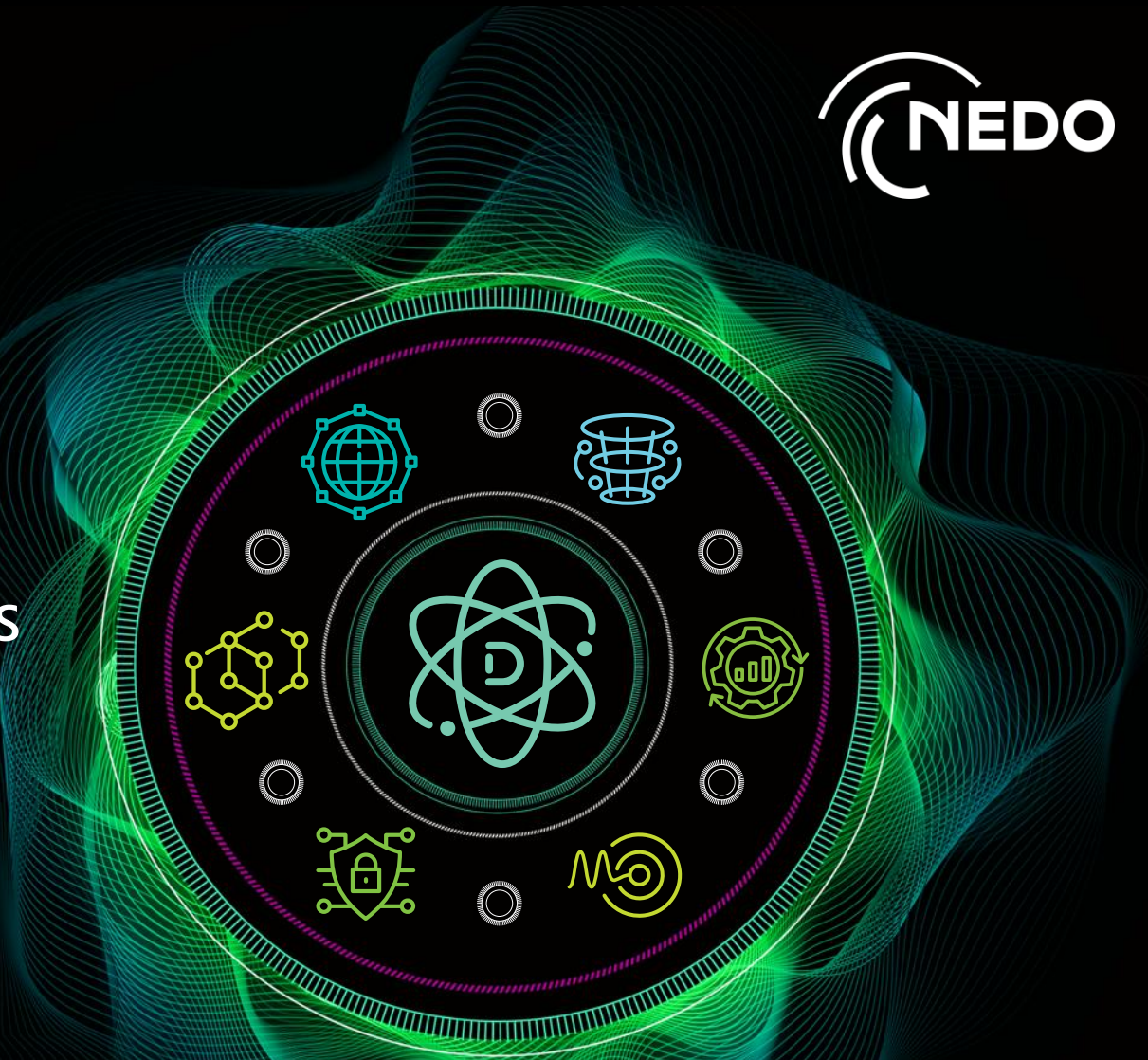
Quantum Computing Use Cases

Energy grid optimization

IonQ, Oak Ridge National Laboratory (ORNL), US Department of Energy (DOE)



New Energy and Industrial Technology Development Organization (NEDO)

IonQ, Oak Ridge National Laboratory (ORNL), US Department of Energy (DOE): Energy grid optimization [2025/7]

Validation

Industry	Energy
Process	transmission and distribution
Method	combinatorial optimization
Category	Gate*

Background

- Currently, more than 60% of the energy used to generate electricity is lost, and improved planning and calculation methods are expected to reduce waste.
- Due to the modernization of the electric power grid, it is essential to consider both dispatchable power sources such as nuclear power, thermal power, and hydropower and variable power sources such as solar power and wind power at the same time, and the generator schedule (unit commitment) complexity increases.

Issues and motivation to be solved

- We want to solve large-scale unit commitments that minimize total costs while meeting demand and reserve capacity in high-quality and realistic time under variable renewable energy and complex operational constraints.

Problem setting as a quantum computer

- Demonstration of a hybrid method that combines IonQ's 36 qubit Forte Enterprise with classical computing to address realistic unit commitments (26 machines x 24 periods)

Expected business benefits

- The possibility of solving the unit commitment problem of power grids using ion trap quantum computing devices is demonstrated.
- The quantum optimization method is applicable not only to energy but also to a wide range of industries including logistics, scheduling, and finance.

See Also: IONQ: "IonQ Partners with Oak Ridge National Laboratory, Demonstrating Quantum Power Grid Optimization Advances" (https://investors.ionq.com/news/news-details/2025/IonQ-Partners-with-Oak-Ridge-National-Laboratory-Demonstrating-Quantum-Power-Grid-Optimization-Advancements/default.aspx)
*Gate（gate-based）: A computing approach in which operations are applied sequentially to qubits to perform calculations. Similar in concept to logic circuits in classical computers, it can address a wide range of problems.

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

New Energy and Industrial Technology Development Organization (NEDO)
AI and Robotics Department (e-mail: quantum_ai@ml.nedo.go.jp)

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