Research and Development/Intellectual Property



We will take on the challenge of creating new products and acquiring new technologies that will drive our growth strategy.

Kazuya Nakayama Executive Officer Corporate General Manager, Corporate R&D Headquarters

R&D Portfolio

Changes in the business environment surrounding us include the accelerating shift to a decarbonized society, evolving digital technologies, and expanding infrastructure investment in emerging countries. In response to these changes, we will strengthen the development of new products that realize Green Transformation (GX) and Digital Transformation (DX) as well as global products that contribute to solving new challenges for our customers. In addition, we will gain insights into how future social issues will change and, through co-creation with partner companies and academia, aim to create new products that meet new needs and take on the challenge of acquiring innovative new technologies that will contribute to the realization thereof.

We will also focus on strengthening our intellectual property portfolio to ensure our new technologies and products enjoy a competitive advantage, and on rulemaking activities to make our technologies into industry standards in order to advance our business.

Medium- to Long-Term R&D Initiatives

The new R&D strategy in the FY2026 Medium-Term Management Plan incorporates R&D themes related to new fields that will contribute to growth in 2027 and beyond while keeping the same priority investment in growth fields as in the past (see the figure on the right).

In the existing fields (shown in (1) on the right), we will develop next-generation development projects that contribute to the maintenance and expansion of our existing businesses, develop technologies to enhance competitiveness, and develop platforms to reduce costs and development time.

In the growth fields (shown in (2) on the right), we will accelerate the development of new products such as GX and DX as well as global products that will drive our growth strategy, aiming to bring them to market by fiscal 2026. We will invest 1.3 times as much in R&D as during the three-year period starting in fiscal 2021, or 55% of total R&D expenditures, as a priority.

In the new fields (shown in (3) on the right), we will strengthen R&D to create new products and acquire new technologies in areas such as "fuel conversion," "thermoelectric systems," and "carbon capture," all of which are expected to experience market expansion after 2030. We plan to significantly increase R&D expenditures for these new fields by approximately three times compared to the three-year period starting in fiscal 2021.

(2) Growth Fields Carbon capture 1 Thermoelectric systems → GV/DX/Global (1) Existing Fields (1) Existing Fields

Existing Markets Existing Expanding Markets and New Markets
Our Target Markets



Key research themes in growth and new fields

Growth fields	GX	Storage battery systems, Products for data centers, Products for ships and harbor, Automotive power electronics, Automotive IGBT, Automotive SiC, Modules for renewable energy
	DX	Factory DX, Vending machine DX, Store DX
	Global	VCB panels, Mmold transformers, Large-capacity UPSs, New compact inverters, High-voltage inverters, Coffee machines
New fields	Thermoelectric systems	Exhaust heat recovery heat pumps, Ejector cooling systems
	Fuel conversion	Water electrolyzing apparatus system for hydrogen production, Ammonia gas leak sensors
	Carbon capture	Carbon separation and capture equipment
	Energy storage	Long-term energy storage systems
	DC electricity distribution	DC/DC transformers, Semiconductor circuit breakers

Enhancement of New Product Creation

To accelerate the creation of new products in new fields and growth fields, we have established the New Products Development Office. This project office plans new product development themes based on analysis of customer and market trends from a medium- to long-term perspective, and promotes development in collaboration with the business and sales divisions, the R&D division, and partner companies.

In addition, we have begun formulating a "roadmap for new fields" to create new value offerings that will contribute to solving future social issues. In addition to megatrends, we are also working on the creation of new product concepts and the identification of technologies to be acquired, which we are doing by envisioning social issues in 2030 and beyond based

New Product Net Sales

Fuji Electric positions new product net sales as the most important KPI for R&D. In our fiscal 2023 results, sales of energy, industry, and semiconductors grew 1.7 times compared to fiscal 2018, reaching a record high and contributing to the achievement of consolidated net sales of 1 trillion yen under the FY2023 Medium-Term Management Plan.

In the FY2026 Medium-Term Management Plan, in addition to launching new products in GX, DX, and Global, which we have designated as growth fields, we aim to create new products in new fields to achieve further business expansion in 2030 and beyond, and to increase net sales of new products.

Fuji Electric's core technologies

Fuji Electric has four core technologies, centered on power semiconductors with the industry's top-of-the-line power conversion efficiency and power electronics to convert and utilize electric power freely and without waste, as well as measurement and control technology, which supports industrial automation and energy saving, and heating and cooling technology cultivated in our industry-leading



on the future visions of our customers and partner companies, backcasting from there, and identifying the new value that we can provide by leveraging synergies with our business and technologies.



We will continue to bring new products to market and drive Fuji Electric's growth strategy.



New Product Net Sales Transition (relative value)

vending machines. These core technologies are supported by both analog and digital advanced technologies and common fundamental technologies, including power conversion and EMC*¹, and AI and machine learning. In addition to these, we will acquire new technologies to realize new value provided in the GX-related market and

realize new value provided in the GX-related ma expand our technology domain.

* New products: Within five years after market launch

Medium- to Long-Term Intellectual Property Activity Initiatives

Fuji Electric regards intellectual property as an important management resource, and under the intellectual property policy shown on the right, we ensure our products' competitive advantage through the strategic acquisition and utilization of intellectual property rights. We are also working to comply with the international standards that are required to participate in the global market.

