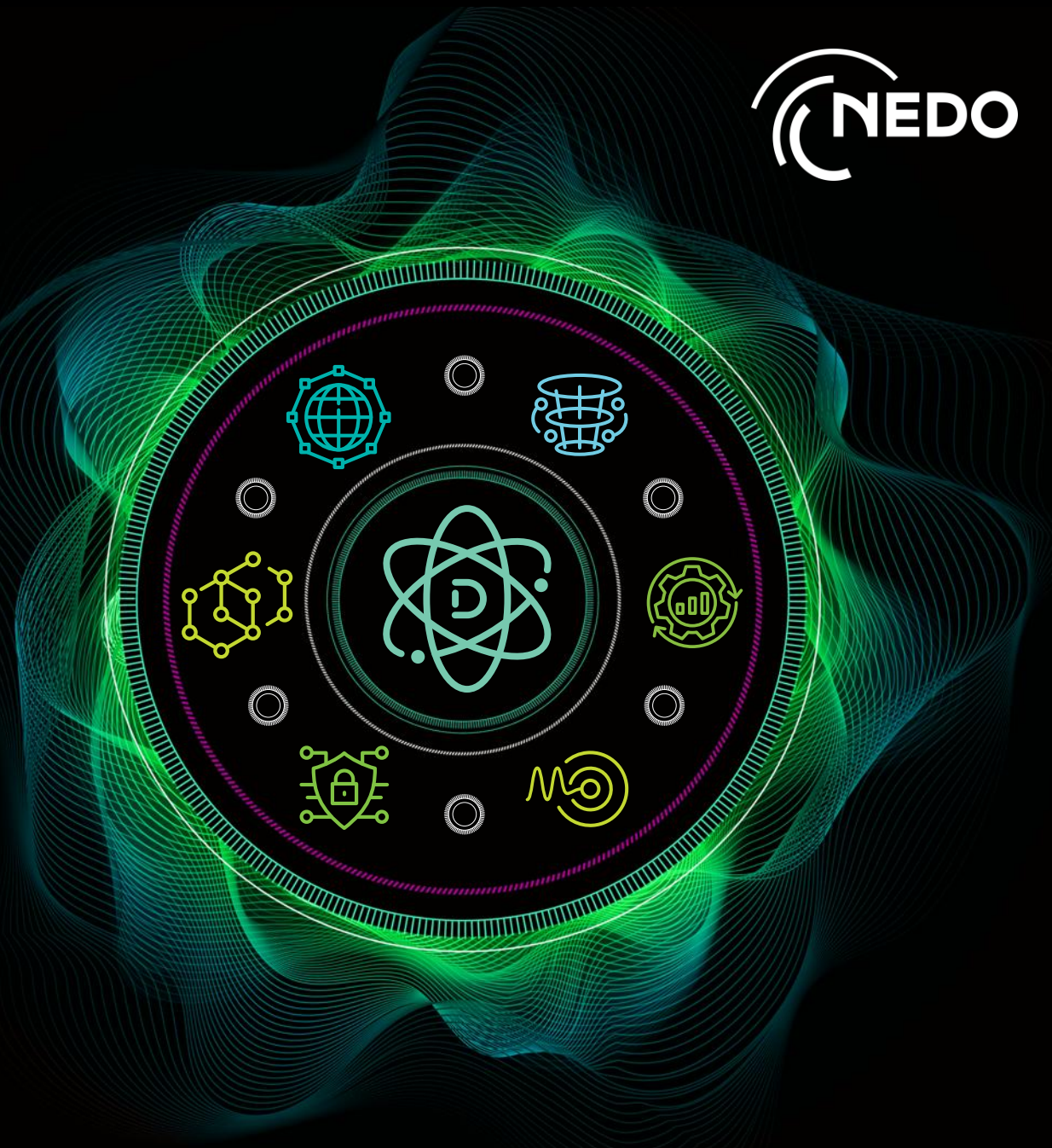
Quantum Computing Use Cases

Improving efficiency of semiconductor manufacturing processes

ROHM, Quanmatic



New Energy and Industrial Technology Development Organization (NEDO)

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Improving efficiency of semiconductor manufacturing processes [2025/7] 1/2

Operational Use

Industry	Discrete Manufacturing
Process	Production
Method	combinatorial optimization
Category	Ising*

Background

- In the semiconductor industry, **the number of combinations increases exponentially with larger manufacturing processes, and the number of constraints makes it difficult to obtain an optimal solution.**
- **In the EDS process, too, the number of combinations of manufacturing devices, test equipment, test conditions, etc. is enormous, and it was** very difficult **to derive a solution to optimize the manufacturing process even for a part of the process.**
- Conventionally, operations (process allocation) were performed based on basic calculation rules and utilizing accumulated knowledge and know-how.

