Watt-Bit Collaboration in the AI Era: Optical Standards for Distributed Data Centers

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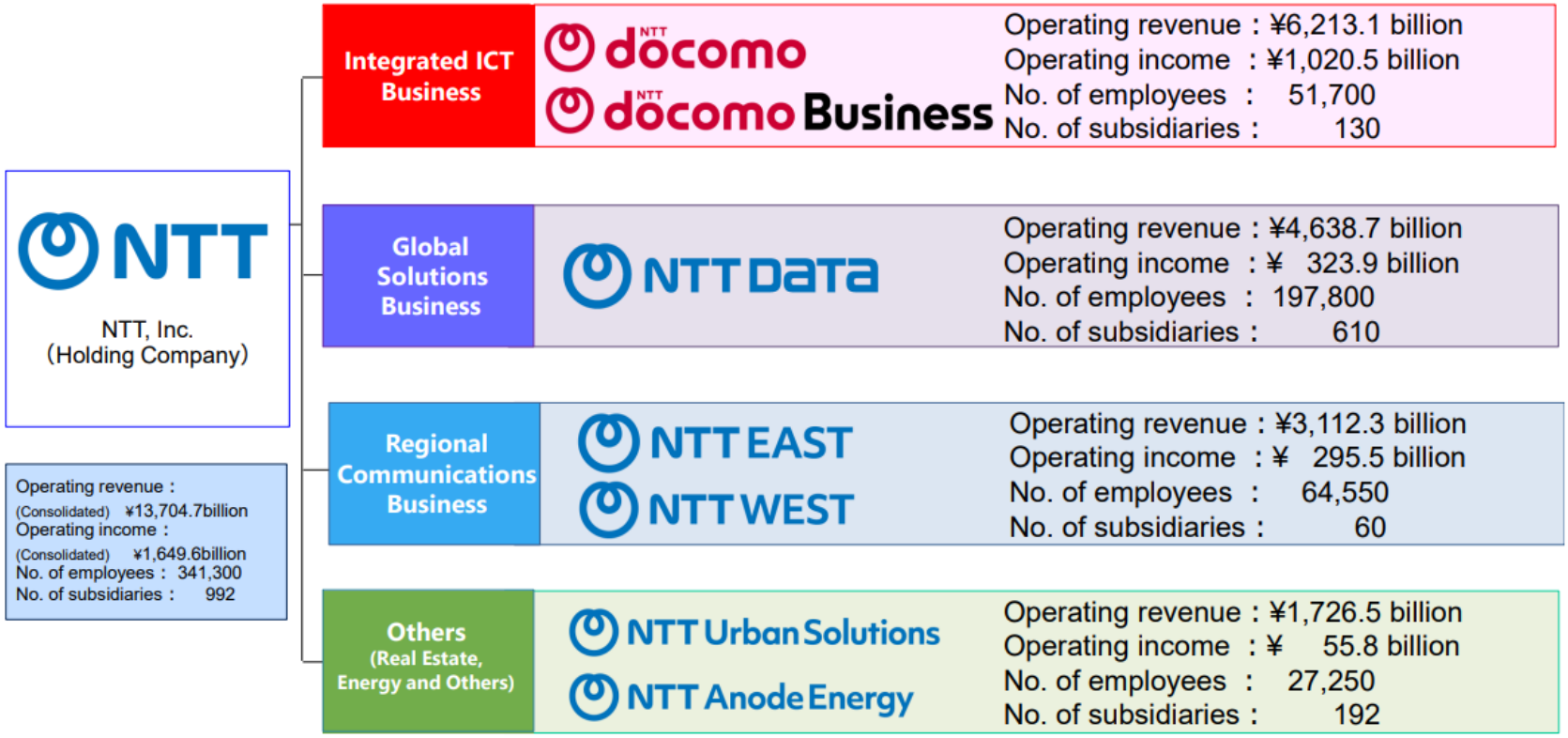
About NTT Group

