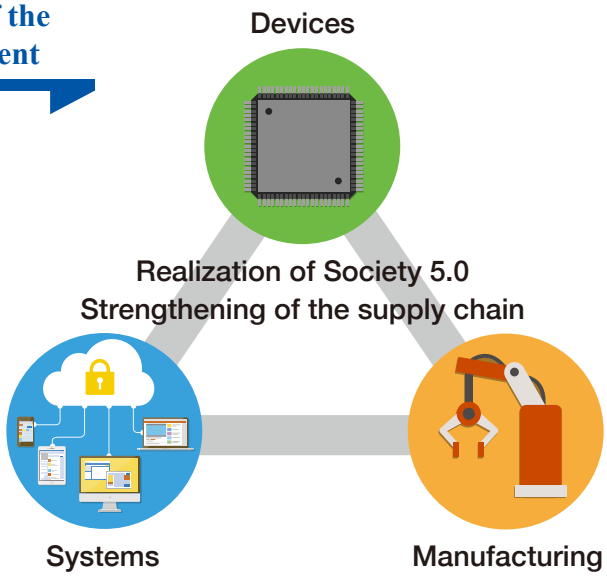
Profile of the Internet of Things Promotion Department (FY2023)

National Research and Development Agency New Energy and Industrial Technology Development Organization

OUR **MISSION**

In order to survive amid increasingly fierce international competition, the IoT Promotion Department, an innovation accelerator in the IoT field, will contribute to (1) advance society through cyber-physical integration, and (2) strengthen the supply chain in the semiconductor and information communication fields that support the advancement of the society.

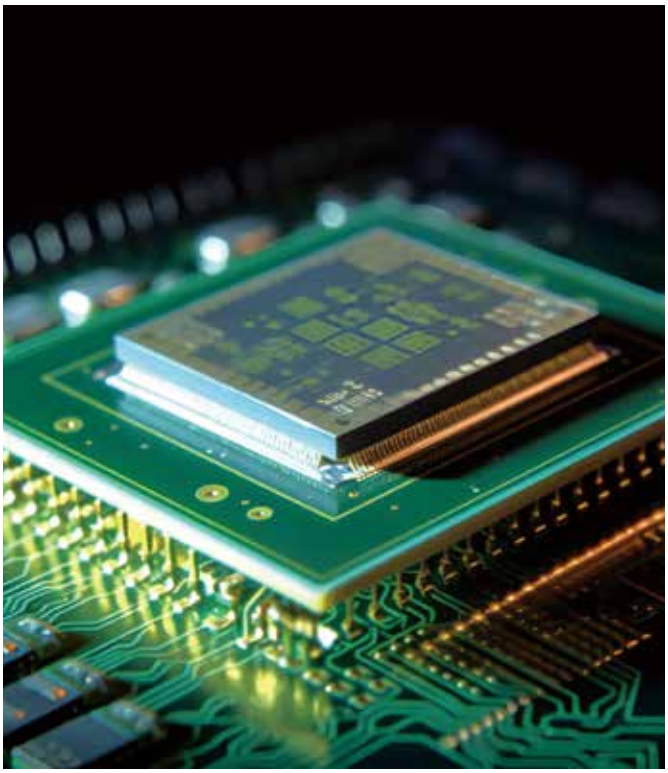
The three target fields of the IoT Promotion Department



Device Fields

Devices for information processing and control are being incorporated in all fields from smartphones, PCs, and various home appliances to transportation and industrial machinery, leading to further advancement and energy conservation in society (Society 5.0).

For Japan to be a forerunner in pioneering this situation, the IoT Promotion Department is promoting research and development in anticipation of technology industries that will become the trend, not only in the immediate future, but also in five to ten or more years into the future, such as chip technology that enables efficient and high-speed operation of AI, control devices that enable high-speed communications, power devices that are the key to energy conservation, and quantum and brain computers that are not an extension of existing technologies.



*IoT (Internet of things): A system for acquiring data from and remotely controlling objects by embedding information transmission functions in the objects and connecting them to the Internet

System Field

As society transitions from Society 4.0 to Society 5.0, it is essential that devices are not only introduced in large numbers throughout society, but also for systems to be able to operate, coordinate, and control them efficiently.

The transition to Society 5.0 also means that the volume of data and communication traffic generated by society as a whole will explode. It is therefore also essential to reduce information processing costs and energy, and to develop various communication, distributed processing, data integration, and security technologies that enable the transmission and reception of vast amounts of information without delay. The IoT Promotion Department promotes research and development of various technologies to solve these issues.

Manufacturing Field

At all manufacturing sites, including those for industrial equipment, aerospace, and medicine, it is expected that the advancement, efficiency, and energy conservation of production facilities using IoT, artificial intelligence, and high-performance devices and materials will become even more important in the future.

To solve these issues, the IoT Promotion Department is engaged in research and development of high value-added, complex, and precise processing/modelling technologies and innovative technology for advanced semiconductor equipment. It also conducts research and development of processes to ensure that advanced semiconductors can be manufactured in Japan in the future, supports the establishment of production facilities for the stable supply of semiconductors, and supports the autonomous and overall optimal operation of manufacturing sites.

By researching and developing these technologies, the IoT Promotion Department aims to strengthen Japan's industrial technology capabilities.

