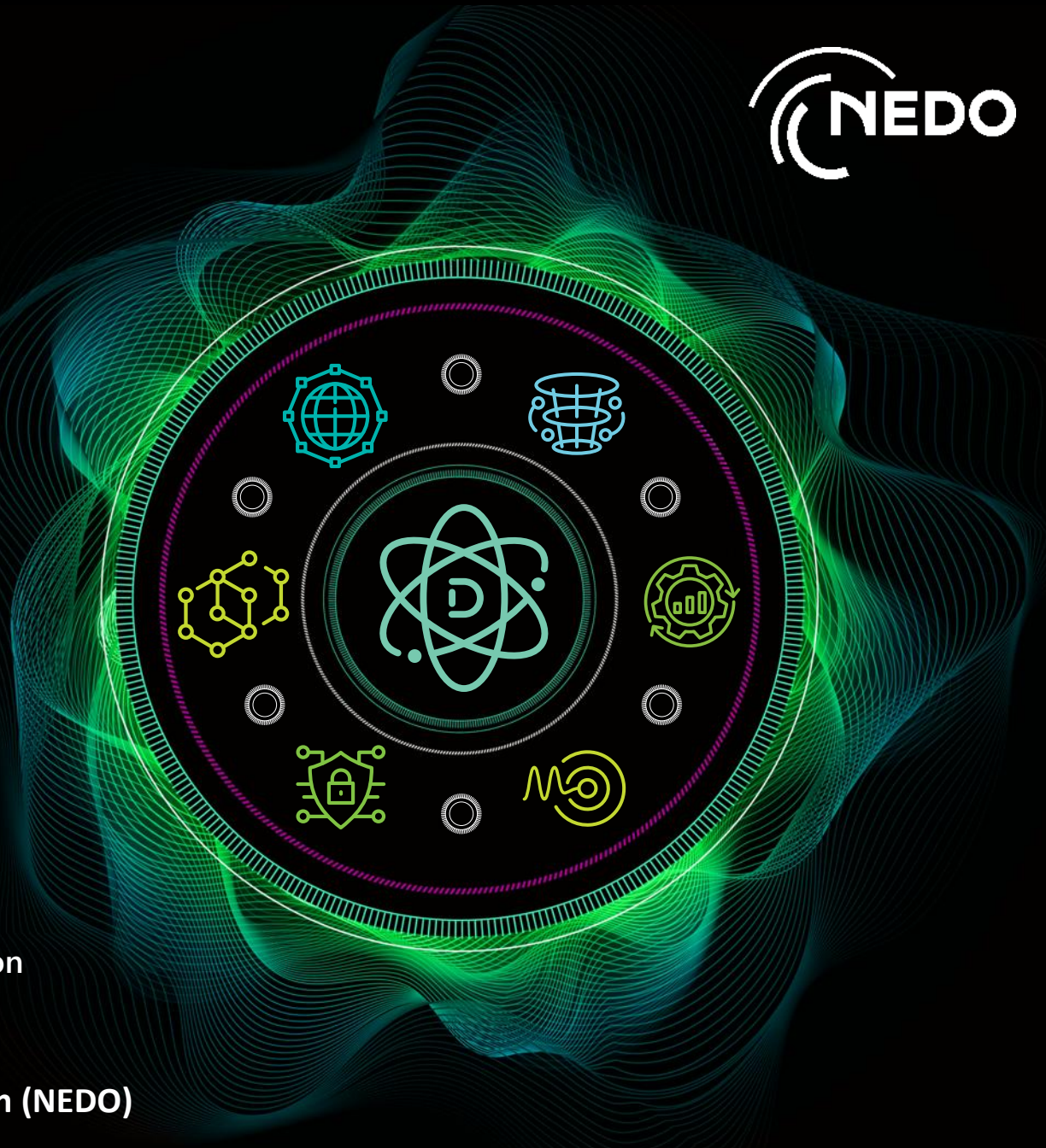
Quantum Computing Use Cases

Behavioral change services based on renewable energy generation



Promotion of SDGs with Quantum Technology

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New Energy and Industrial Technology Development Organization (NEDO)

再エネ発電量に応じた行動変容サービス
Behavioral change services based on renewable energy generation

NO IMAGE

ユースケース概要 **Use Case Overview**	電力供給量の予測に基づき、需要側の行動を調整 Adjusting demand-side behavior based on forecasts of electricity supply.
解決できる課題と効果 **Issues to be addressed and their effects**	大きく変動する電力供給に合わせた電力の使い切り Utilization of electricity to match the significantly fluctuating power supply.
量子技術の貢献 **Contributions of quantum technology**	電力供給量や交通渋滞・工場稼働率のシミュレーション Simulation of power supply, traffic congestion, and factory operating rates.