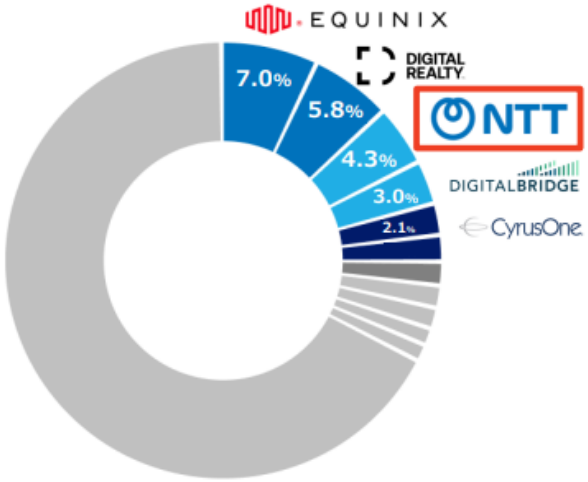


- Operating revenue and operating income for each segment are FY2024 figures including inter-segment transactions..
- The figures for both employees and subsidiaries are as of March 31, 2025.

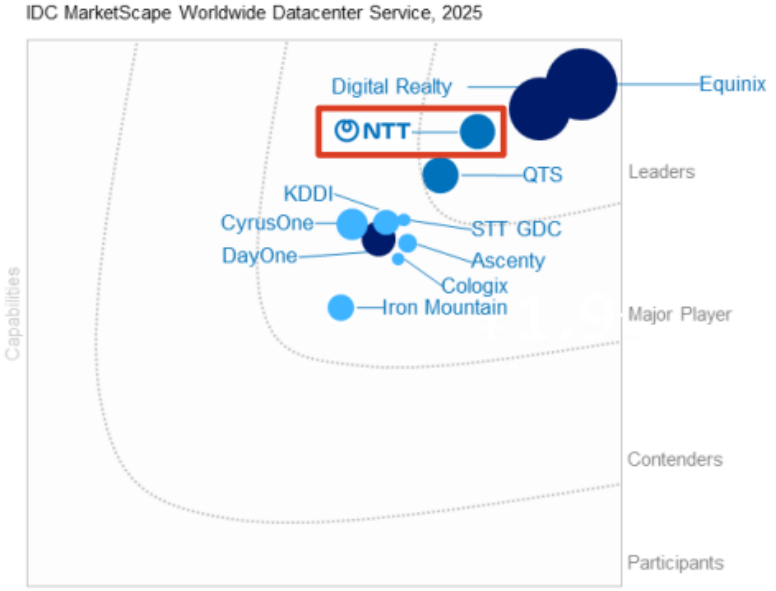
Our Business Example

Global Data Center Colocation Revenue Share[1]

1	Equinix
2	Digital Realty
3	NTT GDC
4	Digital Bridge
5	CyrusOne
6	CenterSquare
7	QTS
8	American Tower
9	Stack Infrastructure
10	KDDI Telehouse
11	Others



Global IDC MarketScape Vendor Assessment [2]



NTT GDC is widely recognized as the third largest data center operator with a global footprint

(1) NTT created the chart, excluding service providers in China, based on the Structure Research August 2025 Report.

NTT is named as a "Leader" due to it broad service offering and global reach

2. IDC MarketScape* : Worldwide Datacenter Services 2025 Vendor Assessment (August 2025, IDC #US52983725)
The IDC MarketScape visually ranks ICT vendors based on capabilities and strategy, using both qualitative and quantitative criteria. Capabilities reflect short-term execution; strategy reflects long-term alignment with customer needs. Icon size indicates market share.

