Introducing the Shiroi Data Center Campus

- Shiroi Data Center Campus
  - Overview
  - Shiroi DCC Specifications
  - Shiroi DCC Phase 3 Building
  - Future Development and Challenges
  - History of Demonstration and Development

Abbreviation:
FY2026 stands for a fiscal year from Apr. 1, 2025 to Mar. 31, 2026, others alike
DC stands for data center, Shiroi DCC stands for Shiroi Data Center Campus, Matsue DCP stands for Matsue Data Center Park

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Integrating IIJ's accumulated DC expertise and proactively introducing new innovations

IIJ's IT services (Cloud, Network, etc.)

Housing services for customers' IT equipment

R&D hub for IIJ-DC technology

Design Concept
Building on the success of Matsue DCP, we take on the challenge of overcoming the obstacles and issues we faced

Features
Facility: 1,000-rack capacity
Air Conditioning: Direct outside air cooling
Electrical: Utilization of Lithium-Ion Battery Storage
Three-phase four-wire UPS, bus duct
Green DC
PUE*: 1.2 range (design value)

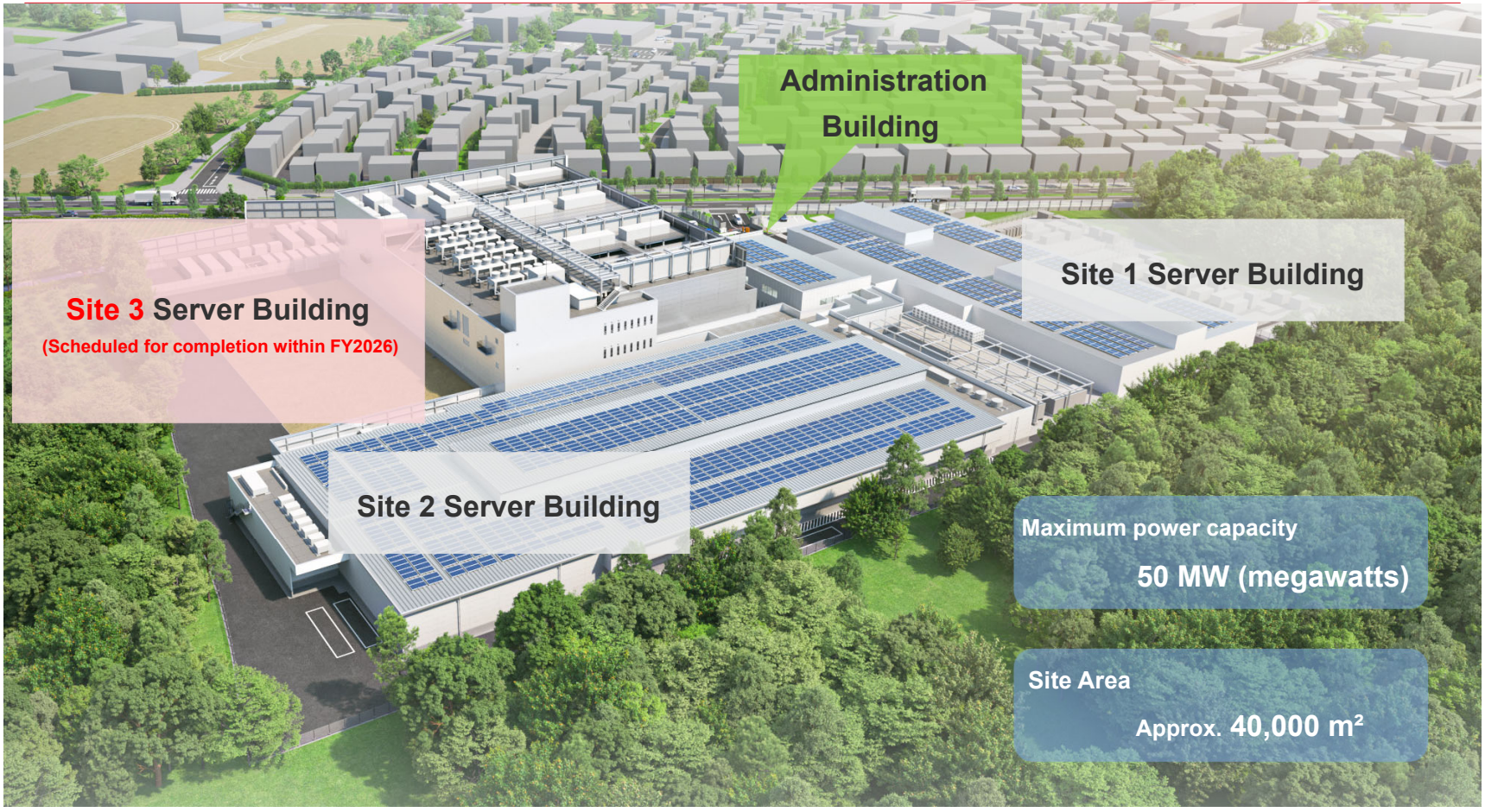
DC service start
Phase 1: May 1, 2019
Phase 2: July 1, 2023
Phase 3: Scheduled within FY2026

The Vision Behind "Campus"
We chose this name with the vision of creating a HUB (campus) that aggregates explosively growing digital data, flexibly adapts to new technologies, emerging needs, and new services, and generates new value.

