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Science

Science is our competitive edge. Cutting-edge technologies to deliver creative solutions

Management of Technology (MOT) is the engine of sustainable growth at the Mitsubishi Chemical Group, driving innovation so we can deliver value to society. We will step up the pace of creating new solutions by using advanced technological capabilities spanning everything from basic research to manufacturing technology, extensive intellectual property, and an open innovation approach that allows us to incorporate new trends. We are also utilizing digital technologies to accelerate R&D, optimize and improve efficiency in the value chain, and achieve fundamental improvements in business efficiency.

Innovation Strategy ▶Page 45

New research facility established at the Science & Innovation Center ©GRAFILM

Digital Strategy ▶Page 49

Lithium-Ion Battery Electrolyte

Science. Value. Life.
Changing electrode surface properties to prolong battery service life and improve performance

In the 2000s, the MCG Group started working on the development of EV batteries with long service lives and high power output. Rather than taking the conventional approach of changing the composition of the electrolyte itself, we invented a method that significantly enhances output by adding minute quantities of an additive (lithium difluorophosphate) to the electrolyte to reduce electrical resistance on the electrode surface. With conventional technologies, there was a trade-off between long service life and performance, but our method has allowed us to develop batteries with both these characteristics.

This discovery has had a huge impact in scientific circles, stimulating debate on electrode surface modification technologies in both industry and academia.

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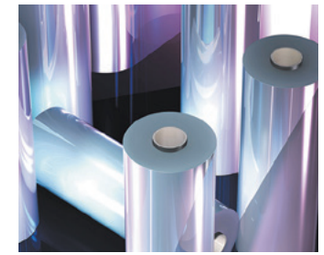
Science. Value. Life.

Leveraging our technological capabilities to develop a portfolio of display components

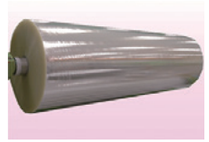
Across the MCG Group, we have developed proprietary and basic technologies in a wide range of business domains. Our optical polyester films have captured approximately 20% of the global market. We are now moving to rapidly secure supply capacity for growing global markets and deliver solutions for increasingly high-level needs in order to support the evolution of a wide range of industrial products.

We are also developing a range of functional components designed for displays, including base materials for polarizing plates, light guide plates, optical adhesive sheets, and reflector films.

Optical polyester films
Share of global market:
Approx.
20%

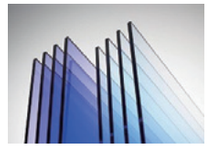


Main display components



OPL Film

This optical polyvinyl alcohol (PVOH) film is used as the base material for polarizing film. Images and characters can be displayed vividly when this film is used.



SHINKOLITE

This acrylic resin sheet is used in a wide range of fields, including signage, displays, large water tanks, and light guide plates. The *SHINKOLITE* grade for light guide plates features superior surface properties and produces bright, uniform illumination under varied light sources.

CLEARFIT

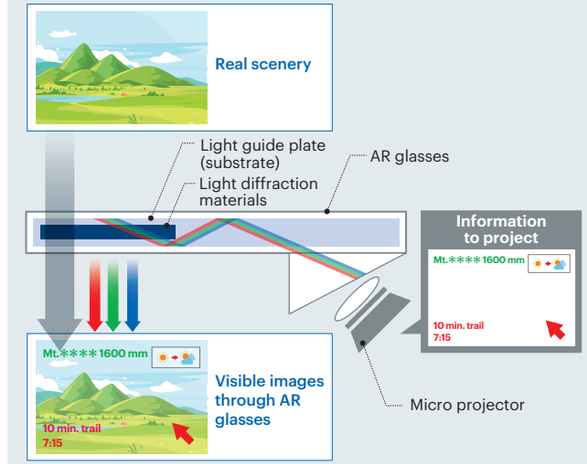
This clear, adhesive sheet can be used as a filler between layers of panels used for touch and other types of displays. Use of this sheet to fill voids in the display prevents mirroring and improves contrast.

Future products under development

Light guide plate materials for AR glasses (xR-related optical materials)

Augmented reality (AR) glasses have the potential to be the next major innovation after smartphones, and the market is expected to grow rapidly in the future. At the MCG Group, we are focusing on the development of resin sheets used in light guide plates. Leveraging our capabilities in optical control technology, we aim to expand our business in the growth market for AR glasses.