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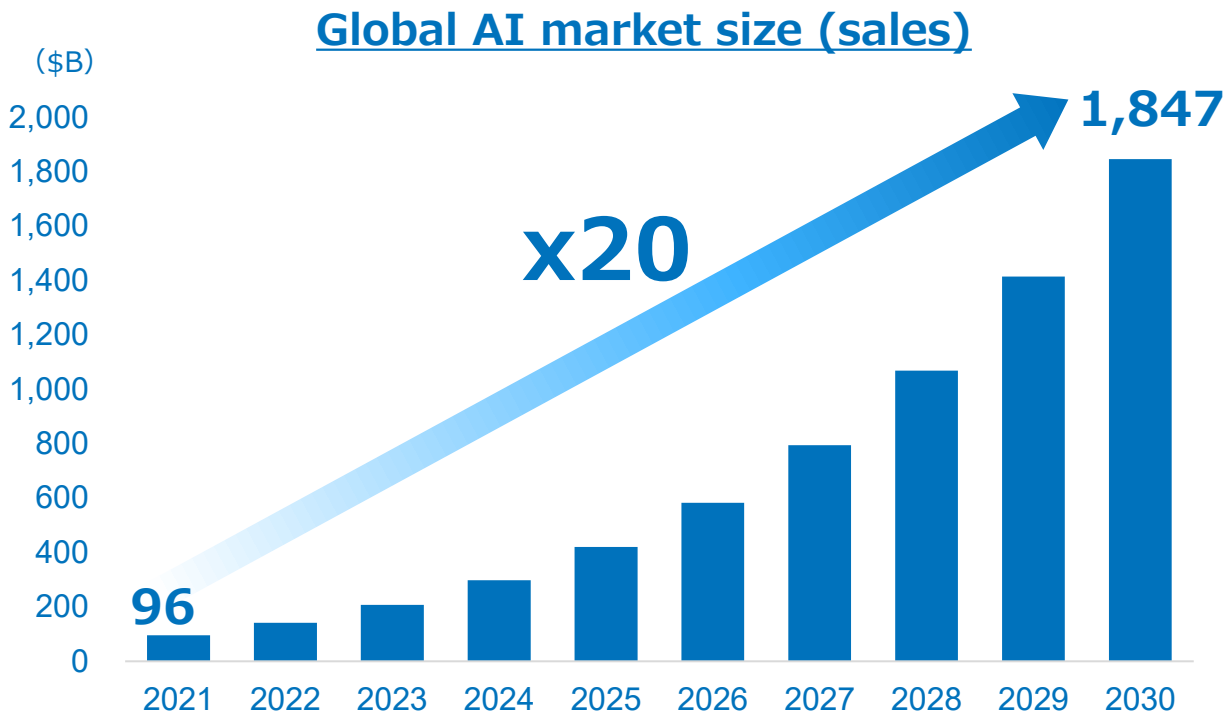
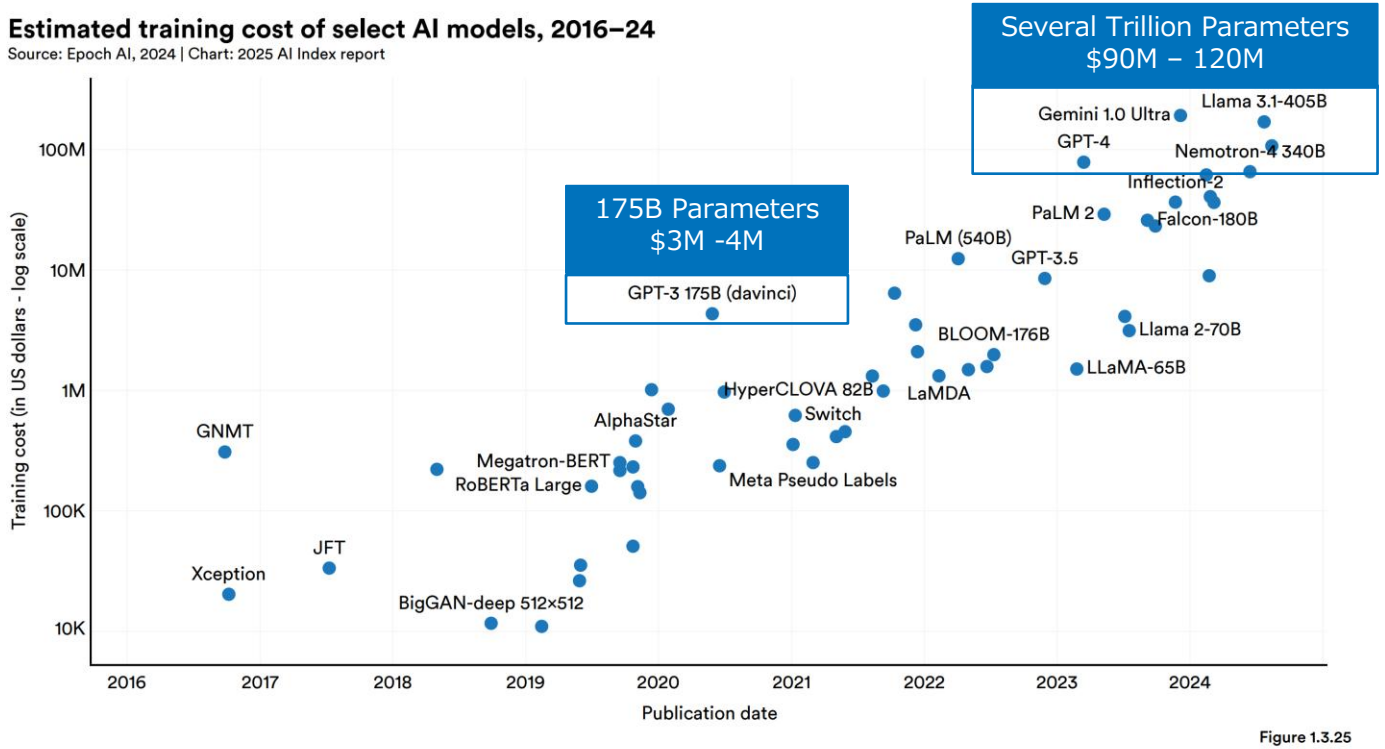
Growth of the AI market

