Press Release

NTT DATA
Trusted Global Innovator

NTT DATA Achieves 97% Reduction in Energy Used to Cool ICT Equipment with New Method of Direct Cooling in Liquid

Service launch planned for fiscal 2023, helping realize a decarbonized society

TOKYO – June 6, 2022 – NTT DATA, a global digital business and IT services leader, today announces that it has built a data center cooling system utilizing liquid immersion cooling ("liquid immersion cooling system"), as part of its efforts to realize a decarbonized society. Liquid immersion cooling is a method of directly cooling servers and other ICT devices by submerging them in a special liquid. Compared to conventional air cooling, the technology is drawing attention as a highly energy efficient, next-generation cooling method.

To confirm the efficiency and operational performance of this system, and identify potential hurdles to commercialization, NTT DATA conducted verification testing of the liquid immersion cooling system at its Mitaka Data Center EAST facility from March to April 2022. The results showed that compared to conventional data centers cooled with air, energy used for cooling the data center could be reduced by up to 97%[1] (estimated PUE[2] = 1.07[3]). The testing also confirmed the stable operation of servers and network equipment, and determined the practical issues involved with maintenance and other aspects of equipment operation.

Based on the results of this verification testing, NTT DATA aims to implement and put into operation an energy efficiency data center utilizing a liquid immersion cooling system within fiscal 2023.

About the Verification Testing

1. Background

The rapid increase in data volume brought by the digitization of society is driving a steady rise in power consumption by data centers. Amid the focus on decarbonization as a management issue for companies, reducing the amount of energy consumed by data centers has become a key concern.

NTT DATA has set a goal of achieving carbon neutrality at its data centers by 2030. To meet this target, the company adopted a liquid immersion cooling system, which is attracting attention as a next-generation cooling method, and conducted verification testing of this system together with nine partner companies.

2. Overview of the Verification Testing

Period:	March 9 to April 28, 2022
Location:	Mitaka Data Center EAST
Test equipment:	Two-phase liquid immersion cooling system (6kVA, 2 units), manufactured by LiquidStack
Test content:	1) Test of cooling system and cooling system energy performance using load simulators.
	2) Performance testing using ICT devices.

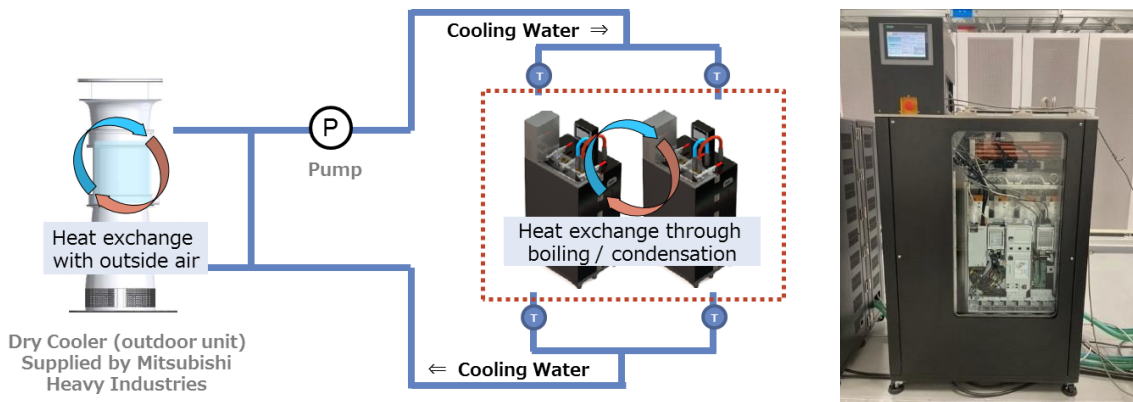3) Determination of issues regarding design and operations.

Fig. 1: Overview of Liquid Immersion Cooling System
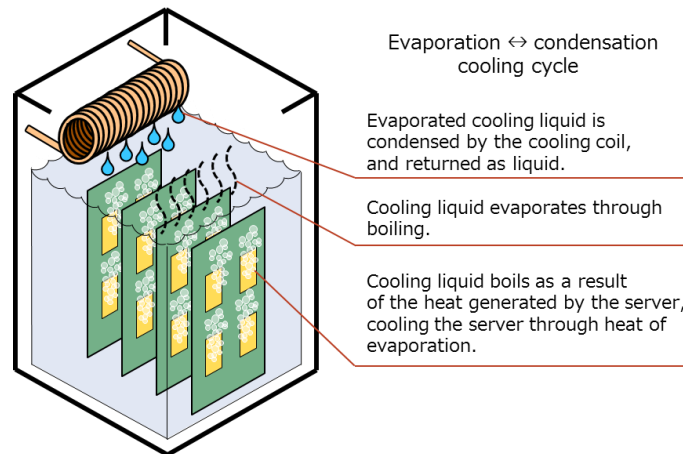

Fig. 2: Image of Two-phase Liquid Immersion Cooling

Liquid immersion cooling is a means of efficiently cooling IT equipment by submerging it in a nonconductive liquid. The verification testing conducted by NTT DATA employed a "two-phase" method that utilizes the heat of evaporation from the boiling of the liquid, which is considered to provide the greatest cooling effect. An additional advantage is that because high heat generating servers can be placed in close proximity to one another, less space is required compared to conventional methods using air. Further, the ability to operate equipment at a fixed temperature in a closed environment reduces the failure rate.

