

R&D

Message from the Officer in charge



We will continue to engage in technological and product development to impact the world 10 years from now

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Operating Officer in charge of Research and Development Laboratory

Research and Development at TAIYO YUDEN

Deriving Optimal Solutions for the Entire Process from Material Development to Mass Production

The Research and Development Laboratory applies its basic philosophy, “leveraging its material technology and deploying diverse core technologies to take on challenges for the development of next-generation devices and providing solutions,” to technological research and development at TAIYO YUDEN.

In product development, we mainly use such technologies in the areas of materials, processing, evaluation, design, and mounting, the first of which is the most essential. We are proud of our ability to handle the entire process, from material development to product development, and consider it one of our strengths. We take a high-level view to optimize the end-to-end process through to mass production, including product design and manufacturing, not only to produce the best possible, cutting-edge materials but also to bring out their full potential.

Role of the Research and Development Laboratory

Practicing Research to Help Achieve Goals of the Next Medium-term Management Plan and Beyond

At TAIYO YUDEN, the business divisions and the Research and Development Laboratory work closely together, with the former engaging in commercial product development and the latter handling medium-to-long-term R&D projects. As such, the Research and Development Laboratory formulates a roadmap by imagining how the world will be 10 years from now and how our products will help people there, under the motto, “envisioning ten years from now, depicting five years from now, and setting concrete goals to be realized three years from now.” Therefore, as we push forward with our medium-term management plan, which lays out our goals for FY2025, the Laboratory is moving ahead with its research initiatives with the intention of creating technologies that will serve as the basis for generating revenue under not only the current plan but also the next medium-term plan, and the one after that as well.

Today, technologies are evolving so rapidly that it is not easy to specifically imagine what kind of products will be needed 10 years from now. However, we believe that our research and development initiatives can have an impact on the future if we continue to pursue groundbreaking and exceptional performance and specifications, in accordance with our R&D slogan, “Innovative advance.”

Utilizing Shin-Kawasaki Center SOLairoLab

New Development Themes Emerging from Active Discussions

Launched for the purpose of promoting co-creation with external parties, Shin-Kawasaki Center SOLairoLab has recently been actively engaging with external stakeholders, after a couple of years of interaction being limited by the COVID-19 pandemic, which struck shortly after its opening. In FY2023, SOLairoLab accepted over 700 participants. As the participants discuss various topics, some of them are already starting to identify new development themes.

In other developments with research and development organizations, we spun off the Basic Technology Center and Material Science Laboratory into independent organizations in FY2023. Under the new organizational structure, business divisions are more actively utilizing the Basic Technology Center, which manages various simulation projects, and are starting to see positive outcomes, such as shorter product development periods and lower costs. Similarly, the Material Science Laboratory, which handles computational science, informatics and advanced analysis technology, is serving as a bridge in an increasing number of cross-department projects, such as projects involving the material development and product development departments. We hope to further promote cooperation between the business divisions and research and development organizations.

In recent years, we have been working on raising environmental awareness under the motto, “Greener and Smarter.” We will continue to uphold our commitment to impacting the world 10 years from now in our research and development activities by prioritizing both performance and environmental protection, in turn creating both economic and social value.

R&D

Fundamental Stance on Research and Development

The Foundation of Our Research and Development Activities

Hikohachi Sato, the founder of TAIYO YUDEN, was a researcher in ceramic materials, and since its establishment, has believed that product commercialization should start from the development of materials. This has been one of the strengths of TAIYO YUDEN, and has resulted in us

creating many products that have been “world firsts.” TAIYO YUDEN’s research and development activities are aimed at further honing the many elemental technologies it has so far developed to create products that contribute to the ongoing development of electronic devices.

— Research and Development Principles —

“Innovative advance”

Technology precedence

Promote leading edge technological development as the precursory to innovative product development and become a global leader in technology

Technological applicability

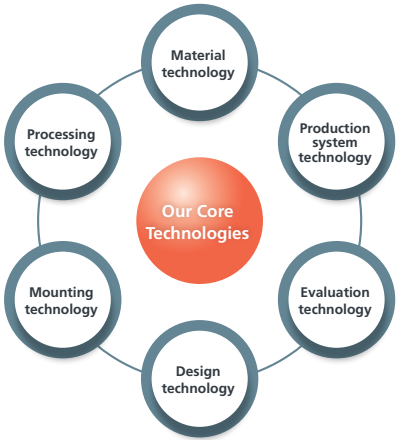
Devise technologies which can be applied not only to specific products but also to other areas useful to the markets we serve