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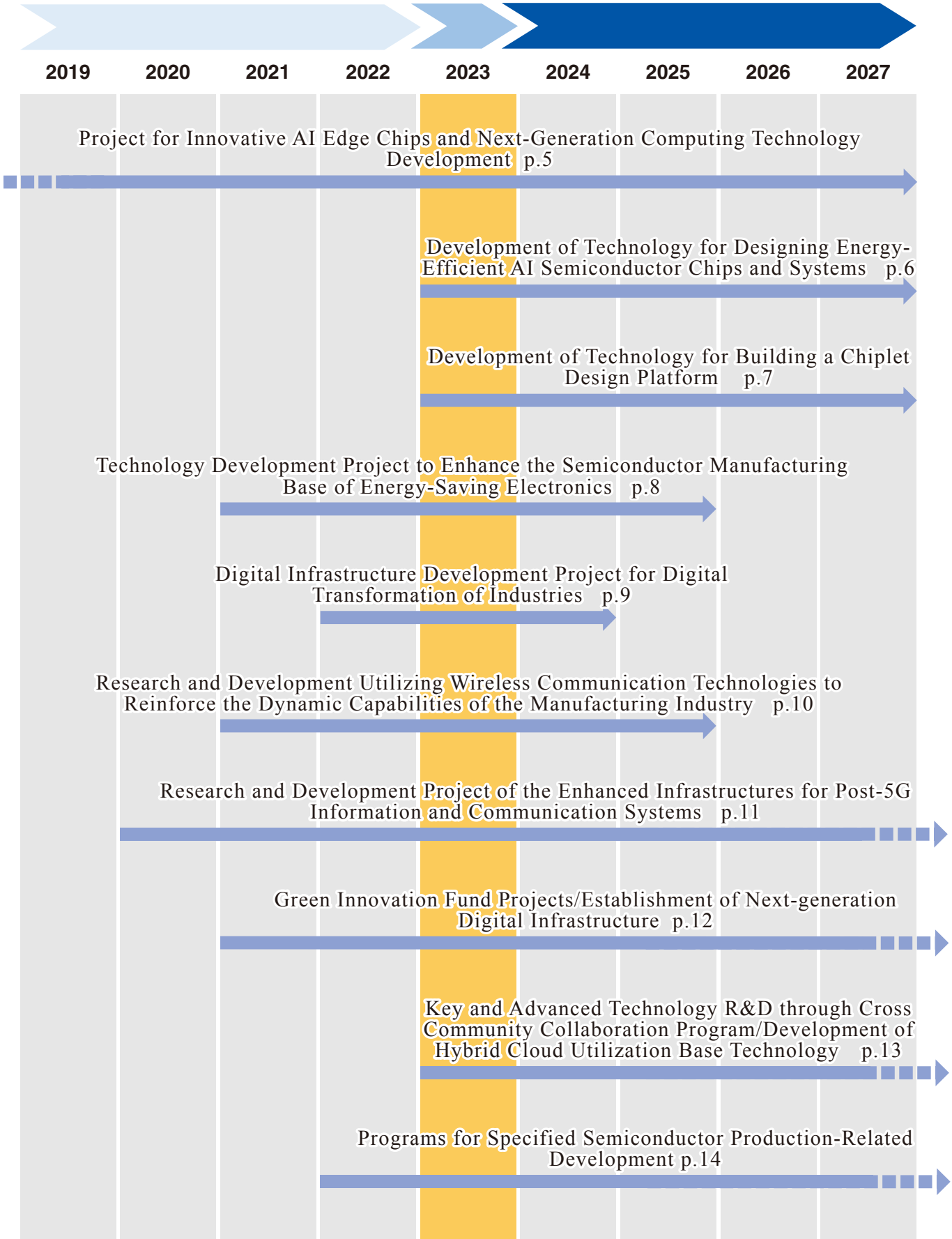
Project Chronology



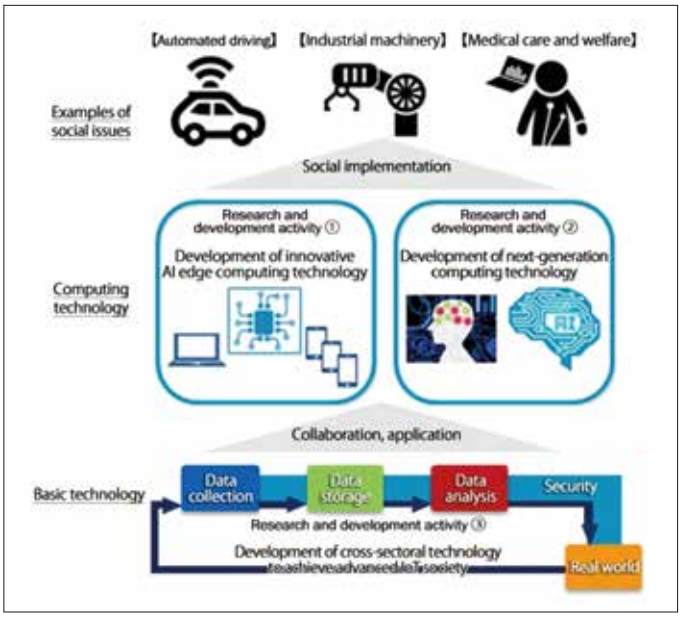
Project for Innovative AI Edge Chips and Next-Generation Computing Technology Development

Project Manager
ENDO Takenori

Scan here
for project details

● Project Overview

In order to promote the advanced utilization of information that has rapidly increased due to the advent of the IoT society, it is essential to realize the decentralization of processing by shifting from the traditional cloud-intensive type approach, such as edge computing, which performs centralized information processing at the end (edge) of the network. In addition, the end of Moore's Law, which is a development index for semiconductors, is approaching, and while the extension of existing technologies is reaching its limit, it is necessary to realize new principle technologies that can dramatically reduce the processing power for significantly increasing data.



This project aims to solve social problems in the post-Moore era, and to strengthen and revitalize the competitiveness of the information industry. It aims to carry out integrated technology development for next-generation computing technologies based on ultra-low power consumption such as edge and new principles, including not only hardware but also software and security.

● R&D Description

(1) Development of Innovative AI Edge Computing Technologies
The project is carrying out research and development to realize AI processing in edge computing related to specialized chips with advanced processing capabilities that are small and energy-saving, and computing technologies that use them, with a view to social issues. In addition, the project is carrying out research and development on security base technologies for edge computing.

(2) Development of Next-Generation Computing Technologies
As computing technologies for the post-Moore era looking beyond 2030, the project aims to establish computing technologies that combine high-speed and low-power consumption, next-generation data center technologies, and secure base technologies by developing technologies that are not an extension of existing technologies.

(3) Development of Cross-sectional Technologies for Realizing an Advanced IoT Society
The project is carrying out cross-sectional technology development related to information collection, storage, analysis, security, and other areas to realize the efficient and advanced use of large amounts of data.