Over the medium- to long-term, we will strengthen our intellectual property activities and international standardization

Business Support by Strengthening the Intellectual Property Portfolio

The company manages its intellectual property as an intellectual property portfolio (intellectual property holdings organized by key technologies) per business and continuously carries out its maintenance, including retention and abandonment, in consideration of changes in business conditions.

To achieve further growth, we are strengthening this intellectual property portfolio. Specifically, we are clarifying our strengths and weaknesses based on comparative intellectual property analysis with our competitors to strengthen the scope of our rights, to increase the number of patent applications, and to promote selection of countries where filing applications is advantageous for our business. As a result of our recent strengthening activities, in the field of power semiconductors, which is one of our core businesses, as shown in the figure we

activities that target businesses and products in our growth fields. We will also promote the use of intellectual property analysis to enhance our market analysis capabilities during the source stage of new product creation.

Intellectual Property Policy

- 1. Develop and implement intellectual property strategies by analyzing intellectual property.
- 2. Strengthen each business's intellectual property portfolio and
- reduce risks 3. Strengthen strategic international standardization activities.

hold the highest number of patent families among our Japanese and overseas competitors, thereby supporting the growth of our business.

Power Semiconductor Patent Family Rankings (Worldwide)



* Patent family: A group of patents derived from the same patent application and granted rights

Support for New Product Creation by Utilizing Intellectual Property Analysis (IP Landscape)

As part of activities to create new products, we are promoting the use of IP landscapes during the source stage of product development (hypothesis formulation and planning).

Specifically, in addition to our traditional analysis of customer needs and market trend forecasts, we are now using IP landscapes for technology-based market analysis. We use market player analysis, which mainly examines published patents and papers, to identify customers, competitors, and collaborators. We then combine this with technology trend analysis to discover the Company's strengths.

As a recent example, in developing a locker vending machine for vegetables and processed foods, we analyzed Japanese and overseas companies, including startups, to identify relevant technology trends and potential needs, which

Strengthening of International Standardization Activities

Fuji Electric is systematically promoting compliance with international standards and the acquisition of certifications necessary for overseas business development. The International Standardization Committee, of which the Corporate General Manager of Business Groups are members, determines policies and strategies. Based on these policies and strategies, working groups that have been formed for each business field conduct international standardization activities. We continuously strengthen these activities.

Over the medium to long term, we will focus on rulemaking activities with the aim of entering new markets ahead of our

we used for planning purposes.

In the future, we plan to expand the use of IP landscapes to create more new products while working to improve the sophistication of analysis with AI.

Steps for New Product Creation



competitors, demonstrating our strengths, and contributing to the expansion of the market itself.

One key element in any rulemaking activity is to secure a leadership position. For example, we are leading standardization activities in key international positions in the electronics industry, such as serving as the Japanese representative to the Conformity Assessment Board (CAB), an upper-level committee of the International Electrotechnical Commission (IEC). We will continue to strengthen our human resource development so that we can produce suitable human resources to serve in key positions.

TOPICS (Research and Development)

Ejector cooling systems that halves power consumption during cooling water generation through effective use of waste heat energy

About 2/3 of primary energy used in Japan is disposed of as heat instead of being used effectively. For example, it is difficult to effectively use low-temperature (40°C to 70°C) waste hot water from cooling equipment at factories, etc., so such water has been discharged directly into the atmosphere. Fuji Electric is developing an ejector cooling system that effectively utilizes low-temperature waste heat to generate cold heat.

A proprietary high-efficiency ejector (pressure booster) circulates refrigerant using thermal energy recovered from waste heat, significantly reducing power consumption and eliminating the need for a compressor, which is used in





TOPICS (Intellectual Property Activities)

Strategic rulemaking activities in the growth fields of GX and DX

The Global Business Strategy Office, which was established in August 2022, develops and promotes business strategies for GX, carbon neutrality, and DX. In these new fields, we obviously require a "competitive axis" of differentiation through technology development and intellectual property. To build a new, unprecedented social system, it is necessary to establish "standards" (e.g., green value definitions, common data definitions, and security requirements) in cooperation with various companies, organizations, and countries, which is the axis of cooperation. To promote the two axes needed in the new fields, we must first develop a business strategy and then consider both simultaneously. Toward our carbon-neutral goal of 2050, we have started to develop long-term human resources capable of building business strategies in new

conventional chillers (cooling water circulators). Verification using last year's experimental system (see the figure below) confirmed that the power consumption for recovering thermal energy from 50°C waste hot water to generate 25°C cooling water can be reduced by 55% compared to the conventional method.

We are working to commercialize this ejector cooling system for potential applications in beverage factories (cooling after heat sterilization), semiconductor factories (e.g., cooling of film forming equipment), and data centers (cooling of water-cooled servers).

fields. This program, the International Business Strategy Skills Personnel Development Program (IBSP), is designed for young personnel around the age of 30 who will lead the next generation. IBSP participants, in addition to acquiring skills pertaining to international standards (including certification and regulation), learn business strategies and acquire rulemaking strategy skills.



Scene from an IBSP lecture