Image projection principle of AR glasses



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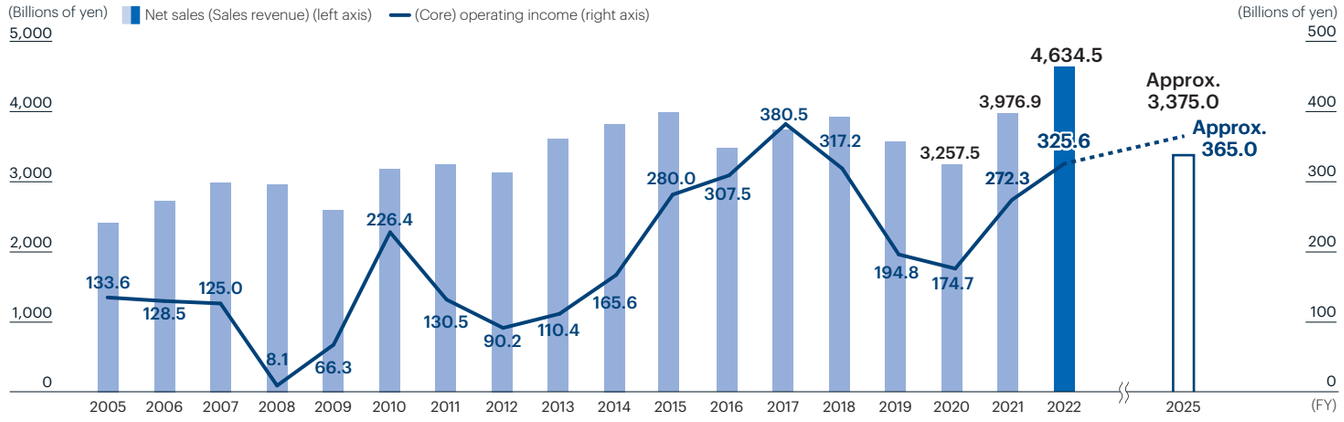
Value

What we create is Value. We will deliver value to all stakeholders by tirelessly driving portfolio reform.

To maximize value for customers, shareholders, and all other stakeholders, we will emphasize economic efficiency by practicing Management of Economics (MOE). In addition to building a sound financial position by tirelessly driving portfolio reform, we will focus management resources on markets with high growth potential based on key global trends and exercise sound managerial judgment in the conduct of our business, thus strengthening profitability.

Business Strategy ▶ Page 34

Net sales (sales revenue) and (core) operating income



Pursuit of business scale through M&A and integrations, and restructuring of unprofitable businesses

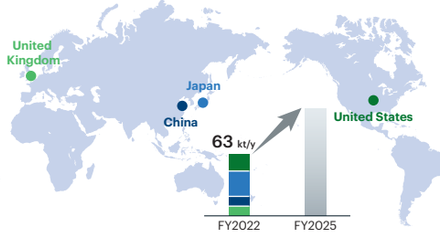
Become a corporate group with high growth and a profitable business through Performance Products, Industrial Materials, and Health Care

With a clearer strategy to drive operational excellence and unlock business potential, we can deliver more value to our stakeholders

Lithium-Ion Battery Electrolyte

Science. Value. Life.
Expanding production capacity to match growth in the lithium-ion battery (LiB) market

Amid continuing rapid change in the LiB market, we have identified automotive applications sector as a target market and aim to secure a 25% share of the total market by fiscal 2025. To increase market share, we will work on a global basis to establish a production system able to adapt to rapidly expanding demand and to secure a stable supply of raw materials.



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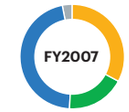
Tirelessly driving portfolio reform for sustainable increase in corporate value

Medium-term management plans and portfolio reforms ● Growth measures ▲ Restructuring

