

Energy saving technology for data centers

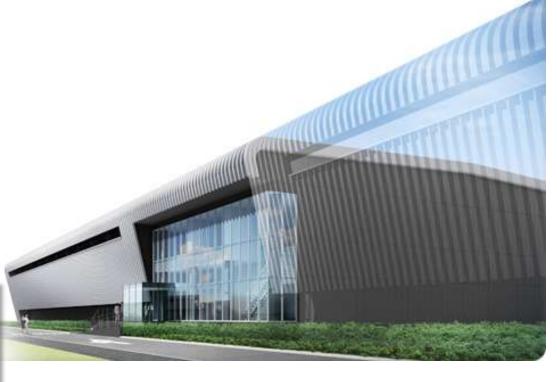
HVDC (High Voltage Direct Current) + 12V Server rack system

Green Solution Business Unit
Environmental Technology Division
NTT DATA INTELLILINK Corporation









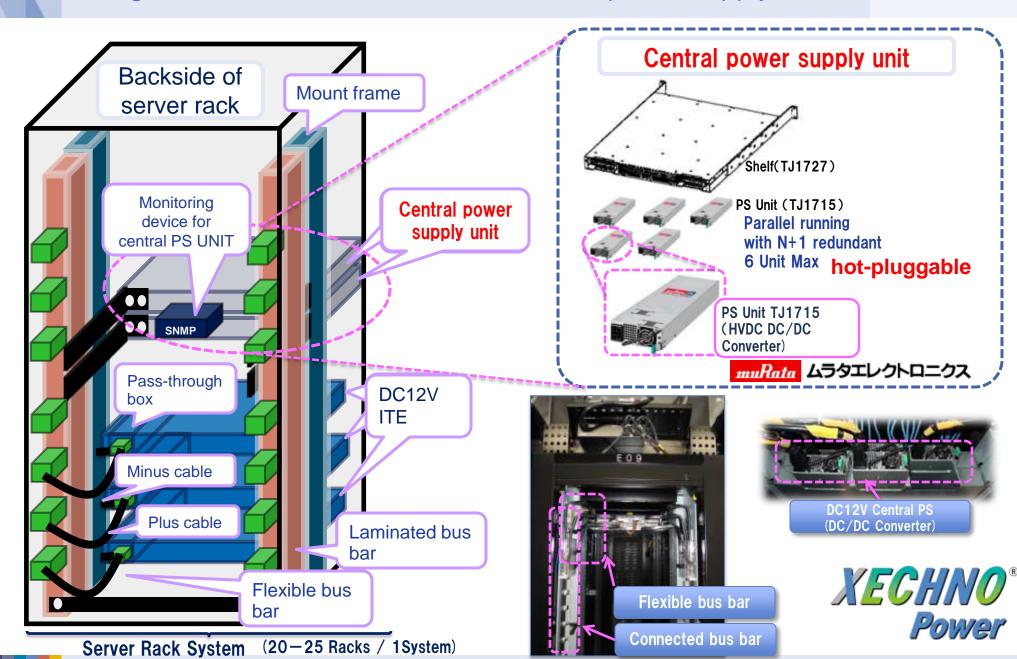
- System:

 DC12V Type HVDC Power Supply System

 (Product: FRESH HVDC® and XECHNO® Power)
- Location: Ishikari DC of Sakura Internet
- Range: 19Racks 140kW

Configuration: XECHNO-Power and central power supply unit





What HVDC DC12V type can do for You

NTT Data

Benefit 1

HVDC DC12V can help you succeed in the future with greater productivity and lower costs.

Benefit2

- ◆ Total Efficiency higher than 90% with reducing the number of conversion!
- High efficiency with real loading factor, unlike UPS
- Intensive PS system with central power supply unit in server rack
- Reduction of electricity charge

Energy-saving effect

Safety

- Solving high voltage-current problems!
 - Arc suppression circuit
 - Middle point ground
 - · DC12V

- Non-stop maintenance and expansion through n+1 redundancy!
- Seamless connection to battery during power outage!
- Less AC conversion!
- Eliminating PS form ITE, long-lasting, highly-reliable!
- Fanless, liquid-capacitor less!

High reliability

The future technology

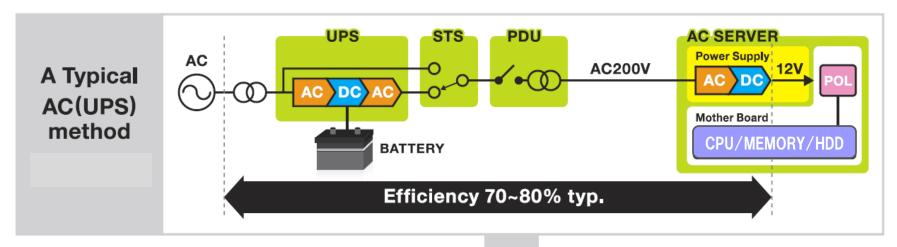
- Solar power
- LED Illumination
- Fuel cell
- Cooling system with outside air
- Superconductors etc…