Reproducibility

Logically verify the reproducibility of the technology we develop

Environmental consideration

Develop technologies that are feasible and applicable economically to our manufacturing process and that meet critical environmental standards



Approach to Research and Development

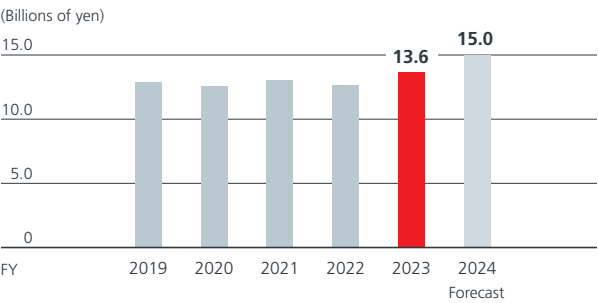
Achievement of Our Vision through Development of Smart Products

TAIYO YUDEN aims to manufacture “smart products” and is actively working to develop and supply steadily such products.

We develop smart products to eliminate the three M’s— *muda* (wastefulness), *mura* (inconsistency) and *muri* (overburden)— over their entire life cycle from design through production, sales, and incorporation into the final product right up to final disposal, to add value for customers and local communities we serve as well as our employees. We believe that our research and development activities aimed at creating a higher standard of smart products will enable us to realize our vision of “To be an excellent company that enjoys the trust and highest regard from all stakeholders.”

R&D Expenses

We recognize that continuing innovations and advancement in our technologies through R&D is the foundation for TAIYO YUDEN to create the future. As such, in recent years we have continuously invested a fixed amount into R&D activities, rather than making major adjustments based on the financial results.



R&D Themes

At the Research and Development Laboratory, the center of TAIYO YUDEN’s R&D activities, we share the roles with the business departments on a medium- to long-term perspective and leverage the core technologies we have so far cultivated to develop new materials and new processes. We are expanding various inspirations through ideas from different fields, co-creation with outside talents, etc., and taking on challenges in manufacturing and providing solutions without fearing failure. We are stepping up our initiatives that address themes

which contribute to the creation of new value through items including all solid-state batteries, fuel cells and smell sensors as well as themes related to the SDGs and the environment.

To strengthen the core technologies for the creation of new products, we draw up research themes based on the development strategy roadmap and operate a system that takes a unique twist on the phase-gate process in order to improve the success rates, completion rates, and speed of product development.

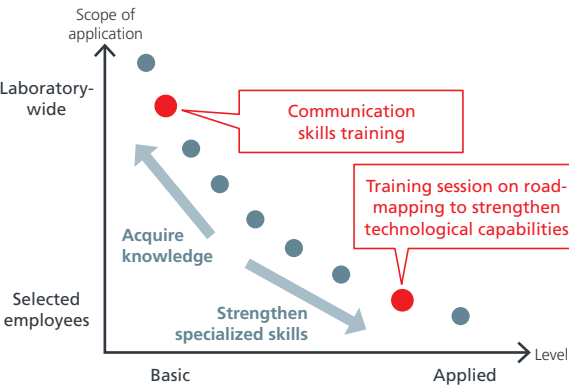
Research Personnel

The Research and Development Laboratory focuses on policies for strengthening our human resources to develop a more innovative organization and talents.

Since FY2021, we have been pushing ahead with a three-year plan to improve our employees’ communication skills to boost psychological safety and build a workplace culture that encourages people to take on challenges. As of FY2023, approximately 50% of the Laboratory employees had attended the communication training, as part of the efforts to embed psychological safety in the organization. We will continue to maintain our commitment to improving our employees’ interpersonal communication skills through FY2024.

Approximately 30% of the employees at the Research and Development Laboratory have completed the ongoing training on formulating long-term R&D strategies by working backward from major social trends to develop research and development roadmaps for the future, among other topics. We will continue to help our employees improve their roadmapping skills by having third-parties conduct evaluations to rate and measure their skills.

Image of Human Resources Development Program at the Research and Development Laboratory



Lecture on latest technologies

TAIYO YUDEN’s Research Facility

We are committed to upholding our claim to be “the TAIYO YUDEN of technology and the TAIYO YUDEN of development.”Based on this, we opened the R&D Center (Takasaki City, Gunma Prefecture, Japan) in 1998 with the aim of continuing to create the world’s best products. Establishing the R&D Center has accelerated our R&D activities, and today it serves as a source of development and technological progress, and a foundation of creativity focusing on the future.