- The AI market is predicted to grow 20 times from 2021 to reach $1.8 trillion by 2030



Source : Information and Communications in Japan White Paper 2024, MIC
https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2024/2024-index.html

Enormous Development/Training Costs



Stanford Univ. Artificial Intelligence Index Report 2025

Issues associated with expanding demand for data centers in Japan

1. Securing land

2. Securing electricity

3. Reducing environmental impact

Enormous Power Consumption

TO Develop GPT-4 class LLM

Power Consumption

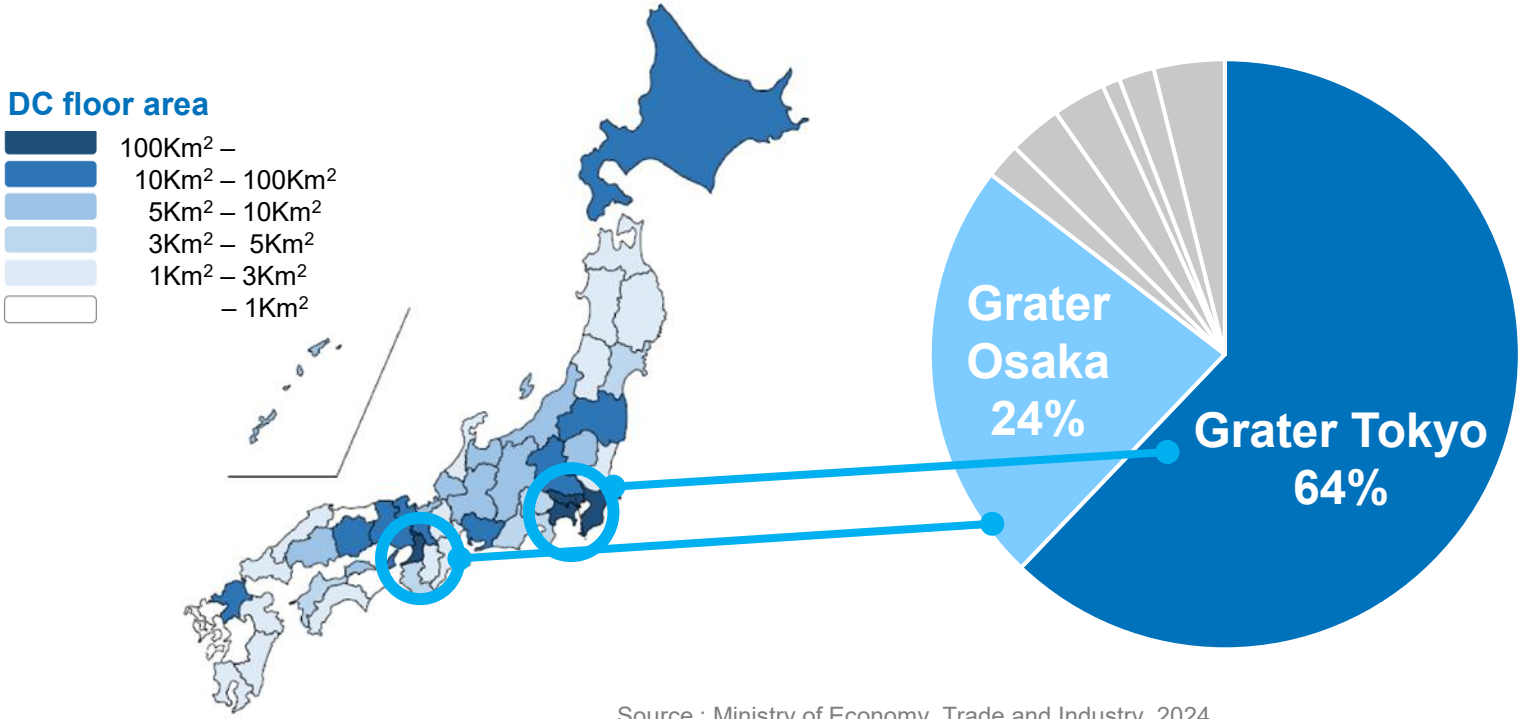
Approx. 40,000MWh[1] /1 training

Equivalent to
40 Nuclear Power Plants
(Approx. 1,000MWh / 1 Nuclear Plant)

[1] Stanford Univ. Artificial Intelligence Index Report 2024 Figure 1.3.22