*Power Usage Effectiveness. Total energy consumption of the DC facility/Energy consumption of IT equipment

Further challenging and evolving from Matsue DCP

Buildings


Administration Building
Site 1 Server Building
Site 3 Server Building
(Scheduled for completion within FY2026)
Site 2 Server Building
Maximum power capacity
50 MW (megawatts)
Site Area
Approx. 40,000 m²

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Strategically located on the disaster-resilient Shimousa Plateau, in the globally recognized “INZAI” area

Hub for Financial DCs

- Formerly designated as a certified low-disaster-risk location under the old FISC safety standards (60 km separation requirement), it developed as the eastern DC cluster in Chiba New Town (west: Tama New Town)
- Located approximately 32km from central Tokyo (Otemachi)

About the Shimousa Plateau

A gently undulating plateau spanning eastern Saitama Prefecture to northern Chiba Prefecture, with elevations of approximately 20 to 40 meters. The upper strata are covered by the Kanto loam layer. It has no active faults and features solid bedrock

Building Structure

Direct foundations were adopted based on geological surveys, with a low-rise, seismic-resistant design. PML value: 6.2%

Status of Various Hazard Maps

Seismic Vulnerability	• Level 1–2 out of 5
Liquefaction susceptibility	• Not subject to liquefaction • Boring survey determined no liquefaction-prone strata present
Building Flooding Sediment	• Not subject to potential sediment disasters, inundation/flooding • Approximately 15 km from the coastline • Approximately 1.6 km from the nearest Class 1 river • Approximately 23.8m above sea level

- The construction site for the Administration Building and Site 1 Server Building falls under "Type I-B: Plateaus and hilly terrain. Pleistocene deposits (Kanto loam), bearing capacity approximately 100–1000 kN/m²" as specified in the Japan Society of Civil Engineers' "Guidelines for Site Investigation Planning for Building Foundation Structural Design."
- "Direct foundations" are specified as the foundation type for low-rise structures of 1 to 3 stories on ground type "I-B".
- Geological surveys confirmed an N-value of 68, indicating solid ground.

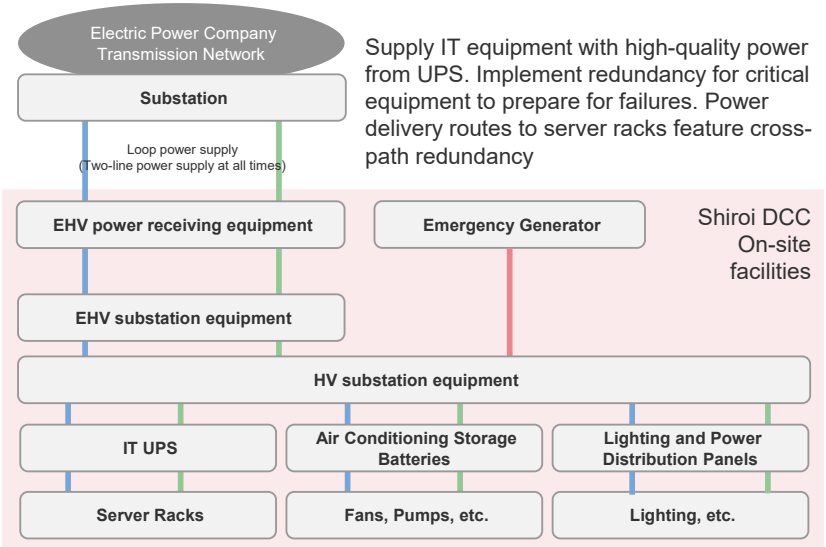
Extra-High Voltage Loop Power Receiving Secures a maximum power capacity of 50 MW

Enables large-scale construction and scalability

Maximum 50MW power capacity. Expandable within the campus (same site) to match business growth

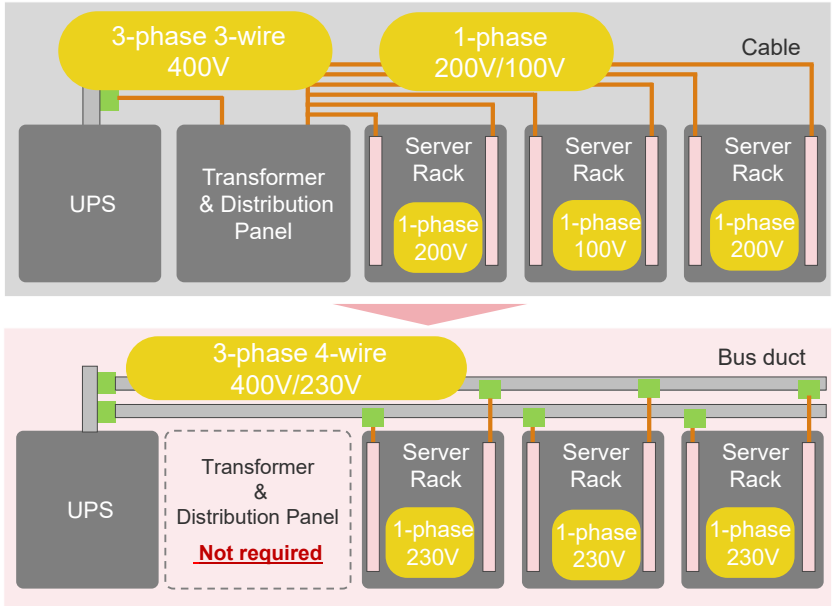
Emergency Generator

Emergency generator installed. Fuel stockpiled for 72 hours of continuous operation (*Priority supply contract available)



Supply IT equipment with high-quality power from UPS. Implement redundancy for critical equipment to prepare for failures. Power delivery routes to server racks feature cross-path redundancy

3-phase 4-wire system Adoption of UPS and Bus Duct Power Supply



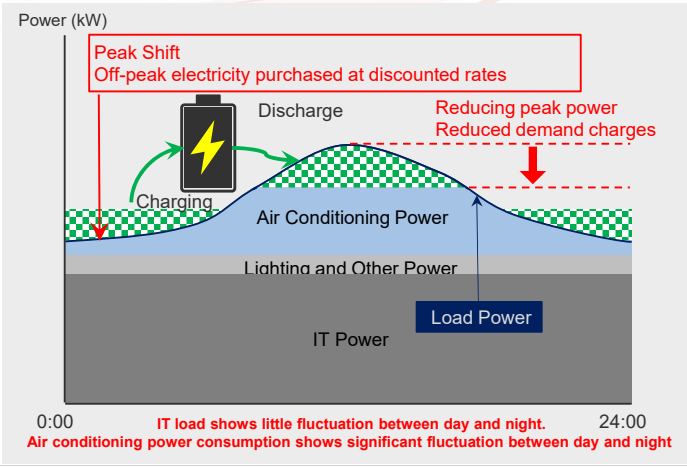
- UPS output (3-phase 400V) is distributed via bus ducts directly to IT equipment, supplying single-phase 230V power to IT equipment
- Reduce transformer investment, reduce transformer losses, reduce transmission losses, optimize space utilization