Benefit3

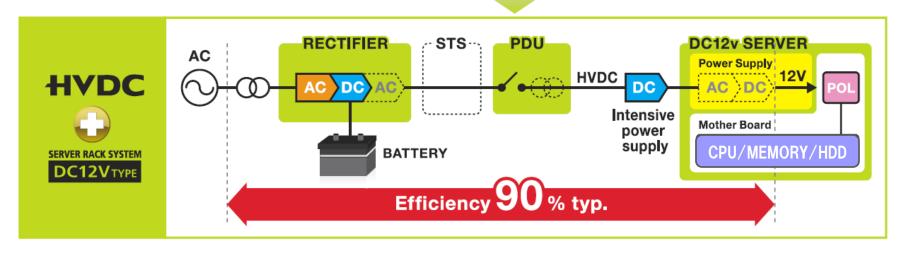
Benefit4



HVDC DC12V Power Supply System reduces AC/DC conversions between commercial power and ITE. Power loss is reduced by approximately 10-20%.

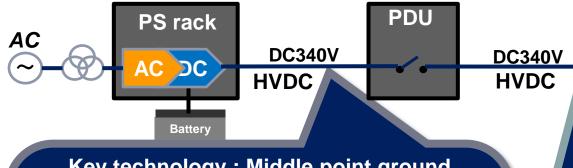


Approximately 10-20% electric energy reduction





Multiple safety guard!



Server (DC12V) **Mother board** DC12V **CPU** HDD Memory

Central Redundant Power Supply

Server

DC

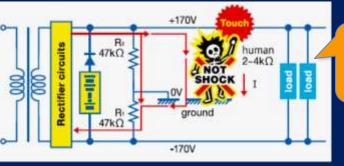
rack

Key technology: Bus bar



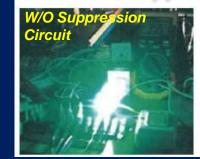
Key technology: Middle point ground

The current is limited within safety current for human through high resistors of $47K\Omega$.



Dangerousness by the high voltage had been pointed out. But ,,,

> **Key technology: Arc suppression circuit**





Resolved the arc discharge issue at the time of switch-on/off and disconnection.

The difference UPS to HVDC-DC12V **NTT DaTa** DC380V SERVER **PDU Switching UPS** DC/AC AC **Power supply** Power supply (Isolation AC/DC) (PWM Switching) (PWM Switching) Mother (PWM Switching) **Board Switching** Power supply **Battery** (Isolation AC/DC) (PWM Switching) **PDU UPS** n =80~92% DC/AC AC DC12V Power supply (PWM Switching) (PWM Switching) **Battery** Conventional DC12V DC200~400V **Diode Rectifier** DC12V SERVER $\eta = 99.5\%$ (Non-Isolation) Non-stable power supply (Non-Switching) **PDU Switching** DC340-380V Pass-Through Power supply (Isolation DC/DC) (W/Protection) Mother (PWM Switching) η =98~99% PDU **Board** n+1 n+1 redundant redundant **Battery** $n = 93 \sim 95\%$

Battery

Battery

n+1 redundant

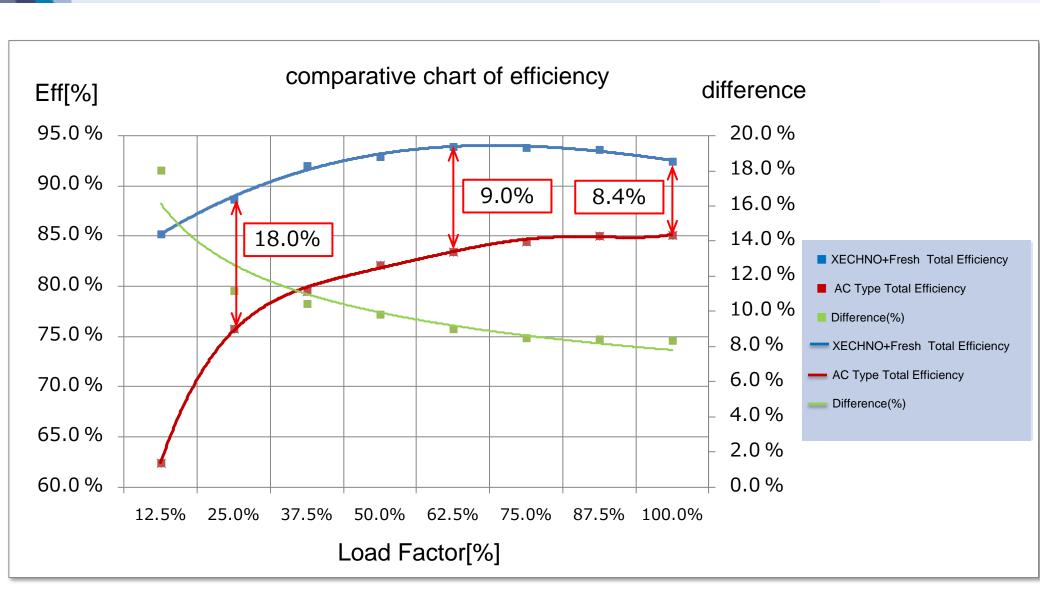
AC

AC

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Energy-saving effect: Total efficiency of HVDC