https://gizmodo.com/chatgpt-ai-openai-carbon-emissions-stanford-report-1850288635

Challenge: Securing land

- Japan's data centers are concentrated in the Tokyo and Osaka metropolitan areas (88% of all data center land in Japan)
- It will become more difficult to secure land for data centers in the future



Source : Ministry of Economy, Trade and Industry, 2024
https://www.meti.go.jp/policy/mono_info_service/joho/conference/digital_infrastructure/0007/004_jimukyokusiryou.pdf

Challenge: Securing electricity

- In the Tokyo area, the development of the power grid has not kept up with the growth in DC demand, and waiting times for power supply can exceed 10 years

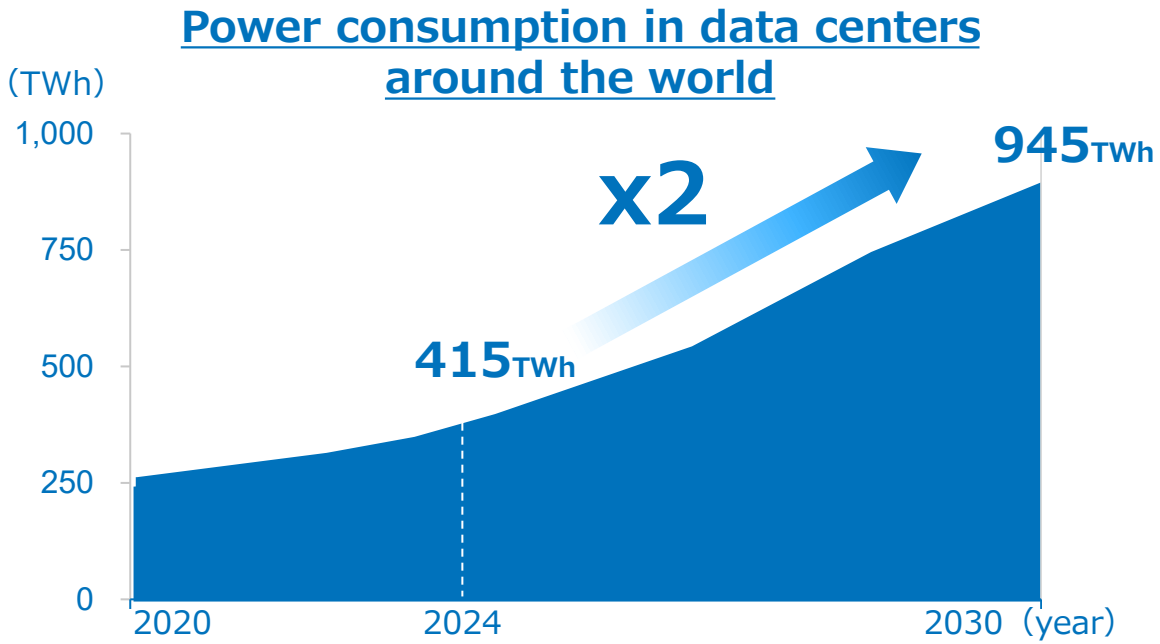
Waiting time for power supply to new data centers near Tokyo:

Ca. 10 years

Example:
Inzai City, Chiba Prefecture, near Tokyo (as of March 2025)
40 customers waiting for power (total 2.5GW)

Issue 3: Reducing environmental impact

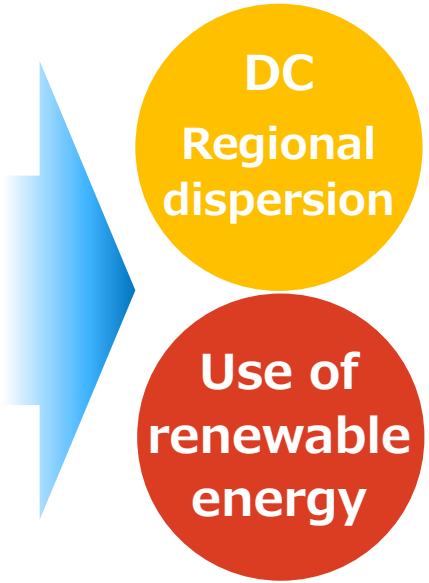
- Data center power consumption is expected to double in 2030 compared to 2024
- How to reduce power consumption is a global issue



Source : IEA “Energy and AI” (published April 2025) Figure 2.11
https://iea.blob.core.windows.net/assets/34eac603-ecf1-464f-b813-2ecceb8f81c2/EnergyandAI.pdf

Approach to addressing issues

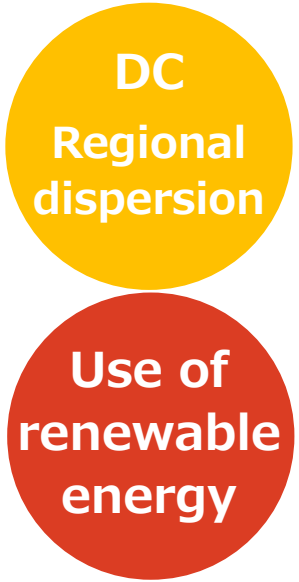
1. Securing land
2. Securing electricity
3. Reducing environmental impact



New challenges

- Increased communication latency lead to a decline in service quality?
- Decentralization lead to increased maintenance and operational costs?
- Unstable of Power supply?
- Efficient operations management?

Approach to addressing issues



New challenges

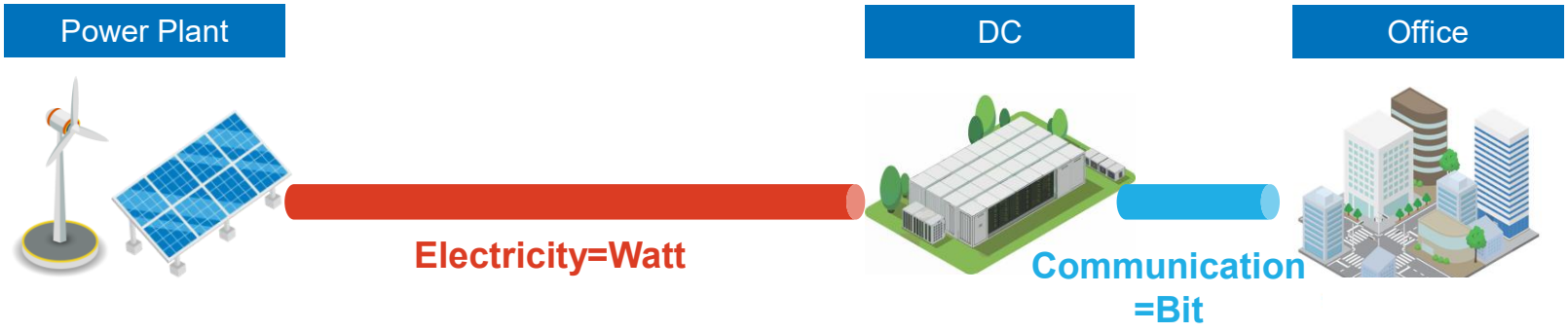
- Increased communication la… s…
- D… In… o…
- U…
- **Efficient operations management?**

Watt-Bit Collaboration

IOWN

Ultra-low latency, ultra-low power consumption, and ultra-wideband

Watt-Bit Collaboration



Cable installation costs reduced to:

1/100

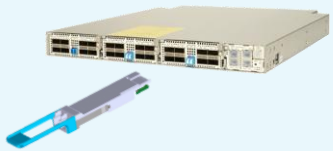
IOWN (Innovative Optical and Wireless Network)

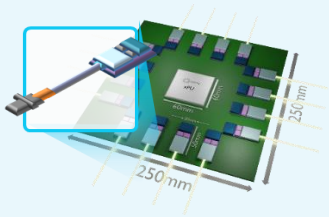
- 2019: Unveiled the IOWN Vision (NTT)
- 2020: Established the IOWN Global Forum
- Today: Steadily Driving Global Standards and Social Implementation

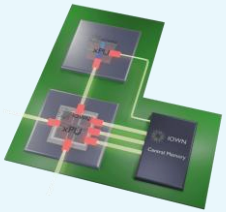
From Electronics to “Photonics”

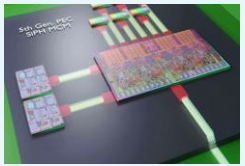
Networking | **Computing**

IOWN 1.0	IOWN 2.0	IOWN 3.0	IOWN 4.0
DC to **DC**	**Board** to **Board**	**Chip** to **Chip**	Inside **Chip**









ITU-T Key Initiatives for the Next Generation ICT Infrastructure for AI

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Synergy Between Energy and ICT is Becoming Critical to Ensuring Future DC Capacity (Watt-Bit Collaboration)

→ SG5 L.WBC_FR **New (June 2026)**

"Framework for Industrial Advancement through Distributed Data Centre Workload Shifting for Watt-Bit Collaboration"

Optical Standards (examples)

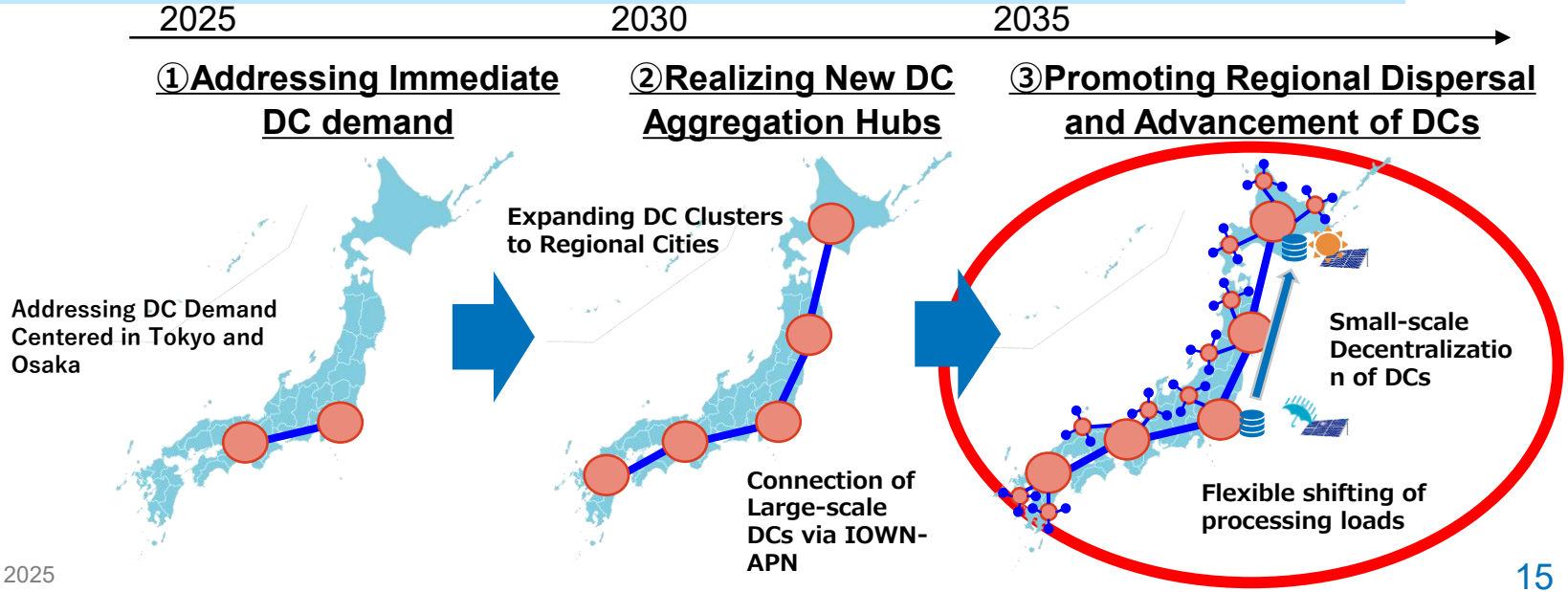
- Low Latency and Energy Efficient Network Framework (SG13)
- Multi-Core Fiber Technologies (SG15)