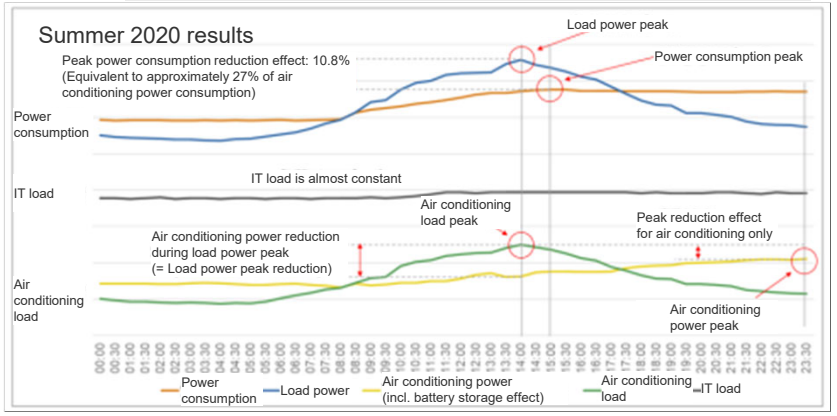
Enables peak cutting and peak shifting

In addition to its role as an air conditioning storage battery, it achieves peak cutting/peak shifting
Targeting an average 15% reduction in air conditioning power consumption

Transforming into a Dynamic Power System

Traditionally, UPS and emergency generators served as reliable backups ensuring high quality. Moving forward, we will expand their utilization as energy resources within DCs and pursue business model transformation





Achieved peak shaving of **10.8%** at power reception, equivalent to **approximately 27%** of air conditioning power consumption

Direct outside air cooling serves as the base air conditioning system, capable of handling high loads

Supports cooling for 20kVA/rack-class systems. By leveraging outside air, hybrid air conditioning significantly reduces summer power consumption. Achieves high-efficiency operation through precise temperature and humidity monitoring, utilizing feedback from various measurement points

High load support

- Handles heat generation of 20kVA-class per rack (floor average: 6kVA/Rack)

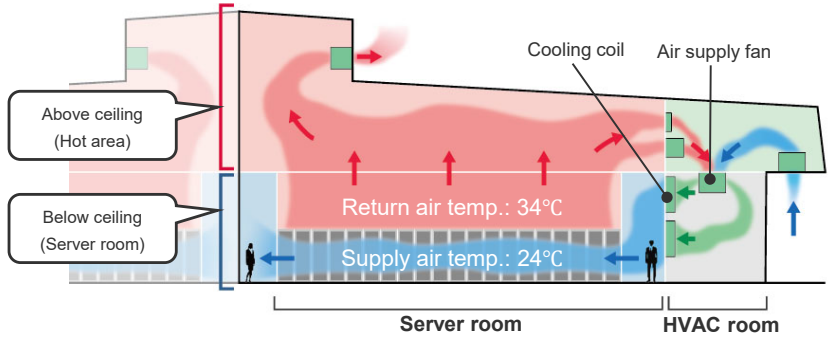
Outdoor air utilization and wall-mounted air conditioning

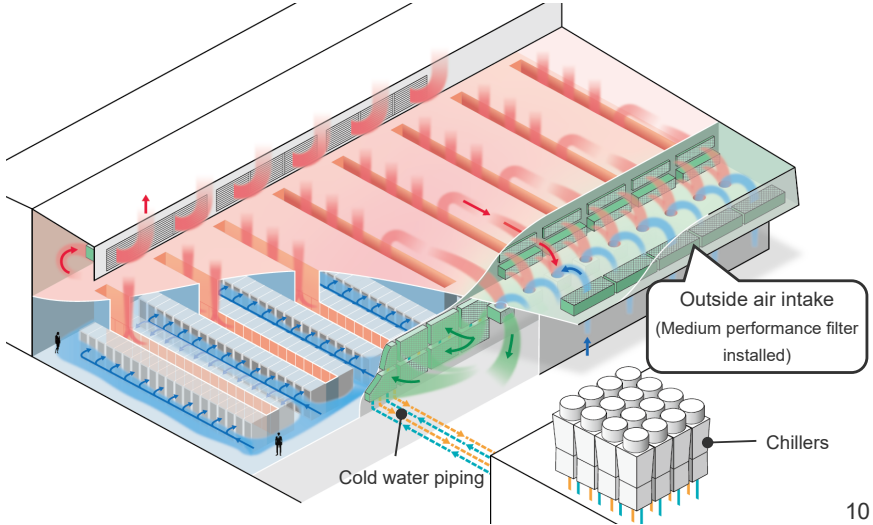
- Reduces chiller load and overall power consumption by using outside air
- Hot aisle containment and large-space design minimize energy loss. Wall-mounted air conditioning reduces airflow power consumption to about one-third compared to floor-mounted systems, ensuring uniform intake temperatures and preventing hot spots

Redundancy and power outage response

- N+1 redundancy configuration
- Cold water circulation pumps and air supply fans backed by battery power to prevent server shutdown during commercial power outages until emergency generators start
- Chilled water buffer tank installed for quick chiller restart

Chiller-related equipment





Engineers and operators are on-site

Compliant with FISC security standards, featuring a flexible design to meet varying security requirements.
Access logs and surveillance footage are retained, and biometric authentication is standard.

Multi-tiered security

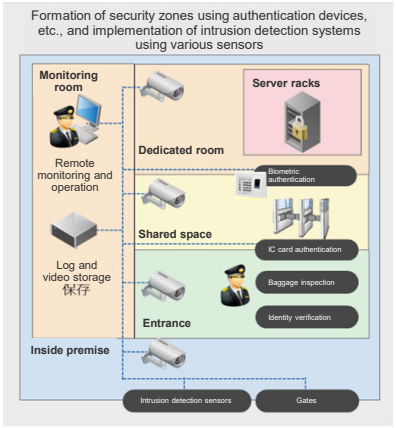
- Multiple security zones and authentication steps are required before accessing server racks.
- Cages can be installed within server rooms as needed.