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Solar Power + HVDC



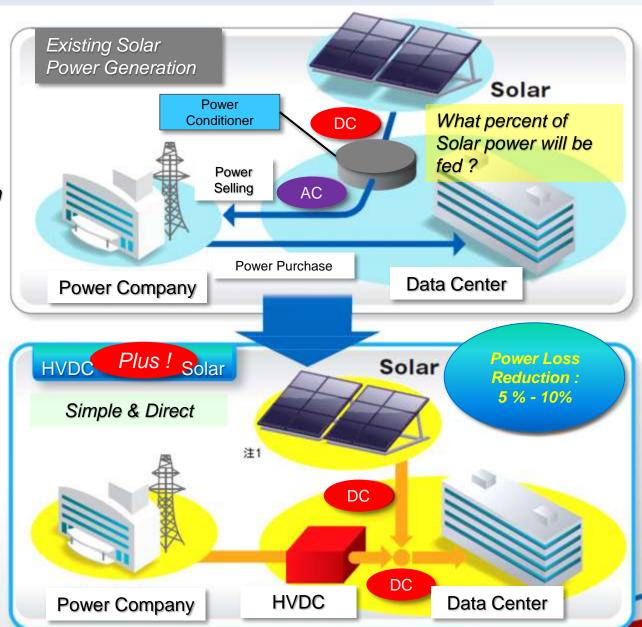
Drive The Future Communication with Sunlight!

Solar battery generates DC that's the same as HVDC!

- ➤ Doesn't need Power Conditioner
- ➤ Local Generation for Local Consumption
- Reasonable Investment

... Say goodbye to Power Conditioners.





International standardization activity for DC12V



DCEM-WG has officially started as a member of Green University of Tokyo Project

DCEM-WG (Data Center Energy Management Working Group)

■SWG1 · · · · DCIM (Data Center Infrastructure Management)

■SWG2····HVDC system(High Voltage Direct Current System)

to be standardized internationally (ITU etc.)

to be standardized internationally (ISO/IEEE etc.)



ASP • SaaS • Cloud Consortium

Ministry of Internal Affairs and Communications

Step 3

Japan Data Center Council (JDCC)

Ministry of Economy, Trade and Industry DPPE

Datacenter Performance Per Energy



Step 2
Technical Spec



Green University of Tokyo Project

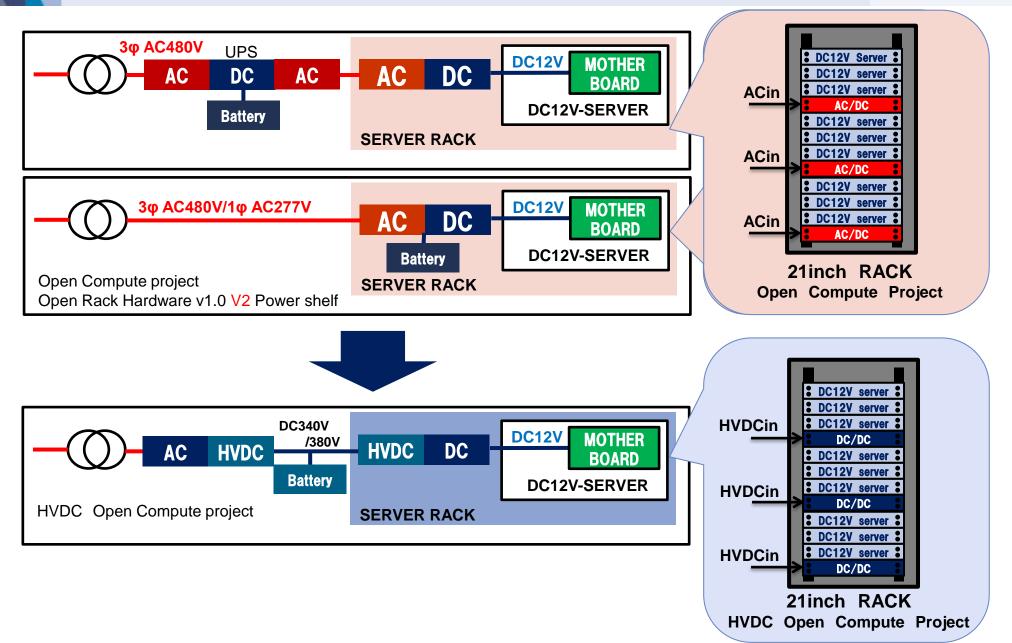
DCEM-WG



To make the Technical SPEC for HVDC/12V PS with DCIM, After one year, via demonstration experiments, we will set the standard for DC12V

High Voltage Direct Current – Open Compute Project









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