				Composition of (core) operating income
FY2005–2007 **KAKUSHIN Plan - Phase 2**	**Operating income** Target ¥**140** billion or more Result ¥**125** billion	**Raised the ratio of the pharmaceutical business and strengthened earnings less susceptible to the economy**	● 2005 Establishment of MCHC ● 2007 Establishment of MTPC	Performance Products 33% Industrial Materials 18% Health Care 46% Other 3% 
FY2008–2010 ***APTSIS 10***	**Operating income** Target ¥**190** billion Result ¥**226.4** billion	**Expanded Performance Products domain** **Shifted to a higher value-added business portfolio**	● 2008 Integrated MPI, MCC's functional products business, and three affiliate companies ● 2009 Conversion of Quadrant AG, the world's largest manufacturer of engineering plastic products, into a consolidated subsidiary ● 2010 Conversion of MRC into a consolidated subsidiary ▲ 2010 Withdrawal from the nylon chain business ▲ 2011 Withdrawal from the PVC chain business Withdrawal from the SM chain business	Performance Products 16% Industrial Materials 47% Health Care 37% 
FY2011–2015 ***APTSIS 15***	**Operating income** Target ¥**280** billion Result ¥**280** billion	**Stabilized profitability through structural reform in the Industrial Materials domain and the conversion of an industrial gas company into a subsidiary**	● 2014–2015 Production optimization of polyolefin ● 2014 Conversion of TNSC into a consolidated subsidiary ▲ 2014 Retained a single naphtha cracker at the Kashima Plant (now Ibaraki Plant) ▲ 2016 Formed a joint venture to operate the naphtha cracker at the Mizushima Plant (now Okayama Plant) ▲ 2016 Decided on the equity interest transfer of the terephthalic acid business in India and China	Performance Products 27% Industrial Materials 36% Health Care 37% 
FY2016–2020 ***APTSIS 20***	**Core operating income** Target ¥**410** billion Result ¥**174.7** billion	**Accelerated growth of the Performance Products domain** **Strengthened management through business restructuring and invested in growth areas**	● 2017 Established the New-MCC through integration of the three chemical operating companies ● 2018 Full operational start of new plant in the Middle East ● 2018–2019 Expanded the global market share of the industrial gases through M&A activities ▲ 2019 Strategic capital alliance with PHC Holdings Corporation through share exchange with LSI Medience Corporation ▲ 2019 Withdrew from the storage media business ● 2020 Converted MTPC into a wholly owned subsidiary	Performance Products 35% Industrial Materials 57% Health Care 10% Other -2% 
FY2021–2025 **Management policy "Forging the future"**	**EBITDA** Target Approx. ¥**600** billion **Core operating income** Target Approx. ¥**365** billion	**More focused approach to maximize our value** **Developing a portfolio focused on market growth potential, competitive capabilities, and sustainability**	▲ 2022 Transfer of the alumina fiber business ● 2022 Changed company name to Mitsubishi Chemical Group Corporation ▲ 2023 Discontinued MMA production in United Kingdom ▲ 2023 Discontinued development of regenerative medicine-related products using Muse cells ▲ 2023 Withdrew from business of Medicago Inc.	**Breakdown of EBITDA target** Specialty Materials 39% Industrial Gases 41% Health Care 10% MMA 10% 

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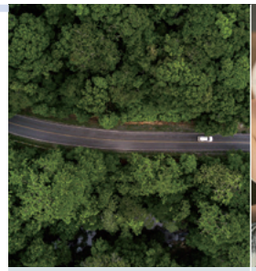
With sustainability as a keyword, we will focus management resources on seven markets identified based on key global trends.

	EV/Mobility	Digital	Food	Medical	Building/ Infrastructure	Consumer goods	Industrial
							
Focus markets							
Key trends	• Electric vehicles • Autonomous driving	• Semiconductors • High-speed communication	• Conservation of water resources and reduction of food waste • Recyclable packaging	• Increase in healthcare expenditures • Aging population	• Growing population • Energy efficiency	• Growing middle class • Product longevity	• Circular economy • Carbon capture, utilization, and storage (CCUS)

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Science. Value. **Life.**

Our aim is to contribute to Life. For people, society, and the whole of the planet

We regard addressing environmental and social issues as an essential management theme, and this is why we practice Management of Sustainability (MOS). We will progressively help realize a circular economy in a way that achieves a balance between economic growth and environmental protection. Among our initiatives are utilizing renewable energy and applying life cycle assessment to develop products of low environmental impact. We are also pursuing sustainability by addressing social issues such as building sustainable supply chains, respecting human rights, and promoting diversity and inclusion.

Implementing Sustainability ▶Page 58 | Progress toward Carbon Neutrality and a Circular Economy ▶Page 64 | Human Resources Strategy ▶Page 67 | Building Sustainable Supply Chains ▶Page 72

New treatment option for ALS patients ▶Page 40

HyCO plants for hydrogen ▶Page 39

Lithium-Ion Battery Electrolyte

Science. Value. **Life** Reducing the environmental impact and contributing to a smart society by boosting EV performance

An electrolyte we developed that helps lessen energy loss is expected to establish an increasingly important profile going forward, as a product that contributes to environmental impact reduction. By promoting the widespread use of EVs and HEVs, it will also contribute to reducing emissions of CO_2 and other exhaust gases.