Enhanced perimeter security

- Multiple intrusion detection measures are implemented according to the shape of the external structure.
- Intrusion detection systems use surveillance cameras and multiple sensors for high-precision monitoring.

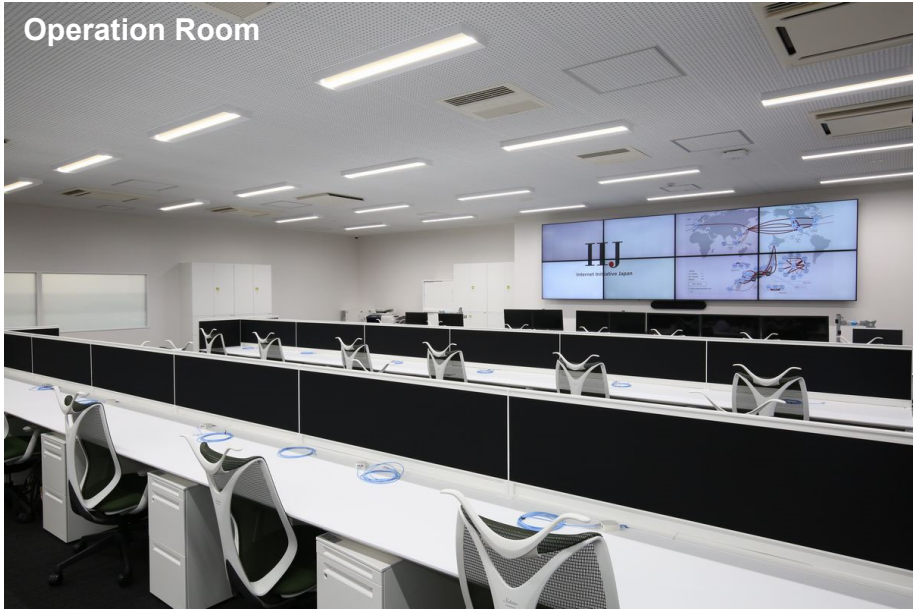
Mutual Monitoring

- Monitoring terminals are installed and interconnected across both sites.
- Engineers and operators conduct maintenance procedures and switching operations at each site while sharing technical expertise.



24/7/365 support

- Reception upon entry/exit, inspection of items brought in/out
- Centralized monitoring of DC information via large multi-screen displays
- Continuous recording of access logs and surveillance camera footage (retention period: 1 year)



Shiroi DCC Specification: Server Room (Housing Room)

Server Rack

- Supports high-density installation with a load capacity of 1.5 tons per rack
- Accommodates server racks up to 2700 mm in height, supporting various rack specifications (including customer-provided racks)
- Standard Rack
  - 19-inch rack
  - 47U (split racks also available)
  - W: 700 mm, D: 1200 mm, H: 2400 mm
  - Electric lock compatible

Electricity

- Average 6 kVA per rack
- Single-phase 230 V, 100 V; Three-phase 4-wire 400 V

Wiring routes

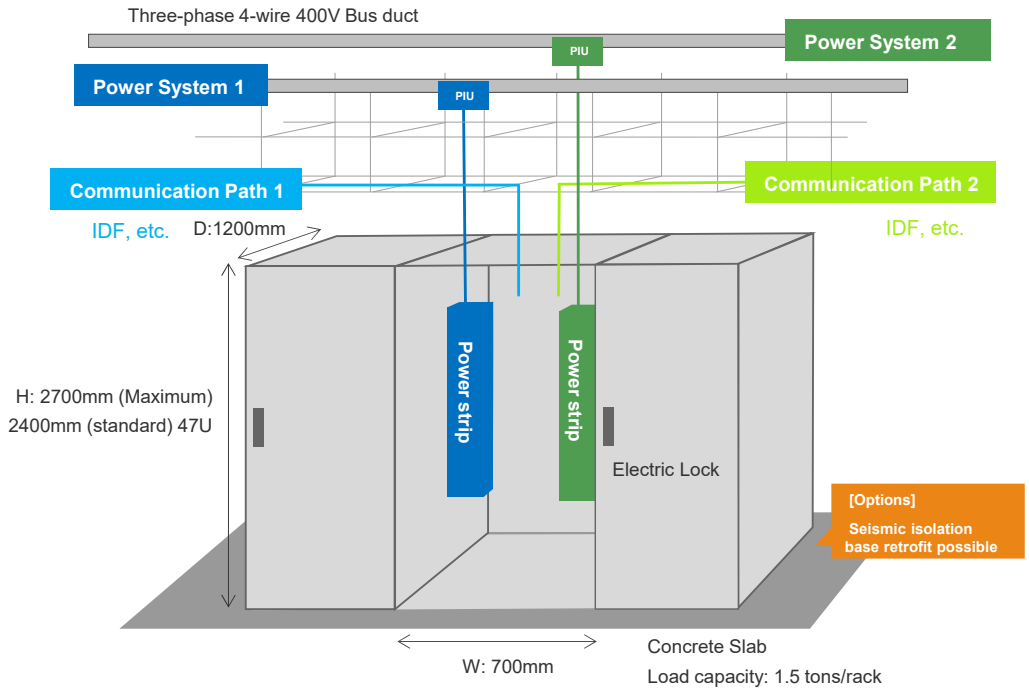
- Supports separate routing for both electrical and communication cables
- Wiring utilizes cable racks installed in the ceiling

Firefighting Equipment

- Early fire detection in server rooms using ultra-high sensitivity smoke detectors
- N_2 gas fire suppression system (quiet-head type) prevents water damage
- Pure water extinguishers suitable for electrical fires

Equipment (Available for Rental)

- Work desk/chair, shelf boards, cage nuts, blank panels, work tools, etc.



Four-route cabling

Four separate external entry routes are deployed for lines connecting the DC to the outside world, and carrier-free compatibility is ensured with no restrictions on usable carriers.
This ensures high reliability while providing equipment with ample capacity for future expansion.

