yellowing curing agent)	Exterior paint	Polyurethane-based paint with HDI used as a hardening agent does not suffer yellowing deterioration to its coating film from ultraviolet rays and is highly durable.	
TOYOCAT® (polyurethane foam catalyst)	Insulation	Toyocat is a foam catalyst compatible with low global-warming-potential polyurethane blowing agent, a next-generation Freon hydrofluoroolefin (HFO). It is used in polyurethane insulation sprays.	
Polyvinyl chloride (PVC)	Sash for window frames	PVC resin has high thermal insulation properties (resin does not easily conduct heat), and features superior weather and water resistance.	
	Rain gutter	PVC resin has superior weather and water resistance, and does not rust like metal.	
	Waterproof sheets	Forms a waterproof layer by affixing it to a sheet-form waterproof material. PVC resin has superior weather and water resistance, and is also flame resistant as more than half the raw material is salt.	
	Exterior wall (siding)	PVC resin has superior weather and water resistance and thermal insulation properties, and is also flame resistant.	
PVC paste	Wallpaper	PVC paste is a special PVC where the particle size is precisely controlled. It becomes a paste with good liquidity when mixed with a plasticizer at normal temperatures, and is easy to process. It also has good printability.	
	Flooring	PVC paste has superior weather and water resistance like PVC resin, and is also flame resistant. It is moldable at normal temperatures (heat is unnecessary in processing), contributing to energy conservation.	
Ethylene-vinyl acetate copolymer (EVA)	Solar panels (solar cell encapsulation materials)	EVA features superior weather resistance, adhesiveness, and optical transparency, and is used as a film raw material in preserving and sealing solar battery cells.	
Diethylzinc	Solar panels (transparent conductive film)	Diethylzinc is used as a raw material in zinc oxide film for thin-film solar cells (transparent conductive film).	

Tosoh Products' Contribution to Society: Automotive

Product Name	Application	Notes	Related SDGs
Caustic soda	Aluminum parts	In the aluminum manufacturing process, bauxite is heated and melted and the alumina component is extracted; in doing so, large volumes of caustic soda are used. Aluminum parts are often used as they can reduce the weight of automobiles.	
MDI (polyurethane material)	Parts (rebound polyurethane, other)	Thermoplastic polyurethane resin (TPU) is resin that combines the elasticity of rubber and the toughness of hard plastic.	
	Seat cushions	Polyurethane foam can be produced with varying levels of strength and elasticity by changing the compounding ratio of raw materials.	
	Seat covers	Polyurethane synthetic leather is made by applying polyurethane resin to non-woven fabric. It has a texture similar to natural leather.	
HDI (polyurethane-based non-yellowing curing agent)	Paint (polyurethane-based paint)	Paint that is used with HDI as a hardening agent does not suffer coloring deterioration from ultraviolet rays, and is highly durable.	
RZETA® (polyurethane foam catalyst)	Seat cushions	RZETA reduces volatile organic compounds (VOC) that are emitted from the use of catalysts, making the manufacture of low-odor polyurethane foam possible.	
TBA (brominated flame retardant)	Electronic circuit board	TBA contributes to high flame retardancy in brominated epoxy used in laminated boards (electronic circuit boards). Demand is growing in line with progress in automotive electrification.	
PVC paste	Underbody coating for preventing rust and stone damage	PVC paste becomes a paste with good liquidity when mixed with plasticizer at normal temperatures, and can be used as a spray coating. It also features superior adhesiveness.	
Chloroprene rubber (CR)	Parts (belts, boots, hoses, other)	CR features superior oil, chemical, heat, and weather resistance, and has high mechanical strength. Crystal resistant grade does not easily become hard even in low temperatures.	
Chlorosulfonated polyethylene (CSM)	Parts (various types of hoses, other)	CSM has the same characteristics of CR, but has even higher heat and weather resistance. Moreover, it is a synthetic rubber that can be easily colored. Tosoh is the world's only manufacturer.	
Polyphenylene sulfide (PPS)	Parts around the engine	PPS is an engineering plastic with extremely high heat resistance and stability. It is used in parts around the engine that require resistance to temperature changes. It also contributes to the reduction of automobile weight.	
Silica	Fuel-efficient tires	Using silica as a reinforcing filler in fuel-efficient tires improves rolling resistance performance (impacts fuel consumption) and wet grip performance (gripping power on wet surfaces).	
High-silica zeolite (HSZ®)	Exhaust gas cleaning catalyst	HSZ is used as a catalyst that assists in chemically breaking down the NOx emitted from diesel-powered vehicles.	

* RZETA and HSZ are registered trademark of Tosoh Corporation in Japan, China, Europe, etc.