Partner Companies
Nine partner companies: Mitsubishi Heavy Industries, Ltd., HPC SYSTEMS Inc., LiquidStack Holding B.V., Hibiya Engineering Ltd., Dell Technologies Japan Inc., Cisco Systems G.K., NVIDIA GK, Intel, 3M Japan Limited.

<div align="center">Chart: Role of Each Company</div>

	Role	Objective and Result
NTT DATA	• Establishing verification fields • Supervision of verification project	• Confirmation of device performance and operating performance of liquid immersion cooling system, and determination of issues regarding practical application
Mitsubishi Heavy Industries	• Supplying of Dry Cooler coolant production system using outside air • Collection of behavior data on coolant supply system, and technical support	• Confirmation of performance and operability of the liquid immersion cooling system • Experience with operation of Dry Cooler in Tokyo metropolitan area
HPC SYSTEMS LiquidStack	• Collection of behavior data on liquid immersion cooling system, and technical support	• Installation of systems at data centers in Japan
Hibiya Engineering	• Building of the coolant system, and technical support	• Know-how regarding installation and operation of liquid immersion cooling systems
3M	• Providing of cooling liquid	• Feedback for product development and improvement
Dell	• Providing of servers and network devices, customization for liquid immersion	• Confirmation of normality of server and network device behavior in liquid immersion cooling system
Cisco	• Technical support for verification testing	
Intel	• Technical support of PoC	• Delivered stress test and power measurement tools.

3. Results

■ A liquid immersion cooling system was installed at Mitaka Data Center EAST. The determination of parameters to maximize use of cooling performance, and the operational limits of devices, confirmed the operating conditions to provide a 97% reduction in cooling energy.

■ In terms of device configuration in consideration of redundancy between tanks when used for an actual system, the determination of the performance of ICT devices at different cooling temperatures, and the behavior of cooling systems and ICT devices when anomalies occur, confirmed the effectiveness of safe and efficient system operation.

■ The determination of customization conditions for software and hardware in ICT device loading and network design, maintenance performance for normal operation, and issues related to the behavior of equipment when anomalies occur, confirmed the feasibility for NTT DATA to use the liquid immersion cooling system to provide the type of integrated system service, from software to hardware, in which the company specializes.

<u>Future Plans</u>

To actively utilize liquid immersion cooling systems, the effectiveness of which has been confirmed through verification testing, NTT DATA plans to install machine rooms for liquid immersion cooling in its data centers, and by implementing an internal system by fiscal 2023, will achieve a service model at an early stage.

In addition, in consideration of the issues involved with liquid immersion, such as specification changes and modifications in ICT device procurement, and loading and operational design, the company will revise its procurement guidelines, and establish an operations and maintenance structure. Further, by using a refrigerant liquid with a lower environmental load (GWP[*4] < 1), NTT DATA aims to realize and provide an energy efficient, environmentally friendly system service.

<u>NTT Green Innovation toward 2040</u>

NTT Group announced its environmental vision "NTT Green Innovation toward 2040" on

September 28, 2021, setting goals for an 80% reduction in greenhouse gas emissions (compared to FY2013), and carbon neutrality in the mobile and data centers businesses, by FY2030, and to achieve full carbon neutrality by FY2040. NTT Group is expanding its initiatives for carbon neutrality to society at large, supporting the Japanese government's target of a 46% reduction in greenhouse gas emissions (compared to FY2013 levels) by FY2030, and carbon neutrality by 2050.

Notes
1. Compared to the total energy use of data centers with a PUE of 1.7.
2. Power Usage Effectiveness (PUE) is an indicator of the cooling efficiency of data centers. The figure is the energy consumed by the entire data center (annual energy consumption), divided by the energy consumption of IT equipment (annual energy consumption). The closer the figure is to 1.0, the more energy efficient the data center.
3. The annual PUE is estimated based on the verification result, taking into account such factors as weather data and the performance conditions for each device.
4. Global warming potential (GWP) is the multiple of the greenhouse effect of a gas, compared to the same mass of carbon dioxide (CO_2).

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About NTT DATA
NTT DATA – a part of NTT Group – is a trusted global innovator of IT and business services headquartered in Tokyo. We help clients transform through consulting, industry solutions, business process services, IT modernization and managed services. NTT DATA enables clients, as well as society, to move confidently into the digital future. We are committed to our clients' long-term success and combine global reach with local client attention to serve them in over 50 countries. Visit us at nttdata.com.

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