Supports carrier-free operation + four-route line entry

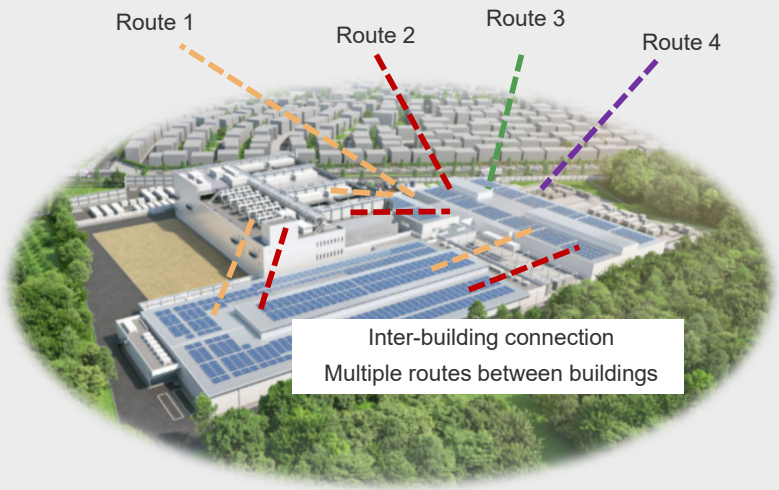
- Four distinct external line entry routes are deployed to ensure high redundancy.
- No restrictions on usable carriers; enables connection environments tailored to customer needs.

Network environment provision

- Internal cabling enables connection to IIJ's network services:
  - [Internet] Internet Access Service
  - [Private Network] IIJ Private Access Service, etc.
- Connect to the cloud using IIJ network services
  - IIJ GIO and IIJ SaaS services
  - Connectivity to third-party clouds is also possible via the IIJ Cloud Exchange Service

Multiple wiring routes within the premises

- Supports different wiring routes within the premises



- Four completely separate routes for service lines from outside the property
- The connection method supports both buried and overhead lines

*The routes shown in the diagram are for illustrative purposes only.

Equipped with rental offices and refresh facilities

Rental office space designed for use as operations, monitoring rooms, and BCP offices
Refresh facilities provide visitors with "healing" and "comfort"

Media Storage Room

- Equipped with dedicated rooms for storing tapes and other media
- Temperature and humidity control optimized for media storage
- Supports high-security level operations

Rental Offices

- Meeting rooms of various sizes available within the management building
- Secure dedicated rental office space for clients
  Interior customization available to meet client requirements

Refresh Facility

- Refresh rooms available for visitors to use anytime
- Equipped with nap rooms and shower facilities to support late-night work and BCP usage
- Vending machines sell beverages and snacks
- Available for anyone to use

Shiroi DCC Specifications: Facility Specifications

Location

- Location: Shiroi City, Chiba Prefecture

Monitoring & Security

- Monitoring system: 24/7/365 operation with on-site staff
- Surveillance cameras: Installed at all doors and between racks
- Intrusion detection: Fence sensors, infrared sensors, etc.
- Access control: Security gates, IC card/biometric authentication

Building

- Structure:
  - ✓ Two stories above ground (Administration Building), one story above ground (Server Buildings 1 and 2)
  - ✓ Seismic-resistant design (Option: Base isolation)
  - ✓ Capable of continuous operation even during earthquakes of the magnitude of the Great Hanshin-Awaji Earthquake or the Great East Japan Earthquake
- Floor load capacity: 1,500 kg per rack

Fire Protection Equipment

- Fire detection: Ultra-high sensitivity smoke detectors, smoke detectors
- Fire extinguishing method: Nitrogen gas extinguishing system, pure water extinguishers

Power Supply Equipment

- Power Supply Method: Extra-high voltage loop power supply
- Emergency generator: Gas turbine
- Generator fuel reserve: 72 hours (at maximum load)
- UPS equipment: N+1 redundant configuration
- UPS battery run time: 5 minutes (at maximum load)

Communication Carrier

- Telecom Carrier: Carrier-neutral
- Power Supply Method: Four separate routes available
- Wiring path: Diverse routing options

Air Conditioning Equipment

- Configuration: Outdoor air / Air-cooled chiller hybrid
- Air conditioning method: Wall-mounted blower system

Compliance Standards

- Japan DC Council (JDCC) Facility Standard Tier 3 (Partially Tier 4)
- Financial Information Systems Center (FISC) Security Measures Standard
- ISO 27001 (ISMS)
- ISO 14001 (EMS)

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Shiroi DCC Site 3 Building: Overview

The Shiroi DCC Site 3 Building will feature a liquid-cooling ready design to support high-load servers

The Site 3 building is initially designed with a power capacity of 10 MVA, similar to the Site 2 building.
If power demand increases due to advances in AI and other technologies, the capacity can be expanded up to 25 MVA.

Site 3 Building Overview

Number of Floors	3 above ground (electrical room), 1 above ground (server room)
Structure	Seismic-resistant Structure, Steel Frame Construction
Fire Resistance Rating	Fire-Resistant Building

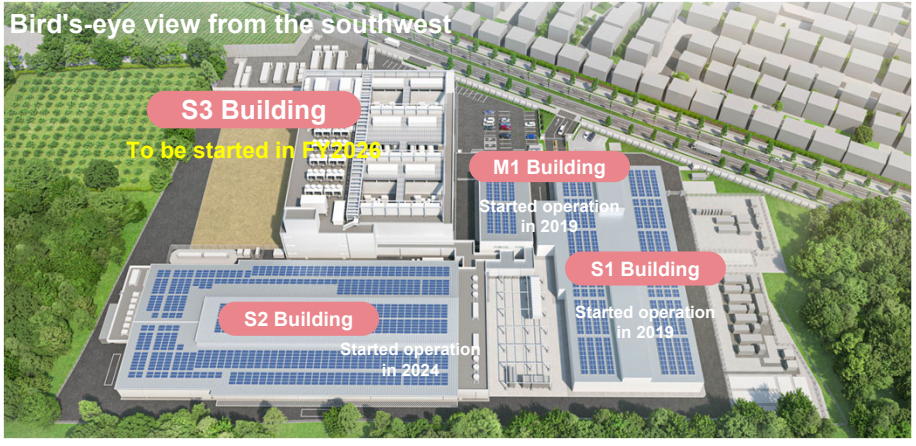
	Site 1	Site 2	Site 3 (scheduled)
Start of operation Maximum power received	May 2019 10MVA	July 2023 10MVA	Planned for FY2026 (expandable to 25 MVA)