Project period	FY2016–2027	Budget	4.9 billion yen (FY2023)

Implemented by: National Institute of Advanced Industrial Science and Technology, NEC Corporation, RIKEN, Toshiba Corporation, Sony Semiconductor Solutions Corporation, Yokohama National University, Waseda University, Tokyo Institute of Technology, Research Organization of Information and Systems, Toyota Tsusho Corporation, Fixstars Corporation, PETRA, Kyushu Institute of Technology, Hitachi, Ltd., SEC Co., Ltd., FLOWDIA Co., Ltd., Ibis Inc.

Development of Technology for Designing Energy-Efficient AI Semiconductor Chips and Systems


Project Manager
MAEDA Hiroo IWASA Tadahiro

Scan here for project details

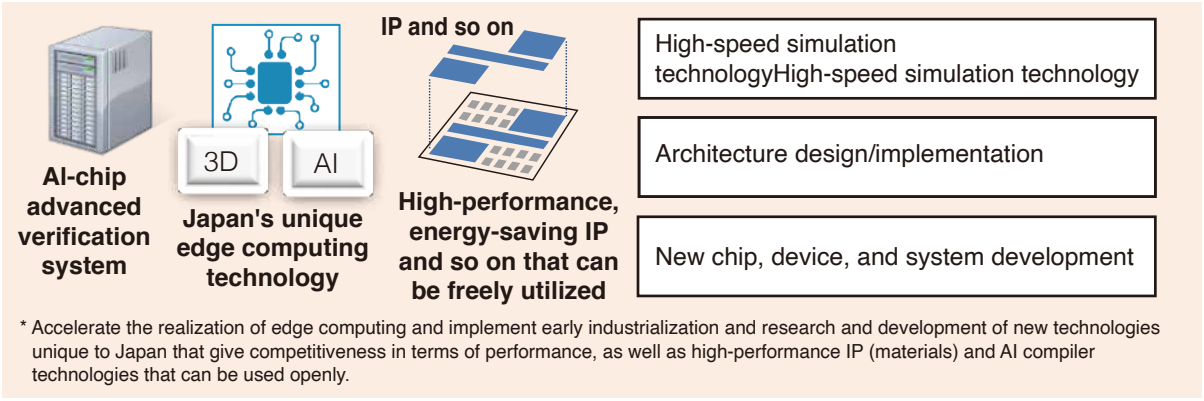
● Project Overview

The amount of data on networks is increasing exponentially due to the sophistication of devices used for information processing, the advancement of digitalization due to the advent of the ICT/IoT society, the creation of various industries using AI, the use of Big Data as the basis for these industries, and the development of new information and communication technologies and infrastructure such as 5G.

In response to the problem of energy use caused by the increasing amount of information, this project will not only contribute to the solution of distributed computing in the edge area, but also promote the practical application of energy-saving, high-performance, competitive semiconductor and system technologies, leading to the revival of the digital and semiconductor industries.

In this project, by using advanced AI semiconductors and systems, it is aimed to contribute to the establishment of a new industrial base and the efficient processing of the ever-increasing amount of information, in addition to maintaining and strengthening the international competitiveness that goes hand in hand with promoting digitalization in the industrial field where Japan has strengths.

In this project, technology development related to AI semiconductors and systems that mainly process real-time information in edge devices in the edge area and are utilized in areas including edge servers as necessary, will be promoted, with the aim of establishing design technologies that can implement such semiconductor development quickly and efficiently.



* Accelerate the realization of edge computing and implement early industrialization and research and development of new technologies unique to Japan that give competitiveness in terms of performance, as well as high-performance IP (materials) and AI compiler technologies that can be used openly.

● R&D Description

(1) Development of Innovative AI Semiconductors and Systems
This project will develop technologies for AI semiconductors and systems that use them to achieve high-speed and high-efficiency advanced data processing using AI in the edge area and associated network environment.

(2) Design Technology Development for the Acceleration of Industrial Applications of AI Edge Computing
The project will develop design technologies that realize a combination of heterogeneous processors and chip designs that can maximize performance, which are important for achieving high-performance computing in the edge area and associated network environment, in a short period of time.

Project period	FY2023–2027	Budget	3.4 billion yen (FY2023)
Implemented by: Tokyo Institute of Technology, Sharp Corporation, Tohoku University, NEC Corporation, Renesas Electronics Corporation, and others			

Development of Technology for Building a Chiplet Design Platform

Project Manager
SERIZAWA Shin

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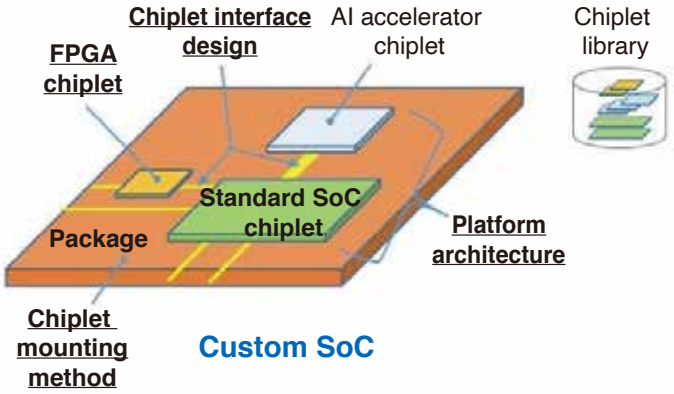
for project details

● Project Overview

Information processing with edge is essential for advancing digital technology towards the realization of Society 5.0. As an AI semiconductor used for information processing, efforts to standardize technology called chiplet* as one of the post-Moore technologies to suppress the increase in design and manufacturing costs while maintaining high performance are accelerating in the United States, and Japan must also respond urgently.

In this project, while closely monitoring the trend of standardization of chiplet technology in the world, the development of technology to build a chiplet design platform to easily realize semiconductors that combine performance and cost will be promoted, with the aim of becoming a base technology that can be widely used by private companies. In addition, AI semiconductor chips that can also be installed in chiplet-type custom SoCs** will be developed, aiming for steady social implementation.



Chiplet-type platform and R&D elements in this project

* With Chiplet technology, CPUs, GPUs, accelerators, and so on that constitute integrated circuits are divided into multiple chips for each function. The chiplets are manufactured using an optimal process and combined and packaged as a single chip. Compared to conventional manufacturing methods that manufacture integrated circuits on a single chip with the same process, cost reduction and high-performance operation are considered to be possible.