Tosoh Products' Contribution to Society: Healthcare

Product Name	Application	Notes	Related SDGs
Glycohemoglobin analyzer	Aid in the diagnosis of diabetes, others	Based on the principles of high-speed liquid chromatography, it performs separation measurement of hemoglobin in the blood which serves as an index to aid in the diagnosis and monitoring of diabetes and glycemic control.	
Immunoassay analyzers and reagents	Blood and urine tests	Through fully automated immunoassay analyzers, biological components such as proteins and hormones in blood and urine are measured; used in tumor and disease examinations.	
Genetic testing equipment and reagents	Genetic testing of infectious diseases etc.	A small, automated system based on the TRC (transcription-reverse transcription concerted reaction) method, it rapidly performs viral and bacterial nucleic acid purification, amplification, and detection; used in infection disease testing.	
Water production equipment for pharmaceuticals	Production of water for pharmaceuticals	Equipment that produces purified water used in manufacturing pharmaceuticals	
Trifluoroethanol (TFEA)	Anesthetics	TFEA is a fluorine compound, and is used as a raw material for anesthetics.	
Low-density polyethylene (LDPE)	Eye drop containers	LDPE is flexible and strong against shock and rupture, and has superior chemical resistance.	3 GOOD HEALTH AND WELL-BEING
Linear low-density polyethylene (L-LDPE)	IV infusion bags	L-LDPE incorporates the characteristics of LDPE, and also features superior low-temperature sealability (a bag can be crimped and sealed at low temperatures).	
Chloroprene rubber	Surgical rubber gloves	Rubber gloves are used in operating rooms where gloves are required to fit snugly. If the material is synthetic rubber, allergies to natural rubber can be circumvented.	
Zirconia	Dental materials	Zirconia is a fine ceramic material with high strength and toughness (not brittle). Dentures and teeth made from zirconia have color tone and translucency that looks similar to real teeth.	
Medicinal oxygen	Medicinal oxygen	Medicinal oxygen is subject to High Pressure Gas Safety Act and Pharmaceutical Affairs Act (gas concentration, properties, purity test, and more are specified) regulations.	
Baking soda (sodium bicarbonate)	Gastrointestinal medicine	Baking soda neutralizes the acidity of gastric juice, and relieves inflammation.	
	Artificial dialysis	Baking soda is used as an artificial dialysis agent. To return acidic bodily fluid to a low alkaline state in the event of kidney failure, baking soda is included in dialysis fluid as an alkalization agent.	
MDI/TDI (polyurethane raw materials)		MDI/TDI are used as a raw material for dialyzer potting material. Polyurethane features superior blood compatibility and adhesion.	

(Reference) Social Contribution of Tosoh Products / Electronics

Product Name	Application	Notes	Related SDGs
HDPE (high-density polyethylene)	High purity chemical containers	High cleanliness is required for containers of chemical solutions used in semiconductor manufacturing. Highly clean HDPE is achieved through a polymerization process using a proprietary highly active catalyst.	
Silica glass ingots	Fabricated silica glass products	Silica glass is glass that is extremely low in impurities (almost all of its elements consist of silicon dioxide). High in purity, it features superior heat resistance, optical transmission, and chemical resistance.	
Fabricated silica glass products	Jigs for semiconductor manufacturing	In addition to heat resistance, optical transmission, and chemical resistance, semiconductor manufacturing jigs are required to have chemical purity (non-reactive to semiconductor materials). Silica glass is a material that meets these requirements.	
	Photomask substrate for LCDs	Photomask substrates are required to have high optical transmission, and they use fused quartz made from chemically fused silica which is higher in purity than fused quartz made from melted crystal powder.	
Sputtering targets	Thin film materials	Sputtering targets are materials used in the Physical Vapour Deposition (PVD) method when forming micron-level metal thin films essential to the semiconductor and flat-panel display manufacturing processes.	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
Photoresist monomer	Photoresist materials	Photoresist material are used in semiconductor manufacturing.	
High-performance etching gas	Etching in semiconductor manufacturing	The ability to perform deep drilling and high-performance etching gas with low resist damage (improved yield) is required in 3D-NAND technology, which stacks memory cells vertically in multiple layers.	
High-purity phosphoric acid	Etching in semiconductor manufacturing	High-purity phosphoric acid is manufactured using the dry method, which has few impurities. It is used in the etching process in semiconductor manufacturing.	
Ultrapure water production equipment	Cleaning of electronic parts	Equipment for producing ultrapure water (water from which impurities have been removed) used in cleaning and other processes in semiconductor manufacturing. Impurities in cleaning water leads to defective products.	
Multi-functional water production equipment		Water purification equipment that can further purify ultrapure water to produce purified water with excellent cleaning properties, such as hydrogen infused water and ozonated water. In addition to improved cleaning performance, a reduction in chemical use	
Electron transport materials and hole transport materials	Organic electroluminescence (EL) materials	Electronic transport material and hole transport material for organic EL. Organic EL elements are comprised of a transparent anode, a hole transport layer, a light emitting layer, an electron transport layer, and a cathode.	