Features of Site 3 Building

- Outdoor-air cooling system capable of handling high-load servers
- Environment prepared for water-cooled server deployment
  - Design allowing dedicated heat source on the roof
  - Secured cold water piping routes to server rooms

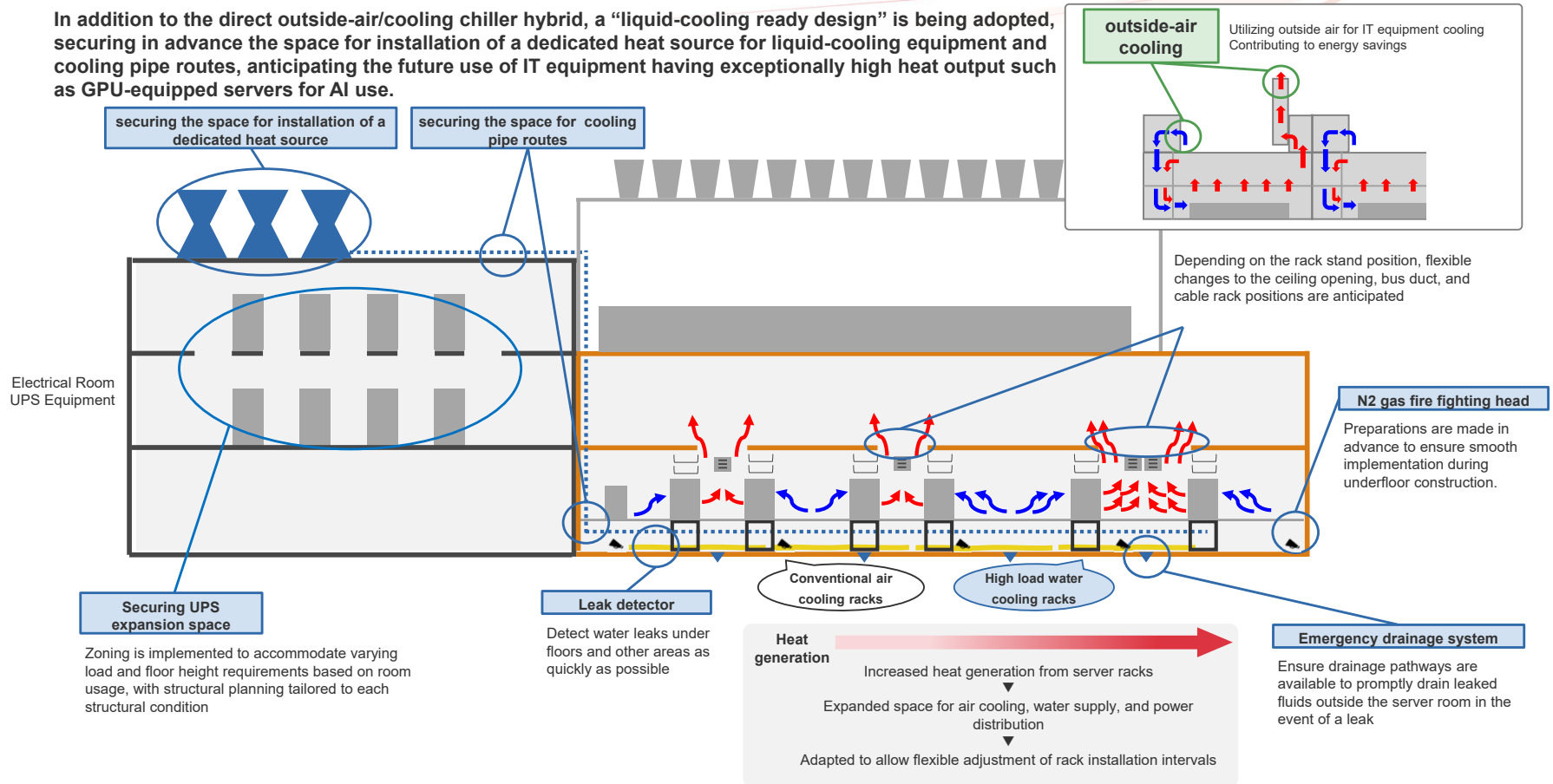
History of Shiroi DCC

- December 2017: Acquired construction land in Shiroi City, Chiba Prefecture, primarily to secure space for in-house service equipment and improve cost efficiency
- May 2019: Site 1 Building opened (reached full occupancy in 2023)
- July 2023: Site 2 Building opened (expected to reach full occupancy in 2026)



Shiroi DCC Phase 3 Building: Overview: Features and "liquid-cooling ready design"

In addition to the direct outside-air/cooling chiller hybrid, a “liquid-cooling ready design” is being adopted, securing in advance the space for installation of a dedicated heat source for liquid-cooling equipment and cooling pipe routes, anticipating the future use of IT equipment having exceptionally high heat output such as GPU-equipped servers for AI use.



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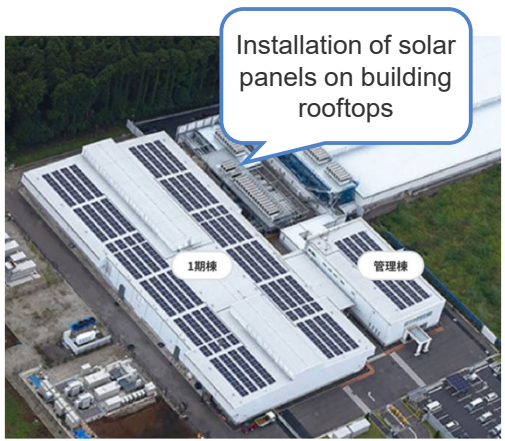
Future Development and Challenges: Coexistence with the Global Environment and Society

- Reducing environmental impact caused by high electricity consumption
  → Industry-wide initiatives aimed at energy conservation and achieving carbon neutrality

- Promoting understanding of high-security facilities located near residential areas
  → Conducting tours for schools and local communities, and leveraging facilities as disaster response hubs