** System on a Chip (SoC): A chip designed to integrate functions of a general microcontroller such as the processor core and functions for applications on one chip of an integrated circuit to work together as a system.

● R&D Description

(1) Chiplet-type Custom SoC Design Base Technology Development

An implementer will be selected to develop the chiplet-type custom SoC design base technology and start research. At the beginning of the research, the latest trends in domestic and foreign technologies and standards related to chiplet technology will be investigated.

Project period	FY2023–2027	Budget	0.5 billion yen (FY2023)
Implemented by: National Institute of Advanced Industrial Science and Technology, University of Tokyo, Curious Co., Ltd., NanoBridge Semiconductor Inc. (scheduled as of August 1, 2023)			

Technology Development Project to Enhance the Semiconductor Manufacturing Base of Energy-Saving Electronics

Project Manager
NOMURA Shigeo

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● Project Overview

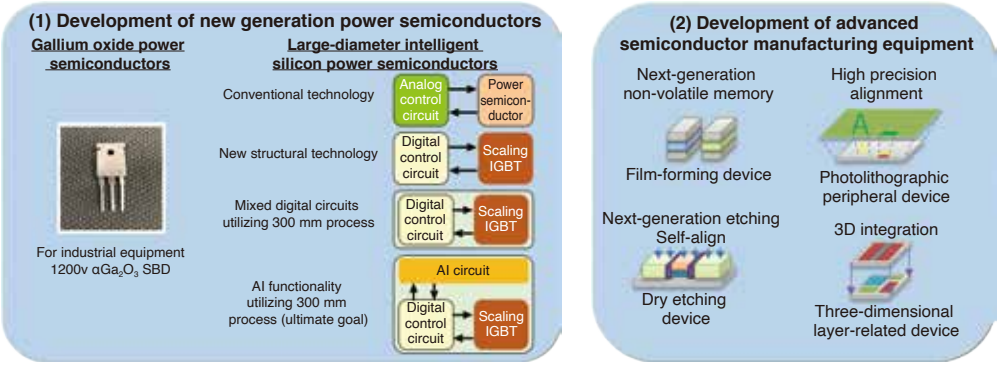
In recent years, with the advancement of industrial IoT and electrification, the importance of semiconductor-related technologies has increased, and there is a growing demand for energy-saving industrial equipment. The key to this is energy-saving electronics technology. It is a technology typified by power semiconductors, which are installed in electronic devices and are responsible for controlling power, and semiconductor manufacturing equipment, which is indispensable for the production of all semiconductors. It is a field in which Japan has had strengths from the past, but in recent years, efforts have been strengthened in various countries around the world.

This project tackles (1) the development of new generation power semiconductors and (2) the development for advanced semiconductor manufacturing equipment to realize a decarbonized society, strengthens the manufacturing base of energy-saving electronics products, and applies advanced power semiconductors and semiconductor manufacturing equipment to major industrial fields and semiconductor factories, thereby reducing power conversion losses and contributing to the reduction of CO_2 emissions.

● R&D Description

(1) Development of New Generation Power Semiconductors
(1)-1 Development of gallium oxide power semiconductors
The project will establish the necessary base technologies, develop new-generation power semiconductors for specific applications, prototype and evaluate modules, and demonstrate that new-generation power semiconductors are at a level that can be used for practical purposes.
(1)-2 Development of large-diameter intelligent silicon power semiconductors
By incorporating AI and other functions in large-diameter silicon power semiconductors, the project will develop power semiconductors (intelligent silicon power semiconductors) with extremely high self-control functions such as automatic optimization and fault prediction.

(2) Development for Advanced Semiconductor Manufacturing Equipment
This project will develop innovative technologies for semiconductor manufacturing equipment that are necessary to improve the performance and productivity of dry etching equipment, exposure equipment, and film forming equipment (CVD equipment and so on), which are particularly large markets within the semiconductor manufacturing equipment market, and for which it is important to maintain and strengthen the competitiveness of Japanese companies. In addition, the project will develop innovative technologies such as three-dimensional lamination-related equipment, including lamination technology in the post-process, as next-generation manufacturing equipment necessary in the post-Moore era.



Project period	FY2021–2025	Budget	2.65 billion yen (FY2023)

Implemented by: FLOSFIA Co., Ltd., Kyushu University, University of Tokyo, Toshiba Devices & Storage Corporation, Tokyo Electron Limited, Hitachi, Ltd., Nikon Corporation, Nissin Ion Equipment Co., Ltd., CANON ANELVA CORPORATION., ORC MANUFACTURING CO., LTD., SCREEN Semiconductor Solutions Co., Ltd.

Digital Infrastructure Development Project for Digital Transformation of Industries

Project Manager
MASE Satoshi

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● Project Overview

While Western countries have made rapid progress in digitization due to the response to the COVID-19 pandemic, Japan has not made progress in the interoperability of systems, and a delay in digital transformation (DX) has become apparent. It is important to build a digital infrastructure that can smoothly link data across companies and industries and to improve the safety and reliability of the entire system when multiple systems are linked in anticipation of society five to ten years into the future.

The focus of this project is on the following five themes (1) to (5) for the development of such digital infrastructure. The focus includes technological development and effectiveness verification for social implementation.

● R&D Description

(1) 3D spatial information infrastructure
To distribute spatial information in various data forms with efficiency and interoperability, unique identifiers to identify specific spatial areas will be defined as "spatial IDs," and an infrastructure to integrate data through the spatial IDs will be established.

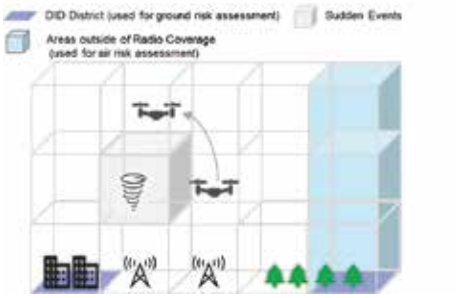
(2) Next-generation transaction infrastructure
For the efficient execution of business transactions and the creation of new services utilizing transaction data, this theme focuses on constructing transaction infrastructure that can digitally complete a series of business-to-business transactions related to sales orders, invoicing, and settlement.