Watt-Bit Collaboration in Japan

① **Addressing Immediate DC demand**
Ex) Promoting DC Placement in Areas with Surplus Grid Capacity

② **Realizing New DC Aggregation Hubs**
Ex) Infrastructure Development for Establishing Large-scale DC Clusters

③ **Promoting Regional Dispersal and Advancement of DCs**
Ex) Operations Utilizing Workload Shifting Technology



Realizing Watt-Bit Collaboration Requires a Comprehensive SG15 Standardization Set

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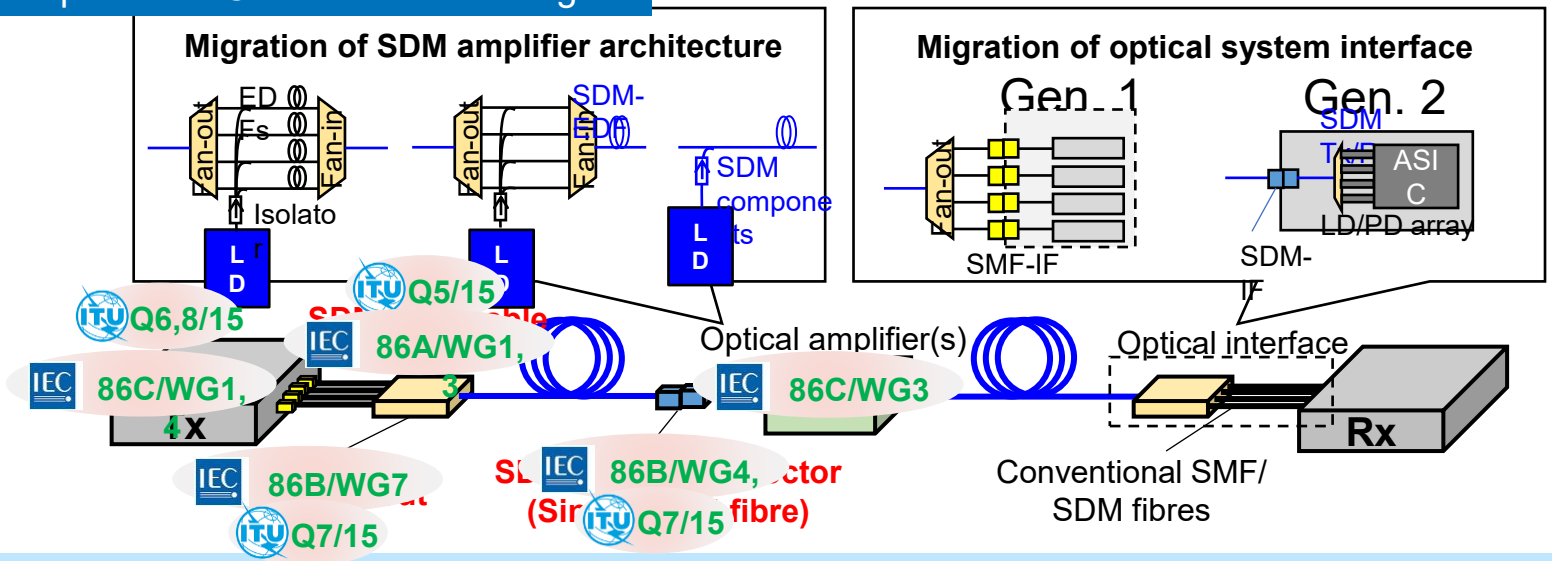
Example: Multi-Core Fiber Technologies



- ✓ At early stage of MCF system, **existing optical components, transceivers and systems can be utilized** by using fan-in/fan-out (FIFO) devices.
- ✓ As aligning with development of MCF techno-ecosystem, MCF components and transceivers having MCF interfaces will be developed and standardized.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