■ Actively introducing renewable energy sources, including solar power

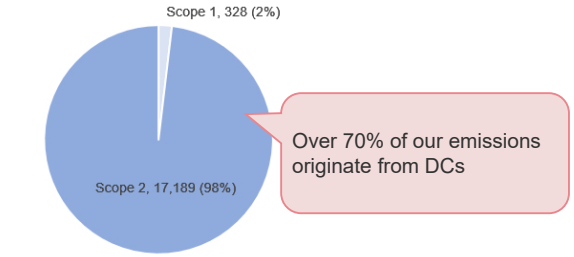


Site 1 Building: Commenced operation in FY2022
Site 2 Building: Commenced operation in FY2025

■ Hosting facility tours for junior high school students

Shiroi DCC Tour
Certain Junior High School / Held in November 2024

■ IIJ Standalone FY2020 Results (Unit: t-CO2)



Calculation Method: "Basic Guidelines for Calculating Greenhouse Gas Emissions through the Supply Chain (Ver. 2.3)" (Ministry of the Environment, Ministry of Economy, Trade and Industry)

For Scope 1 and 2 emissions, which represent the company's own emissions, Scope 2 emissions, reflecting electricity consumption at company-owned data centers, account for 98% of total emissions.

Use of Renewable Energy

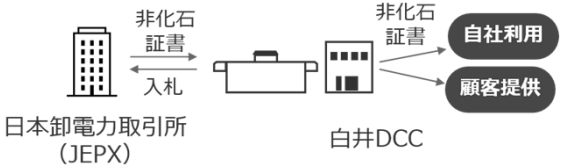
Targeting an 85% renewable energy utilization rate for DCs (Scope 1 and 2) by FY2030

Improving energy efficiency

Continuous innovation to maintain DC PUE at an industry-leading level of 1.4 or below

■ April 2022: Matsue DCP Achieves 100% Renewable Energy Rate

■ FY2023 Shiroi DCC Non-Fossil Certificate Procurement

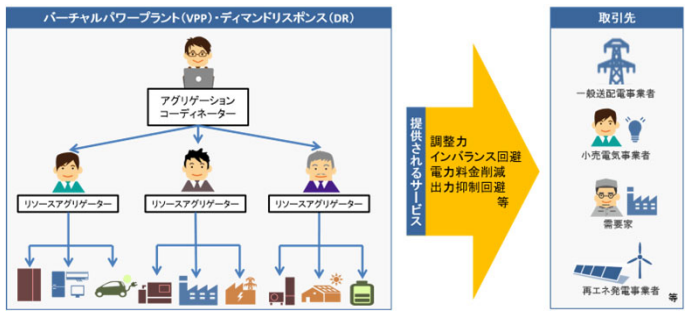


■ FY2022: Introduction of on-site self-generation

Matsue DCP: 300kW

Shiroi DCC: 350kW

■ Participating in Virtual Power Plant (VPP) programs



- Currently participating as a co-proponent in Matsue City's Decarbonization Pioneer Region (a project funded by Japan's Ministry of the Environment).
- Our role is to strengthen regional disaster resilience by installing and expanding large-scale backup power storage batteries at data centers, ensuring emergency power supply to the community when needed.

松江市：「国際文化観光都市・松江」の脱炭素化による魅力的なまちづくり　～カーボンニュートラル観光～

環境省

脱炭素先行地域の対象：**国宝松江城周辺エリア、松江しんじ湖温泉エリア、玉造温泉エリア、美保関観光旅館エリア、防災拠点群、市有遊休地群**
主なエネルギー需要家：旅館・ホテル29施設、民間施設99施設、住宅377戸、公共施設70施設
共同提案者：株式会社山陰合同銀行、ごうぎんエナジー株式会社、中国電力株式会社、日鉄エンジニアリング株式会社、日鉄環境エネルギーソリューション株式会社、株式会社インターネットイニシアティブ、東京海上日動火災保険株式会社、西日本旅客鉄道株式会社、株式会社日本旅行、一般社団法人しまね産業資源循環協会、アースサポート株式会社、一般社団法人松江観光協会

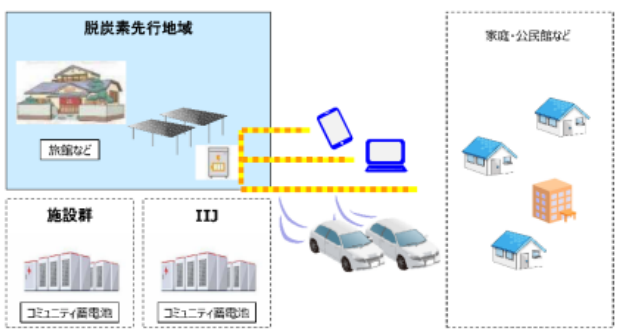
取組の全体像

国際文化観光都市・松江のシンボル的存在である国宝松江城及び周辺エリアの観光施設や、松江しんじ湖温泉と玉造温泉、海沿いの景勝地である美保関町の観光旅館エリアにおいて、既存の卒FIT電力や新規の太陽光発電を活用した**再エネ100%の電力メニュー**を供給して脱炭素化するほか、温泉宿泊施設の給湯機器の省エネ仕様への転換・温泉熱の利活用により、**持続可能な観光の実現**を図る。旅行・宿泊・観光・交通事業者との連携によるカーボンニュートラルツアーで差別化を図り、「**住んでよし・訪れてよし**」の観光都市を目指す。

⑤蓄電池の災害時活用及び完全自立型ソーラーカーポートの設置

市有遊休地群（オフサイト PPA）、(株)IIJ 松江データセンターに設置した蓄電池については、災害時に地域の電力供給インフラとして最大限活用する。また、災害時においても系統からの電力供給無しで運用可能な完全自立型ソーラーカーポート等を設置する。これにより、市民にとっては「安心して住める」、観光客にとっては「安心して滞在できる」災害に強い街・観光地を目指す。

【コミュニティ蓄電池の活用イメージ】



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https://policies.env.go.jp/policy/roadmap/assets/preceding-region/3rd-keikaku-gaiyo-10.pdf