(3) Ensuring the safety of the entire system
To address issues that arise when various systems are intricately interconnected (e.g., difficulty in predicting accidents and identifying their causes), in this theme, data integration infrastructure will be built to ensure the safety and reliability of the entire system.

(4) Supply chain management infrastructure
As social issues (e.g., carbon neutrality) and economic issues (e.g., supply chain disconnections) are getting more complex, data distribution infrastructure that allows data sharing and utilization among companies will be built to support solutions to these issues.

(5) Smart building infrastructure
To enhance the value of buildings and create data-driven services, building data infrastructure that links buildings with each other or with various digital agents such as IoT, AI, and robots will be established.

Image of bridging physical/cyberspace through spatial IDs



Application example of the spatial IDs in the drone field

Project period	FY2022–2024	Budget	2.35 billion yen (FY2023)
Implemented by: Hitachi, Ltd., Takenaka Corporation, Trajectory, Ltd., NEXTY Electronics Corporation, The Ritsumeikan Trust, and others			

Research and Development Utilizing Wireless Communication Technologies to Reinforce the Dynamic Capabilities of the Manufacturing Industry

Project Manager
OGAWA Yoshihiro

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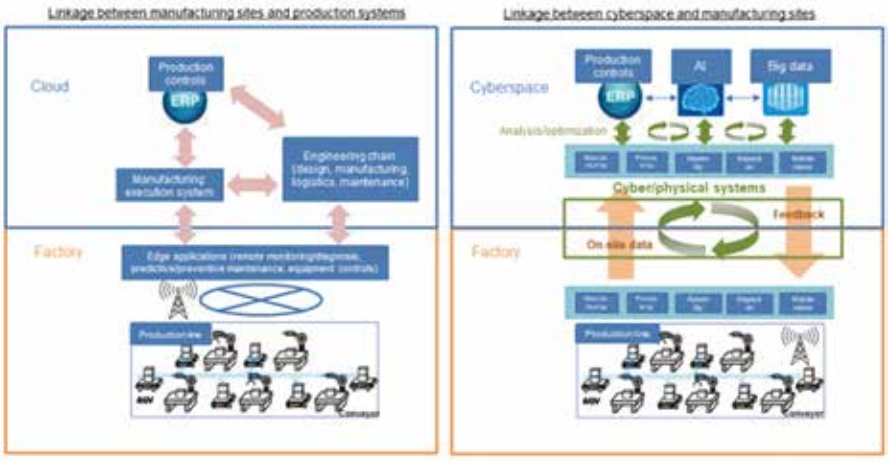
for project details

● Project Overview

In a situation where "uncertainty" is assumed to cause supply chain disruption risks, such as the recent global COVID-19 pandemic, it is important to strengthen "dynamic capabilities" that enable flexible and rapid responses to maintain the supply chain.

This project aims at realizing energy savings per production line and per factory as a decarbonization initiative in addition to bringing autonomous and entirely optimal operation to factories and strengthening dynamic capability at manufacturing sites by utilizing network and digital technology at those sites, such as wireless communication technology through the construction of production lines and production systems that can be flexibly and promptly rearranged and controlled, for example, by rearranging the processing order or changing production equipment according to the situation at the time and through the construction of a cyber-physical system with seamless IT/OT data collaboration.



● R&D Description

(R&D Case Study)
Dynamic production line that can flexibly and promptly reconfigure and control existing production lines

In this project, DMG MORI Co., Ltd. and FANUC Corporation have built a local 5G communication environment and established a pilot line that integrates technology to enable flexible and prompt rearrangement and control of production lines.

This project aims to strengthen dynamic capability in the manufacturing industry through verification of dissemination measures for practical application, as well as rebuilds simulated environments equivalent to existing manufacturing sites with diverse equipment configurations, and pursues future production lines that combine processing-assist modules adapted to the production equipment by combining cloud-based wireless cooperative control platform between automatic guided vehicle with robots (AGV) and production facilities with processing assist module adapted to existing production equipment through local 5G of a high-speed communication standard.

Project period	FY2021–2025	Budget	0.78 billion yen (FY2023)
Implemented by: DMG MORI Co., Ltd., FANUC Corp, Lattice Technology Co., Ltd., Mitsubishi Heavy Industries, Ltd., Allm Inc.			

Research and Development Project of the Enhanced Infrastructures for Post-5G Information and Communication Systems


Project Manager
OSUGI Shinya KAKINUMA Ryo

Scan here for project details

● Project Overview

This project aims to develop core post-5G technologies and enhance Japanese R&D and manufacturing infrastructure for post-5G information and communication systems.

More specifically, as well as developing post-5G information and communication systems and advanced semiconductors to be used in such systems, the project promotes the development of technologies for manufacturing advanced semiconductors so that Japan ensures its manufacturing capability in this sector.

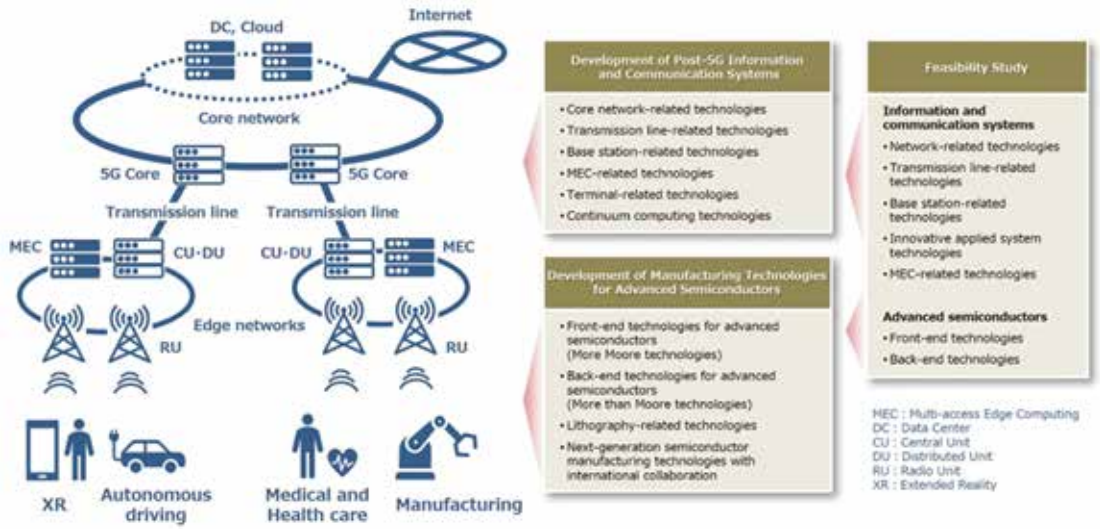
Post-5G Project
ポスト5G情報通信システム
基盤強化研究開発事業