Our electrolyte is also highly compatible with the Mobility as a Service (MaaS) field that aims to realize low cost and high performance in new mobility services known as Green Slow Mobility. As it is also likely to be well suited to use in storage batteries for smart grids, it shows promise as a product that will contribute to realizing a smart society.

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Leveraging our sustainability initiatives and contributions to achieve further Group growth

To address pressing environmental issues, the Mitsubishi Chemical Group will progress measures to reduce greenhouse gas (GHG) emissions, expand the range of low environmental impact products, and implement systems to manage waste and water resources. Through these and related initiatives, we will achieve carbon neutrality by 2050.

For example, Mitsubishi Chemical Corporation (MCC) has accelerated initiatives focusing on plastic recycling. We are developing products with a wide range of properties and working with stakeholders as part of efforts to put in place a circular system. At the same time as helping to grow our business, these efforts will help people lead more comfortable and secure lives and contribute to the global environment.

Toward carbon neutrality

We have achieved major advances in reducing GHG emissions, for instance by switching to green electric power and taking other measures for the proactive utilization of renewable energy at our business sites in Europe and the United States. We are engaged in a wide range of other initiatives to realize a recycling-oriented society in collaboration with the chemical industry, academia, local communities, and various other partners.

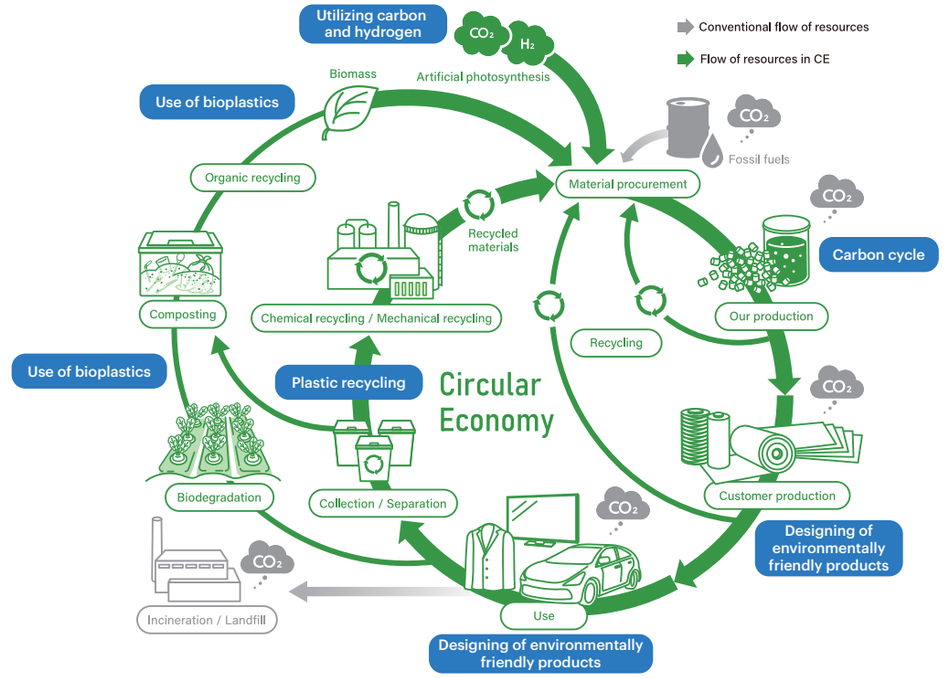
Reporting in Line with the TCFD Recommendations ▶Page 62
Progress toward Carbon Neutrality and a Circular Economy ▶Page 64

MCC's efforts in plastic recycling

Plastic Recycling

Use of Bioplastics
- Biomass as raw material
- Biodegradation

Utilizing Carbon and Hydrogen



Use of LCA

Strengthen products and services that contribute to reducing environmental impact throughout the value chain

LCA case study ▶Page 60

Open Innovation, Collaboration with Stakeholders

AEPW, ICCA, VBA, WEF-LCET, GCNJ, CGC, CLOMA, J4CE, Carbon Recycling Fund Institute, and others

Progress toward Carbon Neutrality and a Circular Economy ▶Page 64