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History of DC Construction and Technology Validation

DC Construction	Year	Proof of Concept (PoC)

IZmo @ Matsue City, Shimane Prefecture
Realization of an Air-Cooled Container-Type DC

Matsue DCP
(Site 1: 2011–)

2010

IZmo Proof-of-Concept
Development and evaluation of containerized DC demonstration units and direct outside air air-conditioning demonstration units

2011

Server High-Density Deployment & Chillerless Operation Demonstration
Calculating cost reduction effects through improved server space utilization, operational evaluation of chillerless systems, and power reduction effects

2012

DC Utilizing the Chimney Effect
Utilizing the chimney effect, server exhaust heat drives air intake and exhaust, ensuring the necessary airflow for cooling without air conditioning units

(Site 2: 2013–)

IZmo @ Domestic Location
Delivered to research institution: 2013

2013

co-IZmo/D Proof-of-Concept
Fabrication and Evaluation of Chillerless Container DC Prototype

IT Equipment Adaptation Testing
Conducted with various server vendors. Evaluation of IT equipment performance in chillerless environments and identification of concerns

2014

co-IZmo/I Proof-of-Concept
Construction and evaluation of a sales promotion container DC prototype equipped with indirect outside air cooling

Server Deterioration Diagnostic Testing
Evaluation of IT equipment degradation rates in chillerless environments and identification of concerns

2015

Power Software Proof of Concept
Evaluation of Power Forecasting and Peak Power Cut Control Software

Container DC Destruction Diagnosis
Destroying fifth-year proof-of-concept containers to diagnose invisible internal mechanisms

co-IZmo/I @Laos

2016

co-IZmo/I v2 Demonstration Experiment
Construction and evaluation of a connected co-IZmo/I demonstration unit. Construction and evaluation of the selective power supply mechanism for fuel cells, PV, and DC-UPS.

co-IZmo/I @Russia

2017

Liquid Immersion Cooling System Proof of Concept
Verification of installability and operability. Comparison with conventional air conditioning equipment. Exploring further applications, including cooling for GPU-equipped servers for AI/HPC.

2018

co-IZmo/Z Demonstration Experiment
Construction and Proof-of-Concept Testing of a Low-Cost Container DC Utilizing Refrigeration Air Conditioning Units

Automation, Battery Storage, AI Control Demonstration Experiment ☆Shiroi to Become DC Technology Development Hub☆
Evaluation of physical robots, RBA/RPA automation platforms, Tesla lithium-ion batteries, and AI-based air conditioning control

Shiroi DCC
@ Shiroi City, Chiba Prefecture: 2019-
Phase 1 Building:
- **1000-rack scale**
- **Outdoor air cooling**

2019

Launch of Shiroi Wireless Campus
Centralized wireless communication technologies like Local 5G and Private LTE (sXGP) in one location. Serves as a venue for customers to experience these technologies and conduct proof-of-concept experiments

2020

Edge Micro DC Proof of Concept
Evaluated a compact DC (approx. 1-2m tall) equipped with essential DC facilities and functions—including server cooling air conditioning, UPS, and physical security—usable as an edge computing infrastructure.

2021

Drone-based surveillance demonstration experiment (Matsue DCP)
Exploring potential for reducing operational burden by utilizing drones for equipment maintenance and DC patrol security

Phase 2 Building:
- **Automation**
- **Green DC**

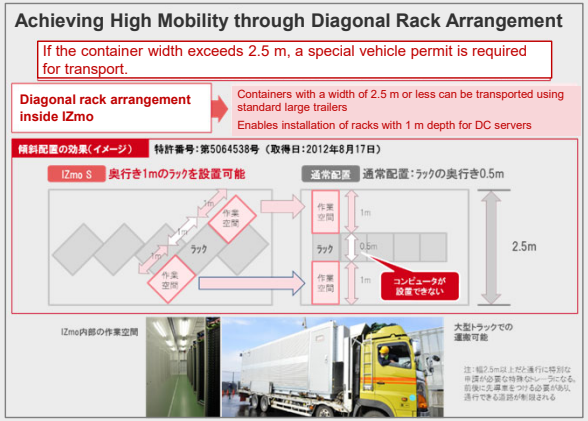
2022

2023

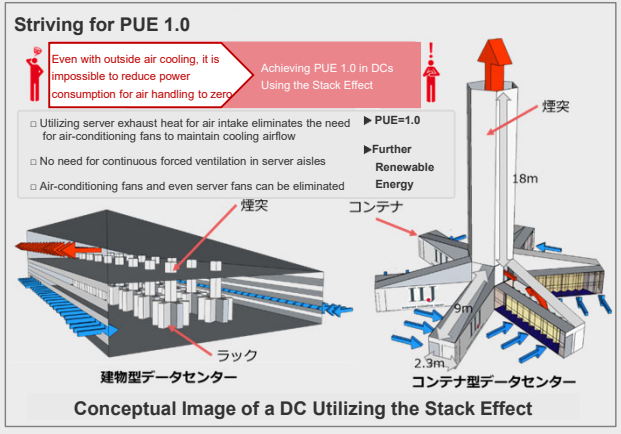
Shiroi DCC's HVAC system received the Technical Award at the Air Conditioning, Heating, and Sanitary Engineering Society Achievement Awards
Recognized for adopting a wall-mounted air conditioning system combined with outside air cooling, optimizing building shape and spatial configuration, implementing AI-driven operational control, deploying displacement ventilation systems in UPS and electrical rooms, and rigorously applying best practices for ICT equipment mounting and airflow control.

2024

Patents



Patent No.: 5064538
(Date of Acquisition: August 17, 2012)



Patent No.: 6153772
(Date of Acquisition: June 9, 2017)

The internet started in Japan in 1992, along with IIJ. Since that time, the IIJ Group has been building the infrastructure for a networked society, and with our technical expertise, we have continued to support its development. We have also continued to evolve our vision for the future and innovate to make it a reality. As an internet pioneer, IIJ has blazed the trail so that others could realize the full potential of a networked society, and that will never change. The middle "I" in "IIJ" stands for "initiative," and IIJ always starts with the future.