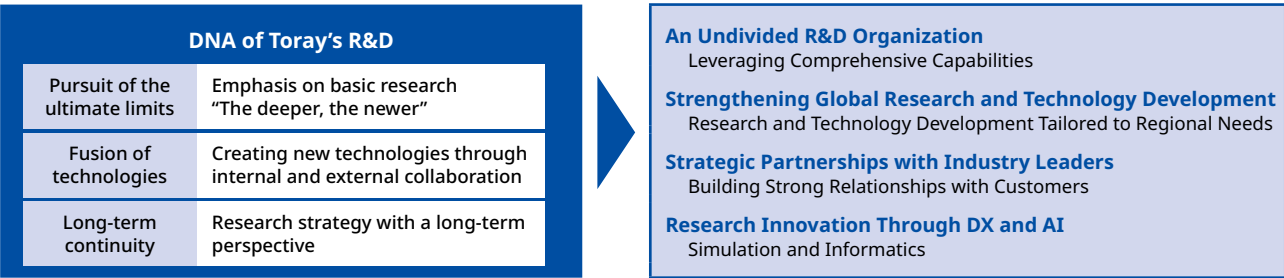


Research and Development (R&D)

Under the corporate slogan “Innovation by Chemistry”, the Toray Group pursues technological innovation with chemistry at its core, aiming to become the world’s leading company of advanced materials. Going forward, we will further bolster the Group’s collective strengths and create innovative advanced materials.

R&D Basic Policy and Organization

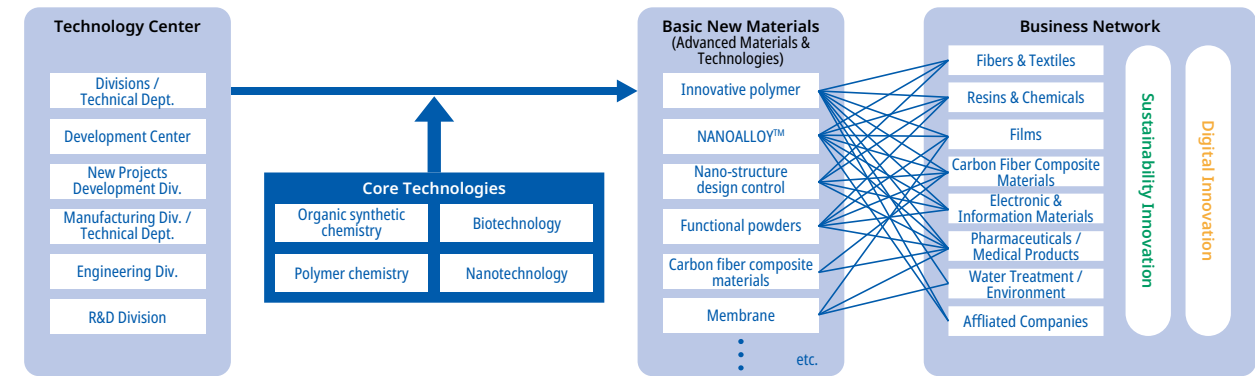


Since the Company’s founding, Toray’s Technology Center has served as the control tower for driving research and technological development into advanced materials based on the conviction that R&D provides the key to building the Toray’s tomorrow.

Toray’s R&D teams have inherited the idea of “The Deeper, the Newer,” a concept that digging deeper into something will result in new discoveries and inventions. This is our DNA of “pursuing the ultimate limits.” On top of that, our strengths lie in our commitment to long-term continuity, based on which we will continue to undertake initiatives from a long-term perspective. Based on a grand vision of the times and

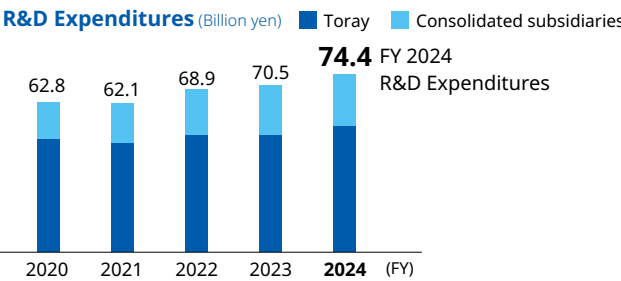
the needs of society, Toray aims to drive innovation that delivers social and economic value.

A notable feature of R&D at Toray is that all research and technological development functions are centralized in the Technology Center. This integrated R&D organization means new technologies arising from the fusion of technologies are more likely to emerge, and advanced materials originally developed for other businesses to be rapidly deployed across multiple businesses. This also enables the Group to fully utilize its combined strength by actively exploiting techniques and knowledge from many fields to solve problems in a single business field.

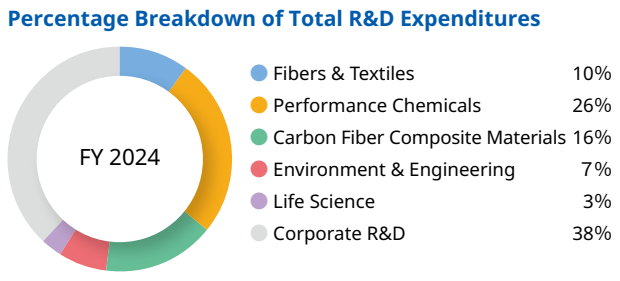


R&D Investment

Over the duration of AP-G 2025 (FY 2023 -2025), we are planning to invest over 80% of the total R&D expenses of 220 billion yen in the Sustainability Innovation (SI) and Digital Innovation (DI) businesses, which we have designated as



growth business fields. To achieve our Company-wide revenue targets, we are promoting research and technological development aimed at “ultimate value creation”, “product and operational excellence”, and “sustainable growth”.