実現予想時期 **Expected realization period**	(Year)2040～2050
産業分類 **Industry classification**	コンシューマ・その他 Consumer・Others
関連するQRAMI階層 **Related QRAMI layers**	機能層 Functional layer
関連する量子技術 **Related quantum technologies**	量子コンピュータ(NISQ) Quantum Computer(NISQ)

新規性 **Novelty**	既存の模倣 Existing imitation
達成難易度 **Difficulty of achievement**	困難 Difficult
社会貢献度 **Social contribution level**	社会全体に貢献 Contributions to society as a whole
市場規模 **Market size**	1~10兆円 1～10T¥

Detail

Behavioral change services based on renewable energy generation

Issues to address

- Significant fluctuation in power supply as renewable energy approaches 100%
- Assumption that electrification will advance, and storage batteries will not be complete

Use case overview

- Accurately predict changes in power supply from 100% renewable energy
- Adjust demand-side behavior based on predictions of power supply

Implementation vision

Achievement target period: 2050



Accurate prediction of power generation by environmental simulator [2040]



Framework for dynamically changing social systems, such as MaaS and FaaS [2030]

Behavior change using MaaS and FaaS with power supply capacity as a constraint [2050]

- Accurately predict power supply from solar and wind power generation using the environmental simulator and communicate the forecasts to power users so that power can be fully used up
- Reduce the risk of power outages by encouraging changes in behavior on the consumer side

Expected benefits

- Encourage behavioral change in conjunction with power supply fluctuations
- At first glance, it may seem that consumers are being forced to make sacrifices, but by transforming social systems such as MaaS and FaaS, the value provided remains unchanged.

Action plan

QRAMI hierarchy	Action
Business	Introduce environment as KPI for services such as MaaS and FaaS
Interface	Communicate power supply volume to MaaS and FaaS providers (must be in real time if forecast is not sufficient)
Function	Environmental simulator for accurate prediction of power supply
Information	Digital twin of cities and factories, such as traffic congestion and factory utilization (3D modeling)
Asset	Quantum computer (Environmental simulator)

Roadmap

Behavioral change services based on renewable energy generation

2023

Adjust with thermal power generation and fossil fuels in accordance with energy demand

Conventional energy supply and demand adjustment

Supply ← Demand

- ✓ Final adjustment of power generation with thermal power
- ✓ Use as much energy as needed

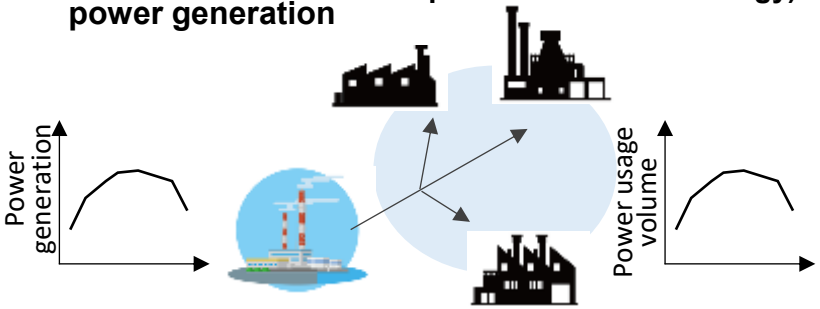




Blast furnace　Gasoline-powered vehicles

Mainly thermal power generation; possible to control the amount of power generation

Many non-electrified equipment (possible to store petroleum-derived energy)