In 2020, we opened the Shin-Kawasaki Center SOLairoLab as a place to co-create at innovative speed and at innovative level by interacting with outside talents without persisting in in-house development. The Shin-Kawasaki Sozo no Mori

(“Forest of Creation”) area where the Center is located has a large number of research institutes and startups that have congregated. We are taking advantage of this location to strengthen our marketing function and application and solution development capabilities through interactions with people outside the Company. We are actively utilizing the Shin-Kawasaki Center SOLairoLab to promote co-creation.

In FY2023, we invited over 700 people to the center to exchange views. We are also accelerating our efforts to create new markets and solve social issues by sharing resources with startups to drive innovation.



AIRBIC, a building where the Shin-Kawasaki Center SOLairoLab is located



Ceremony that celebrates completion of a student seminar on solving social issues

R&D

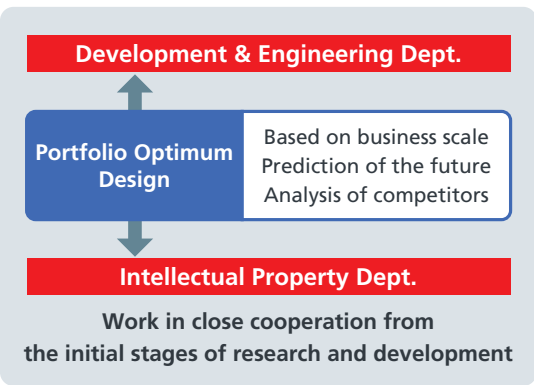
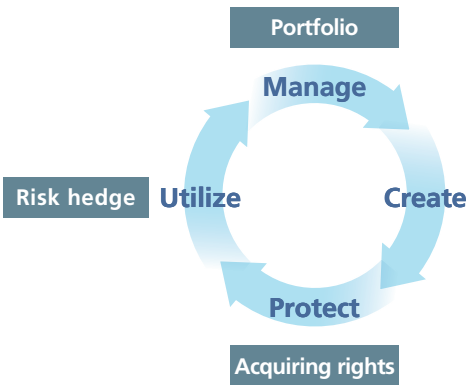
Activities on Intellectual Property Rights

Basic Policy

We, TAIYO YUDEN, endeavor to obtain, maintain and protect intellectual property rights for proper use, and also to respect the intellectual property rights of third parties, in accordance with our CSR Code of Conduct.

Creating, Protecting and Leveraging Intellectual Properties

The Intellectual Property Department works closely with the Development and Engineering Department from the early stages to promote the creation of intellectual properties. We aim to embody “the wonders of science,” as declared in our mission, by conducting pioneering research and development activities. Through these efforts, we strive to maintain the superiority of our technology and acquire influential intellectual property rights that will give us an edge over our competitors. In addition, we manage the process of creating, protecting, and leveraging our intellectual properties through a unique management approach that is optimized for each business unit.



Number of Patents Held

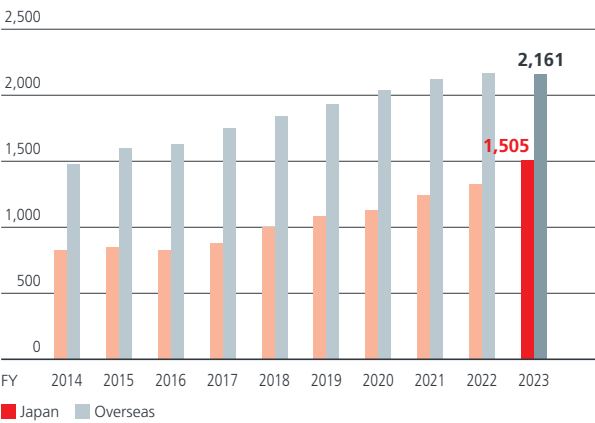
TAIYO YUDEN continuously secures the patents necessary for its business activities both inside and outside Japan (Fig. 1). For sustainable business growth, it is essential to continuously consider the future and apply for patents that focus on technological superiority, technological applicability, and necessity. In addition to forecasting based on current challenges, we also place importance on a backcasting approach to guide innovations that will help address future issues.

Although maintaining patents involves incurring costs, we consider it a necessary investment to maintain the balance of power with our competitors and secure freedom in business operations. We continuously monitor other companies’ activities, while reviewing our patents at the appropriate times. For outdated technologies, we cancel the patents and use the resources saved to strengthen our rights for new technologies. This way, we effectively manage costs while renewing and revitalizing our intellectual property portfolio.

On the other hand, there are certain technical fields in which we deliberately do not apply for patents in order to avoid our technologies being disclosed to the public. Still,

we register this sort of know-how internally for use within the Group as a form of intellectual property and are working to encourage the creation of such intellectual property by providing incentives to those who invent it in the same way we do for patents.