Ultra-Precise Conjugate Spinning Technology That Contributes to High-Performance Comfortable Fibers & Textiles

Our proprietary conjugate spinning technology, NANODESIGN™, precisely shapes a variety of fiber cross-sections at the nanoscale, enabling conjugate spinning using multiple types of raw materials that were previously difficult to conjugate. By way of synergies between precisely controlled fiber cross-sections and raw material attributes, we have been able to continuously realize high-performance comfortable fibers & textiles that exhibit various functions, along with aesthetics and wearing comfort that were difficult to achieve with conventional technology, thereby contributing to people’s safe, secure, and fulfilling lives.

Our water-repellent stretch textile DEWEIGHT™ forms a structure similar to that of natural materials with excellent water repellency by using our NANODESIGN™ new raw yarn, which precisely controls the fiber cross-section, and a special advanced processing technology that creates a spiral structure on the fiber surface, thereby achieving outstanding water repellency and a comfortable, smooth feel without per- and poly-fluoroalkyl substances (PFAS).

In recognition of this technology’s future growth potential and social significance, we won the 2022 Chemical Society of

Conjugate spinning technology, NANODESIGN™

The potential of new fiber materials endowed with unprecedented “thinness,” “shape,” “arrangement,” and “function”

Unique flow control technology enables the design of complex fiber cross-sections

NANODESIGN TECHNOLOGY

Product examples: DEWEIGHT™
Achieving superior water repellency through nanoscale control without PFAS

Conventional water-repellent material (commercially available equivalent) (Non-fluorocarbon water-repellent finish)	DEWEIGHT™ (Non-fluorinated water-repellent finish)
Textile observation	Textile observation
Textile cross-section	Textile cross-section
Textile surface	Textile surface
Water drop photography	Formation of an air layer between the textile and water droplets
Water drop contact angle	51° Advanced water repellency 8°

Precise control of fiber cross-sections

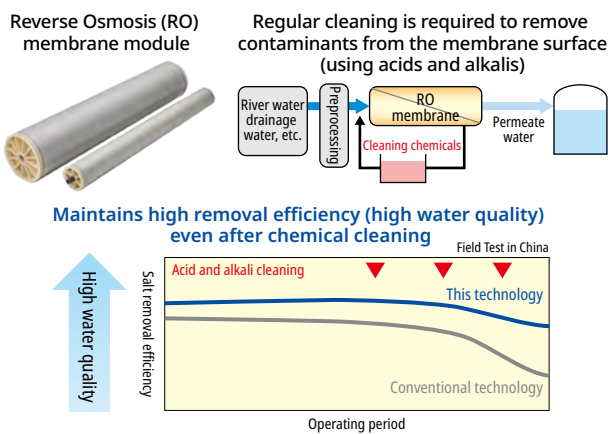
Asymmetric (logo)	Multi-layer laminate	Special sea-island fiber	Profiled nanofibers
50μm	10μm	5μm	500nm
Ultra-thin bimetal	Multi-layer laminate	Profiled sea-island fiber	Profiled nanofibers
100μm	10μm	5μm	500nm

Japan Award for Technical Development, and then in 2024, we received the Main Prize of the 2024 Ichimura Prize in Industry from Ichimura Foundation for New Technology.

Long-Lasting Reverse Osmosis Membranes with High Permeability, High Removal Efficiency, and Chemical Resistance

We identified that low durability against cleaning chemicals (acids and alkalis) that remove dirt adhered to the surface of reverse osmosis (RO) membrane leads to structural degradation and a decline in water quality. To address this issue, we found that (1) improving structural stability against acids and alkalis and (2) controlling the pore size for selective water permeability are both necessary. To achieve these goals, we have worked on the precise control of the membrane formation process. As a result, we have achieved the practical application of RO membrane that balances high permeability, high removal efficiency, and chemical resistance. Since the RO membrane can maintain high water quality even after chemical cleaning, the components also do not need to be replaced so frequently.

The RO membrane utilizing this technology is used in over 100 countries worldwide for the production of industrial water, agricultural water, and drinking water, contributing to the provision of safe and reliable water to address water scarcities faced by the international community.



The invention of this RO membrane was highly evaluated and received the WIPO* Award at the 2024 National Commendation for Invention by the Japan Institute of Invention and Innovation.


*World Intellectual Property Organization

“Night of the Makaizo Society”: Unleashing the Brilliance of Our Engineers

45 engineers from our Engineering Development Center appeared in NHK’s tech innovation entertainment TV show “Night of the Makaizo Society,” where top-tier engineers leverage ultimate ideas and techniques to take on the challenges of transforming toys or household appliances into extreme, high-performance machines, and compete with two other companies.

The challenges for Toray were “Dinosaur Kick the Can” and “Plastic Umbrella Hang Time Match.” In both of them, the members shared their wisdom and techniques to overcome numerous hurdles and tackle difficult tasks. As a result, Toray won the “Plastic Umbrella Hang Time Match.”

By participating in “Night of the Makaizo Society,” we were able to show the presence of our engineers who play important roles at Toray, a materials manufacturer, to a broader audience.





The 45 engineers who participated in “Night Of The Makaizo Society”

*<https://www.toray.co.jp/makaizo/>