Supply-demand adjustment with grids and fossil fuels

Around 2030

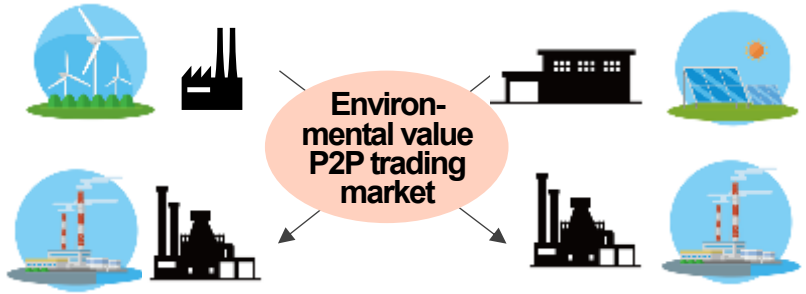
Acceleration of decarbonization (introduction of renewable energy and electrification)

Visualization, reduction, evaluation, and trading services for environmental value

Supply ⇢ Demand

- ✓ Disparities between companies in decarbonization
- ✓ Evaluate and trade the value of environmental improvement

Transition period



P2P trading of environmental value by companies/individuals

Around 2050

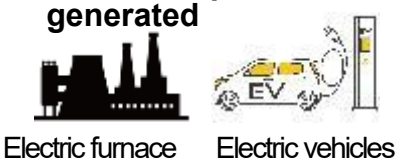
Zero environmental impact with 100% renewable energy and full electrification

Behavior change services in accordance with the volume of renewable energy generation

Supply → Demand

- ✓ Accurately predict power generation through environmental forecasts
- ✓ Change in behavior of individuals/companies depending on the amount of power generated

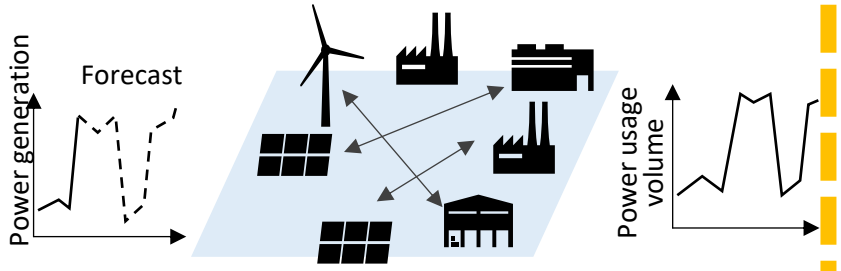




Electric furnace　Electric vehicles

Almost 100% renewable energy generation (unstable power generation)

Electricity demand fluctuates depending on equipment operating status



Local production for local consumption of energy

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Roadmap

Behavioral change services based on renewable energy generation

	2023	203x	204x	205x
	Conventional energy supply and demand adjustment	**Visualization, reduction, evaluation, and trading services for environmental value**	**Behavior change services in accordance with the volume of renewable energy generation**	
Business	Aggregation Power generation adjustment service (thermal power generation)	Environmental trading consulting Environmental value trading service (matching)	Advanced demand response services (MaaS, FaaS*, etc.)	
Interface	Information coordination between power supply and demand	Interface between companies and environmental value exchanges	Interface between prediction of renewable energy generation and local power consumption control	
Functional	Power supply and demand adjustment within the power station's jurisdiction	**Environmental value P2P trading Environmental impact simulator**	**Environmental prediction simulator, regional electric power supply and demand control, electric power demand induction (allocation of usable power, etc.)**	
Information	Actual energy supply and demand Contract energy volume, weather forecast information	**Environmental value data based on actual energy demand and reductions and weather forecast information**	**3D city models, weather data, and local power demand data**	
Communication	4G, wireless communications	5G/6G	5G/ 6G Edge computing	
Integration	Power grid, linkage of collected data to upper systems	Energy grid Environmental information integration platform	Microgrid	
Asset	Smart meters, wattmeters	Various IoT sensors and smart meters Quantum computer	Various IoT sensors, smart meters, quantum computers	
Policy aspect	Reduction of dependence on nuclear power generation and promotion of the introduction of solar power generation	Standardization of environmental impact assessments Establishment of trading market for environmental value	Integration policies of local governments	

* Mobility as a Service (MaaS), Factory as a Service (FaaS, concept of service connecting factory and client)

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)
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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 ”.