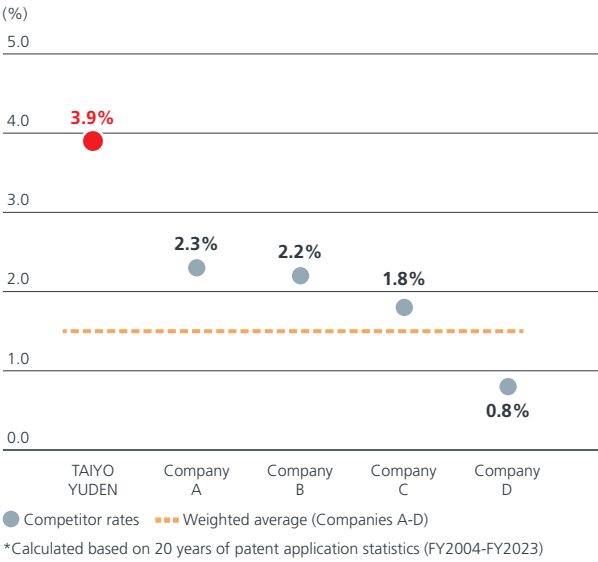
Fig. 1 Number of Patents Held



Blocking Competitor Patent Applications

Patent applications are examined at the Japan Patent Office (JPO). The rate at which TAIYO YUDEN’s patents are cited when other companies’ applications are examined (the rate at which our patents help prevent peer group competitors from obtaining patent rights) exceeds peer average (Fig. 2). By making appropriate patent applications in terms of both content and timing, we strive to ensure our competitive advantage. With this, we are improving the intellectual property capabilities of our core technologies and supporting the initiatives towards achieving the materiality, to “strengthen core technologies to make our core business grow,” thereby contributing to increasing our economic value.

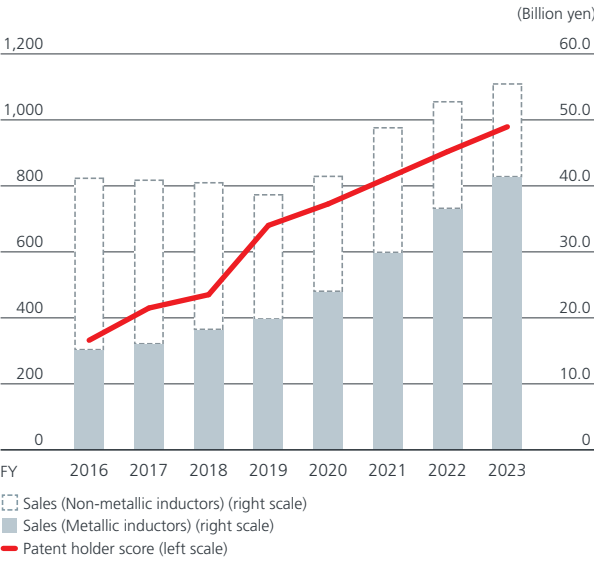
Fig. 2 Rate at which Competitor Patent Applications are Blocked



Examples of Strengthening Intellectual Property Capabilities

TAIYO YUDEN’s efforts to strengthen its intellectual property capabilities have also contributed to the growth of the metal power inductor MCOIL™, which is its core business expected to drive future growth. In 2009, we began the product development stage for MCOIL™ after coming up with the idea for the innovative new material, and in 2010, we filed the first patent application. Since then, we have continuously secured related patents both inside and outside Japan. According to the patent holder scores from Patent Result Co., Ltd., in recent years, business sales have increased in proportion to the rising scores of the preceding patent family (Fig. 3).

Fig. 3 Patent Holder Score for MCOIL™ Patent Family



Focusing on distinct technologies to build a portfolio of intellectual properties that will contribute in the future to the company and society

A key feature of our intellectual property initiatives is that they are focused on technologies that are unique and distinctive, and not found in other companies. We constantly consider how TAIYO YUDEN’s products will be utilized in future society, and we aim to continuously secure intellectual property rights for forward-thinking technologies that are superior, technologically applicable, and necessary.

Additionally, to ensure freedom of research and development, we rigorously manage our intellectual property portfolio. These efforts also lead to blocking the patenting activities of other companies. By systematizing our patents, know-how, and other intellectual assets, and comparing them with those of our competitors, we manage risks through a standardized and balanced process.

Our intellectual property initiatives lay the foundation for our journey to our vision. We hope to contribute to the future of our company and society by building a portfolio of intellectual properties that will help us achieve sustainable growth and promoting innovative research, development and other activities.



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in charge of Intellectual Property,
Legal, Internal Audit Office