

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

NEDO dept. in charge: Semiconductor and Information Infrastructure Department
METI dept. in charge: Commerce and Information Policy Bureau IT Industry Division

Project Overview

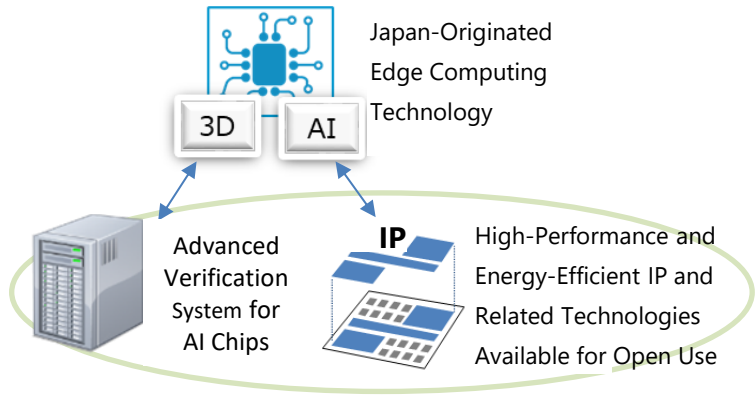
1) Project Objectives

With the rapid increase in information volume accompanying the advancement of digitalization, there is a growing need for efficient information processing. In addition to cloud data centers, edge computing is advancing, where information is processed in a distributed manner at the terminal. This project aims to develop dedicated AI semiconductors specialized for specific applications, along with related systems, to improve the performance of edge computing.

2) Project Details

Under R&D Item 1, the project will promote the development of advanced semiconductors and systems for use in the edge domain. Under R&D Item 2, the project will carry out development to advance the associated design technology. Through these efforts, the project will conduct research and development that supports the industrial application of edge computing.

R&D Item 1: Development of Innovative AI Semiconductors and Systems



R&D Item 2: Development of Advanced Semiconductor Design Environments and Associated Technologies

3) Project Structure

Project period: FY2023 to FY2027
Budget amount: 3.0 billion yen (FY2026) (General Account, Semiconductors)
Support type: Entrustment; subsidies of 1/2 or 2/3
Legal basis under the NEDO Act: Article 15, Item 1(ii), Item 3, and Item 9

Connections to Policies and Other Projects

- This project is being implemented based on the Semiconductor and Digital Industry Strategy and the Technology Strategy for the Computing Technology Field.
- This project supports the industrial application of the development results achieved in the entrustment project area implemented under the Project for Innovative AI Chip and Next-Generation Computing Technology Development, R&D Item 1: Development of Innovative AI Edge Computing Technology (FY2018 to FY2022). In addition, under R&D Item 4 of the same project (FY2022 to FY2024), the development item was transferred and integrated into this project.

Targets

1) Output Targets

The project will conduct system-level verification incorporating the development results and demonstrate that energy consumption efficiency or power efficiency is at least 5 times higher for R&D Item 1 and at least 10 times higher for R&D Item 2, compared with equivalent technologies at the time the project was launched. In addition, individual targets necessary for each technology to achieve competitiveness in its envisioned market will be established, and research and development will be promoted accordingly.

2) Outcome Targets

In the global market for AI-related hardware in the envisioned areas of real-world social implementation, the project aims to capture at least 400 billion yen in 2032, when some of the R&D results are expected to enter the market. The project also aims to create further ripple effects through related software, services, and other offerings. In addition, by reducing power consumption at the edge, in the cloud, and elsewhere, the project aims to reduce CO₂ emissions by approximately 13.73 million tons per year in 2032.