● R&D Description

(1) Development of post-5G information and communication systems (Commission, Subsidy)
The item aims to promote the development of systems important for realizing the levels of performance required in the post-5G era, and development of technologies for semiconductors used in these systems.

(2) Development of manufacturing technologies for advanced semiconductors (Subsidy, Commission)
- Through the creation of pre-commercial manufacturing "pilot lines" and other activities, the item aims to promote the development of manufacturing technologies for leading-edge products, such as logic semiconductors which are not currently available in Japan. (Subsidy)
- The item also promotes the development of core technologies where Japan ensures a competitive advantage, such as system design technologies for advanced semiconductors, technologies for realizing commercial-scale manufacturing technologies related to packaging and miniaturization. (Commission, Subsidy)

(3) Feasibility Study (Commission, Subsidy)
Feasibility studies related to R&D items 1 and 2 are also conducted. This item covers technologies that may not be ready for commercialization in the post-5G era but may be promising in the latter half of the post-5G era and the next generation.



Project period	From FY2020	Budget	795 billion yen
Implemented by : Refer to implementation policy in Japanese from the above QR code:FY2023 version (p.9–14 (Attachment) Project Implementation Structure)			

Green Innovation Fund Projects/ Establishment of Next-generation Digital Infrastructure

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for project details

● Project Overview

Increasingly electrified and digitalized society can realize Carbon Neutrality in all fields including manufacturing, services, transportation, and infrastructure. Therefore, the semiconductor/information and communication industries, as a foundation for digitization and electrification, are the key to advancing green and digital initiatives at the same time.

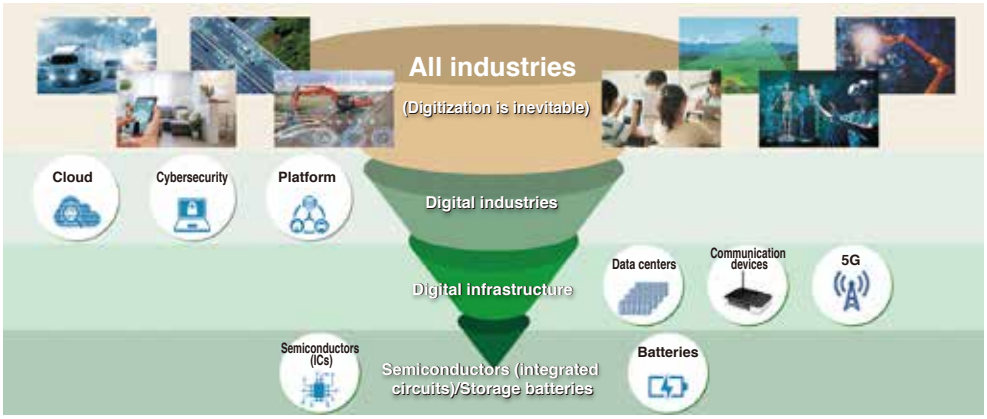
In addition, Power semiconductors are used to control various electrical products related to everyday life, such as automobiles and industrial equipment, electric power generation and railways, and home appliances.

To realize a carbon-neutral society, the energy efficiency of such electric devices is extremely important. Demand is expected to increase with the development of electric and digital technologies in the following areas:

1. Medium-capacity electric vehicles, 2. Large-capacity renewable energy power generation systems, and 3. Power supplies for small-capacity data centers.

Moreover, data flows are increasing rapidly (at an annual rate of approximately 30%), resulting in a steady expansion in the market for data center servers. Because of this rapid increase in large-scale data centers, power consumption for all data centers is expected to increase, and the current pace of technological evolution will not be able to keep pace with increases in power consumption.

The aim of this project, therefore, is by 2030 to: reduce the power loss of next-generation power semiconductors by more than 50%, reduce the cost of such semiconductors to a level similar to that of silicon(Si) power semiconductors(R&D 1 and 2), and improve data center efficiency by over 40%(R&D 3).



● R&D Description

Development of next-generation green power semiconductor technology (R&D 1 and 2)
The aim of this project is to reduce the power loss of next-generation power semiconductors (SiC, GaN, etc.) by more than 50% and reducing their cost to achieve similar cost levels to those of Si power semiconductors, in order to promote their social implementation in the fields where innovative improvements in energy efficiency are required toward carbon neutrality, such as electric vehicles, electric power generation (e.g., by renewable energy) and server power supplies.

Development of next-generation green data center technology (R&D 3)
The aim of this project is to significantly improve the energy efficiency of data centers (i.e., data aggregation hubs) by over 40% through innovative photonics-electronics convergence technology that replaces electrical wiring inside servers with optical wiring.

Project period	FY2021–2030 (maximum ten years)	Budget	141 billion yen (upper limit)
Implemented by: Refer to detailed information from QR code			

Key and Advanced Technology R&D through Cross Community Collaboration Program/Development of Hybrid Cloud Utilization Base Technology

K Program

Project Manager
KURIHARA Hiroaki

● Project Overview

Many cloud services that feature excellent costs and convenience, and are widely used, have become a black box for users in terms of security, and it is difficult to say that they are sufficiently reliable. On the other hand, when handling highly sensitive data safely, a cloud service where the internal structure and operating principles are obvious, and the security aspect is a white box is utilized. Under these circumstances, there is a need to exchange data safely, securely, and smoothly between cloud services with different security levels, and in order to achieve this, it is necessary to build a hybrid cloud that can take advantage of the advantages of each cloud.