Issues and motivation to be solved

- **Reduction of loss during EDS process setup, improvement of equipment availability and throughput, and enhancement of stable supply system**
- Taking advantage of the world's first full-scale introduction of quantum technology at a large-scale plant, we are expanding to more complex areas, including front-end processes, and optimizing the entire supply chain.

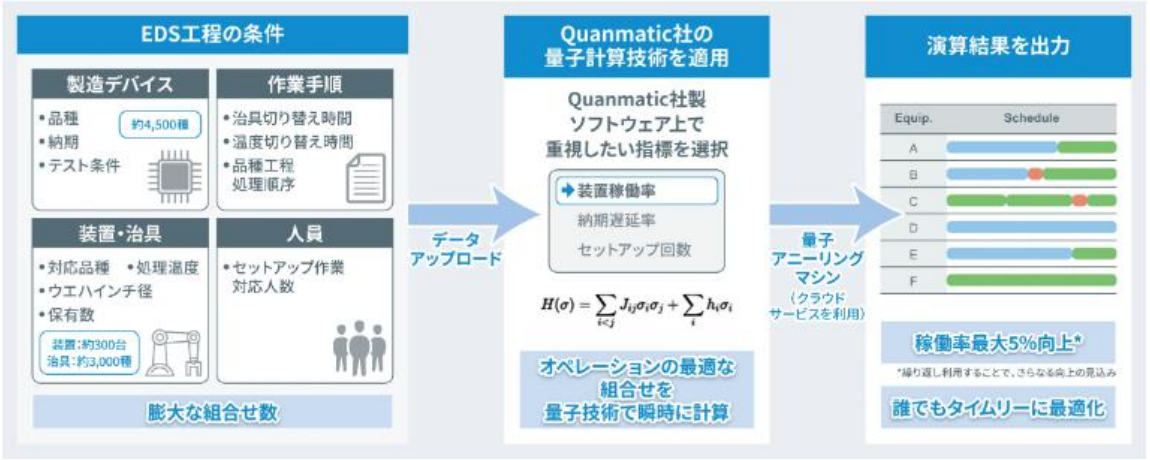


Image of Semiconductor Manufacturing Process Efficiency

Reference: ROHM Co., Ltd. and Quanmatic Co., Ltd.: "Rohm and Quanmatic use quantum technology to improve semiconductor manufacturing efficiency" (https://quanmatic.com/news/semiconductor-efficiency-quantum-tech/)
ROHM Co., Ltd.: "Rohm and Quanmatic complete verification of manufacturing process optimization using quantum technology The world's first achievement in a large-scale semiconductor manufacturing plant, aiming for full-scale introduction of the EDS process in April 2024" (https://www.rohm.co.jp/news-detail?news-title=2023-12-05_news&defaultGroupId=false)
*Ising: A computing approach, mainly associated with quantum annealers and simulators specialized for the Ising model, in which a problem is first formulated as an Ising model and then solved computationally. It is particularly well suited to problems that involve finding the optimal combination from a vast number of possibilities.

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Problem setting as a quantum computer

- Introducing an optimized computing system that combines Quanmatic's product group for improving the efficiency of quantum computing technology based on research at Waseda University and Keio University, a computational framework that utilizes quantum and classical computing technology, and specialized formulation technology with ROHM's vast knowledge, know-how, and various data.

Expected business benefits

- **By applying quantum technology to the EDS process, which is part of the semiconductor manufacturing process, losses during setup were successfully reduced by 40% compared to conventional methods.**
- **This is the world's first full-scale introduction of quantum technology in a large-scale semiconductor manufacturing process and one of the largest examples of improvements achieved.**
  - A demonstration test was successfully conducted in some areas of ROHM Hamamatsu in April 2025, and studies are underway for full-scale introduction in the future.
- They also discussed the possibility of introducing an optimized calculation system using quantum technology to a larger and more complex previous process. **By utilizing the knowledge gained through demonstration and introduction in the EDS process, we succeeded in an effective construction in a short period of time, and a prototype was completed in January 2025.**

Reference: ROHM Co., Ltd. and Quanmatic Co., Ltd.: "Rohm and Quanmatic use quantum technology to improve semiconductor manufacturing efficiency" (https://quanmatic.com/news/semiconductor-efficiency-quantum-tech/)
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More use cases are available on our website. We invite you to explore them.
https://www.quantum-computing-use-cases.nedo.go.jp/english/

More Use Cases

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This collection of use cases was obtained as a result of the work commissioned by the New Energy and Industrial Technology Development Organization (NEDO) "Cyber-Physical Development Business of Quantum/Classical Hybrid Technology/Study of Use Case of Quantum Technology" and the "Post-5G Information and Communications System Infrastructure Reinforcement R & D Project (Quantum Industrialization)/Comprehensive Study for Promoting the Industrialization of Quantum Computers".