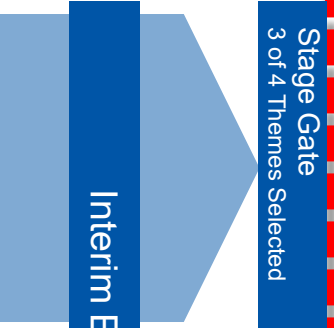
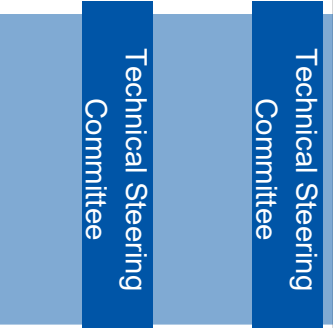
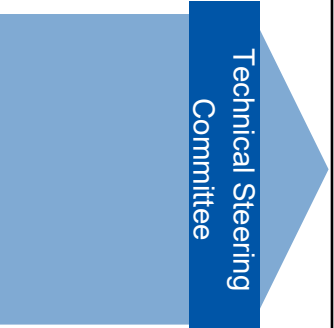
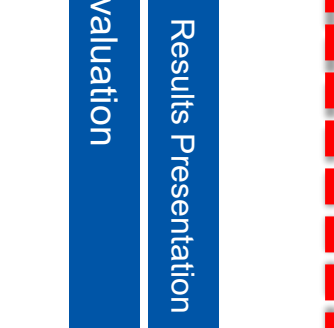
(Initiatives to Achieve Outcome Targets)

For R&D Item 1, the project will carry out development in the edge domain with industrial applications in mind, such as autonomous driving, industrial machinery, and healthcare. From the research and development period onward, the project will work with players expected to commercialize the technologies to address issues in these fields and conduct development aligned with industrial applications, thereby enabling prompt commercialization upon completion of the research and development. For R&D Item 2, the project will support the acceleration of the industrial application of Item 1 by advancing design technology.

Project Organization

R&D Item	Theme Tile	Project Period	Project Participants
1) Development of Innovative AI Semiconductors and Systems (Subsidy: 1/2 or 2/3)	Development of an Energy-Efficient Dynamically Reconfigurable Processor System for Transformer-Based Predictive AI	FY2023-FY2025	Renesas Electronics Corporation (Joint Research Partner: Institute of Science Tokyo)
	Development of an Embedded SoC Platform for Autonomous Driving (AD) Applications and Acceleration of AD SoC Commercialization	FY2023-FY2026	DENSO Corporation, OTSL Inc. TIER IV, Inc. (participated as a subcontractor to DENSO Corporation until July 2024.)
	Development of an Energy-Efficient In-Memory AI Semiconductor and System for Multimodal Processing on Edge Devices	FY2023-FY2027	Nuvoton Technology Corporation Japan (Joint Research Partners: National Institute of Advanced Industrial Science and Technology (AIST), The University of Tokyo)
	Development of an Energy-Efficient Edge AI Chiplet Enabling Generative AI Inference and Training on Edge Devices	FY2025-FY2027	EdgeCortex Inc.
2) Development of Design Technology to Accelerate Industrial Application of AI Edge Computing (Entrustment; Subsidy: 1/2)	Research and Development of a RISC-V System Design Platform	FY2022-FY2024	Institute of Science Tokyo, Seiko Epson Corporation, DENSO Corporation, Kyoto Microcomputer Co., Ltd., OTSL Inc., The University of Tokyo
	Development of a High-Level Synthesis Tool for Real-Time Video Processing on AI Devices	FY2022-FY2024	Sharp Corporation (Joint Research Partner: <i>Osaka Institute of Technology</i>)
	Development and Demonstration of CMOS/Spintronics Hybrid Technology for Improving the Design Efficiency of AI Processing Semiconductors, and Development of Its Application Technologies	FY2022-FY2024	Tohoku University, AISIN Corporation, NEC Corporation
	Development of Versatile High-Level Synthesis and a Novel General-Purpose Dataflow Computing Architecture	FY2022-FY2024	NEC Corporation, The University of Tokyo, Canon Inc. (Joint Research Partner: <i>NEC Platforms, Ltd., Nanzan University, Tokyo University of Agriculture and Technology</i>)
	Development of a Software/Hardware Co-Design Tool for Next-Generation Heterogeneous AI Devices to Improve Energy Efficiency	FY2022-FY2024	Renesas Electronics Corporation

Schedule

	2023	2024	2025	2026	2027
1) Development of Innovative AI Semiconductors and Systems (Subsidy: 1/2 or 2/3)			 		
2) Development of Design Technology to Accelerate Industrial Application of AI Edge Computing (Entrustment; Subsidy: 1/2)			 		
Actual Expenditure (JPY 100 million)	34	48	—	—	—
Budget (JPY 100 million)	—	—	30	30	—

Final Evaluation