In addition, while ensuring the reliability of semiconductors and electronic devices that are manufactured and distributed is a challenge, as seen with the distribution of counterfeit semiconductors worldwide, it is important to establish a verification base that identifies and eliminates any unauthorized functions of the hardware (semiconductors, electronic devices, and so on) that support cloud systems, and to build a safe and secure cloud environment including hardware.

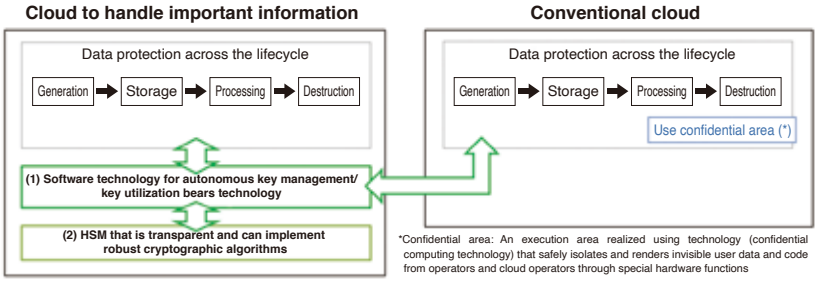
● R&D Description

(1) Development of Hybrid Cloud Utilization Base Technology

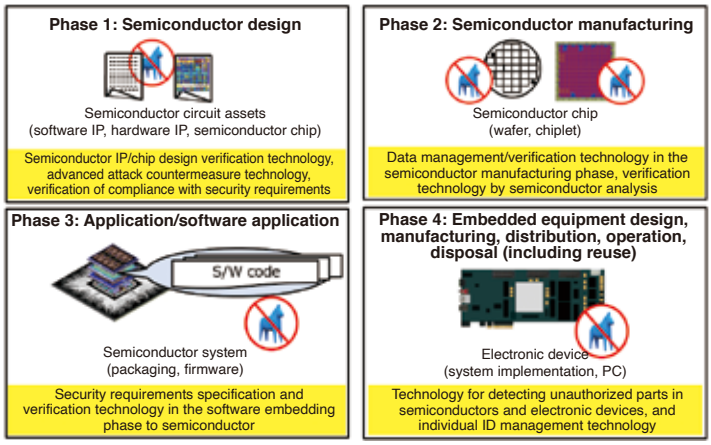
As an elemental technology for building a hybrid cloud, the project will develop (1) a key management system that allows users to manage encryption keys themselves, (2) a technology that automates the protection and distribution of data between multiple data providers and data users, and (3) a technology that specifies, controls, and automates sufficient path characteristics for inter-cloud networks such as encryption and independence.

(2) Establishment of Verification Infrastructure to Eliminate Unauthorized Functions in Hardware Such as Semiconductors and Electronic Devices

The project will establish technologies to check and find out unauthorized functions through each of the four phases of the semiconductor/electronic device life cycle: (1) semiconductor design, (2) semiconductor manufacturing, (3) application/software application, and (4) embedded equipment design, manufacturing, distribution, operation, and disposal (including reuse).



Conceptual diagram of a key management system that allows users to perform encryption key management themselves



Conceptual diagram of the semiconductor/electronic device life cycle and the technologies to be strengthened

Project period	FY2023–2028	Budget	8.5 billion yen
Implemented by: NTT Data Group Corporation, National Institute of Advanced Industrial Science and Technology, and others			

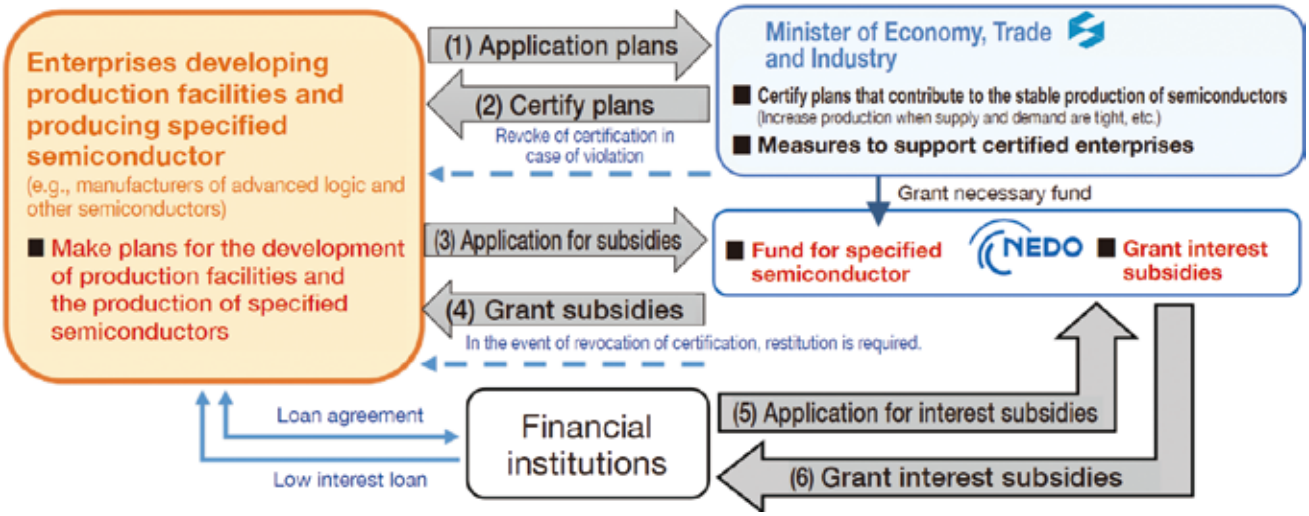
Program for Specified Semiconductor Production-Related Development

Scan here
for project details

● Project Overview

The Action Plan of the Growth Strategy (approved by the Cabinet on June 18, 2021) indicated the need to promote the establishment of domestic production bases for high-performance semiconductors that support the digital society, and to build a reliable supply system. Based on this, and in accordance with the Act on Promotion of Developing/Supplying and Introducing Systems Making Use of Specified Advanced Information Communication Technologies (Act No. 37 of 2020, hereinafter referred to as the "5G Promotion Act"), a certification system for plans to support the development and production of production facilities for specified semiconductors was established.

With this project, performed in close cooperation with the Ministry of Economy, Trade and Industry (METI) and in accordance with Article 29 of the 5G Promotion Act, NEDO will create a fund and grant subsidies to businesses that have been certified under the Act (hereinafter referred to as "certified enterprises"), and will be engaged in the grant interest subsidies to financial institutions that provide loans to certified enterprises.



(1) Specified Semiconductor Funding Program

Granting subsidies to certified enterprises to develop specified semiconductor production facilities (limited to the development of specified semiconductor production facilities)

Project period	From FY2022	Budget	1067.0 billion yen
Japan Advanced Semiconductor Manufacturing Inc., KIOXIA Corporation, Flash Partners,Ltd., Flash Alliance,Ltd., Flash Forward,Ltd., Micron Memory Japan,K.K.			

(2) Program for Specified Semiconductor Interest Subsidies

Granting interest subsidies to financial institutions that loan the necessary funds to certified enterprises for the development of specified semiconductor facilities (limited to production)

Project period	From FY2022	Budget	30 million yen (FY2023)
Implemented by: Financial institutions			

Background Information

Designation
National Research and Development Agency
New Energy and Industrial Technology Development Organization (NEDO)
Business name: New Energy and Industrial Technology Development Organization (NEDO)

Foundation
Originally established on October 1, 1980; reorganized as an incorporated administrative agency on October 1, 2003

Foundation Purpose
The purpose of NEDO is to enhance industrial technology and promote commercialization by comprehensively performing functions such as: promoting research and development carried out using skills from the private sector; promoting research and development carried out by the private sector with regard to technology for non-fossil energies, combustible natural gas, and coal; promoting the technology required for the rational use of energy and technology in mining and industry; and promoting the utilization of such technology in cooperation with the international community; to thereby contribute to ensuring a stable and efficient energy supply in accordance with the changes in the domestic and foreign economic and social environments and to the development of the economy and industry.

Details of Major Operations
Operations relating to research and development management (national projects and practical application promotion activities)

Minister in Charge
Minister of Economy, Trade and Industry

Governing Laws
Act on General Rules for Incorporated Administrative Agencies Act on the New Energy and Industrial Technology Development Organization

Personnel
1,464 (as of April 1, 2023)

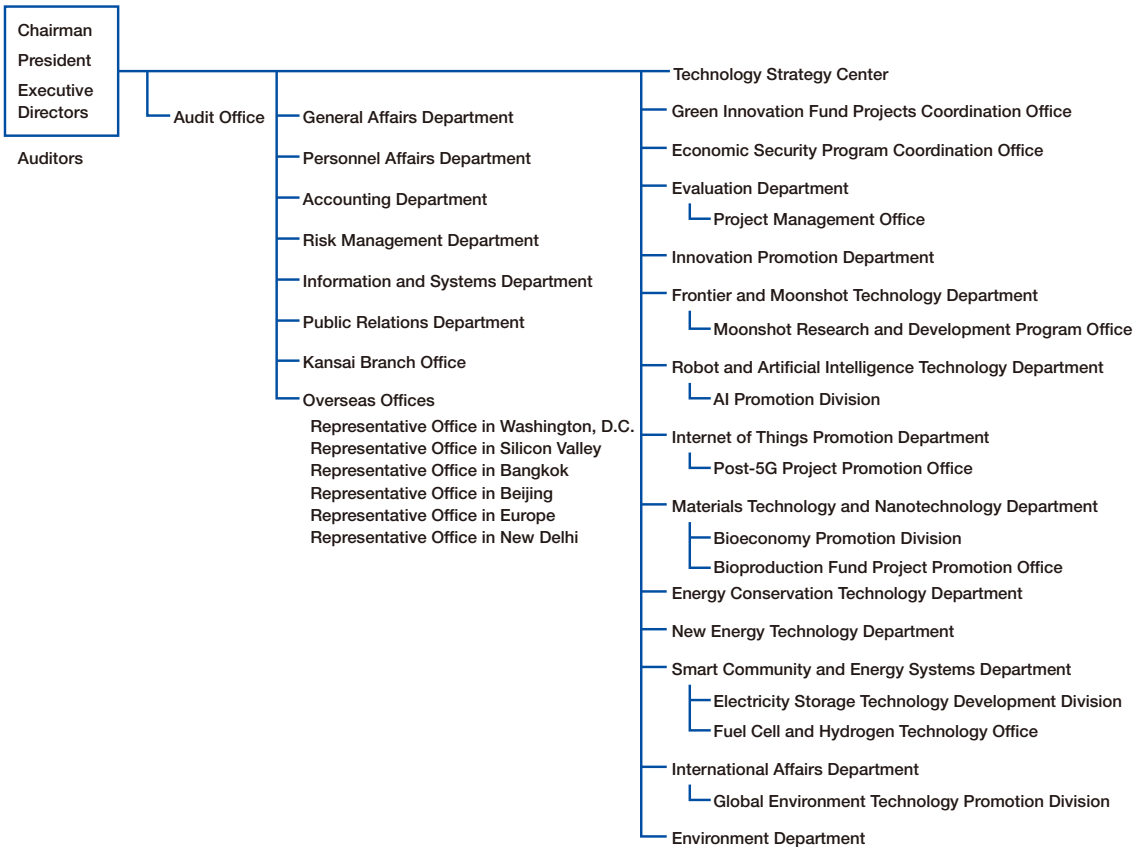
Budget
Approximately 1.14 billion US dollars (initial budget for FY 2023)
*Converted at the exchange rate of 1 US dollar = 133.04 yen
Additional funding programs are also being implemented.

Executives

Chairman	Mr. SAITO Tamotsu
President	Mr. YOKOSHIMA Naohiko
Executive Directors	Mr. YOSHIOKA Masatsugu, Dr. YUMITORI Shuji, Mr. HAYASHI Shigekazu, Mr. NISHIMURA Tomoyasu, Dr. IIMURA Akiko
Auditors	Mr. YABUTA Keisuke, Ms. FUKUSHIMA Michi

(as of October 1, 2023)

Organization



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January 2024 (1st Edition)