Case Study

Advanced Telecommunications Research Institute International (ATR)

Next generation energy control system at Keihanna Datacenter – optimizing datacenter power consumption using Datacenter Energy Management System (DEMS).

The customer

Country: Japan
Sector: Public Sector
Website: www.atr.jp/index_e.html

The challenge

- Reduce power costs with an efficient data center facility
- Include voltage and AC/DC conversion power module for each server
- Introduce new efficient datacenter operations including effective exhaust heat utilization

The solution

FUJITSU Server PRIMERGY RX200 S7 was selected for the Datacenter Energy Management System (DEMS) as its Power Control Unit functionality to improve the energy efficiency via a HVDC (High Voltage Direct Current) +12V power supply and reduce overall TCO.

Prof. Morito Matsuoka, Osaka University, The Cybermedia Center (CMC)

The customer

Keihanna Datacenter, established as the Ministry of the Environment's technology verification project, started verification tests on 15th July 2013. The Keihanna Datacenter was built at the Advanced Telecommunications Research Institute International (ATR) on 1st October 2013. The datacenter operates as part of the Japan Ministry of the Environment's FY2013 project to "Strengthen measures to reduce CO_2 emissions through technological development and verification", and is equipped with the newest technology for linking DEMS (Datacenter Energy Management System) and VM (Virtual Machines).

The challenge

The main aim was to improve overall energy efficiencies by lowering carbon production in the datacenter and improving exhaust heat utilization in the offices.

NTT Data Intellilink Corporation, Osaka University, Takasago Thermal Engineering Co.Ltd., and ATR formed the core management structure for the project, while Fujitsu and Schneider Electric joined as technology partners, with Fujitsu providing FUJITSU Server PRIMERGY RX200 S7 and fan-less servers.

The project was centered on "Joint technology development to reduce carbonization in the datacenter and to improve exhaust heat utilization in the offices". Focusing on Better Usage of Server Exhaust Heat, the datacenter was designed to drastically reduce CO_2 exhaust. Thus, in order to improve Exhaust Heat Utilization (as the temperature of exhaust heat is high), servers which provide stable performance in high temperature environments were required.

Another aim of this project was to promote cross industry collaboration rather than entrust the project to one company. "The previous datacenter was vertically integrated and controlled by one company. However as a datacenter environment is a comprehensive system combining a variety of components, reducing the power consumption of isolated ICT devices, such as servers or air cooling systems, does not necessarily decrease overall datacenter energy consumption. To effectively improve overall system efficiency, companies from each specialist area were engaged including air cooling, hardware and datacenter management." Prof. Matsuoka

The benefits

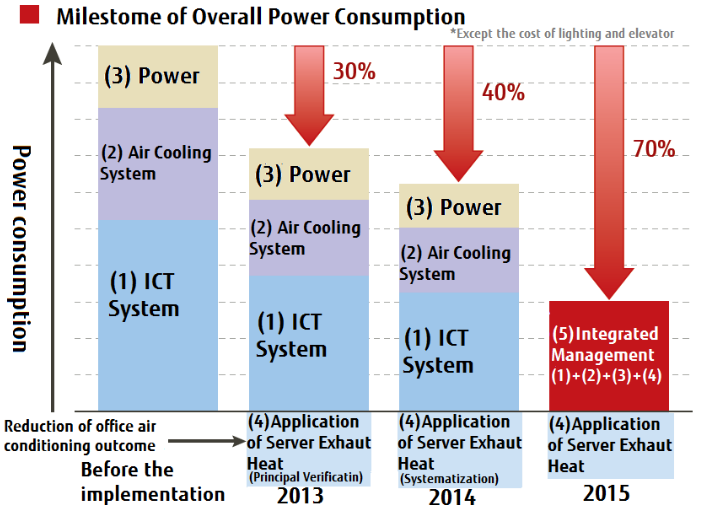
- 12 DC power supply improves energy efficiency (AC/DC) to 90%
- Reduce TCO by combining highly efficient intense power supply (HVDC) and direct current power supply compatible server
- FUJITSU Server PRIMERGY RX200 S7 operates in environments over 40℃
- Reduce power consumption by 30% in FY2013 and strive for a 70% reduction in FY2015

The solution

When ICT components are virtualized and tasks are consolidated, power consumption generally decreases. However this also creates hot spots that require additional cooling, thus leading to increases in expenditure on air conditioning. For this reason, to minimize overall electricity consumption, there must be complete consideration of all components including ICT and air conditioning. DEMS-VM Linked Control is an approach that controls energy consumption by linking vendor developed virtualization systems with DEMS. DEMS is an integrated management system involving 3 individual controlling units; Cloud Control Unit, Air Conditioning Control Unit, and Power Control Unit.

Technical elements of the project consisted of; (1) ICT System: Exhaust heat consolidation using FUJITSU Server PRIMERGY RX200 S7, a model ideal for high temperature environments; (2) Air Cooling System: Integrated low air flow system and individual rack fan using a Wall-Mounted Cooling Structure; (3) Low-Loss Power System: Reduce power loss with implementation of the HVDC+12V and linked controller; (4) Application of Server Exhaust Heat: Humidity control using a high temperature exhaust heat recycling system that is phased across 3 channels, Cold Aisle (20-25 degrees) on the left, Hot Aisle(35 degrees) in the middle, and Super-Hot Aisle(40-50 degrees) on the right; (5) Integrated Management: Manage systems (1)-(4) together in real time, optimizing overall datacenter efficiency and minimizing overall power consumption.

Milestome of Overall Power Consumption



Products and services

- Fujitsu Server PRIMERGY RX200 S7

The System overview

The datacenter increased power efficiency through the (3)Low-Loss Power System by implementing the HVDC+12V. This HVDC+12V was developed by NTT Data Intellilink Corporation as a method of supplying 12V DC, the standard operating voltage of servers and storage, directly to the datacenter server rack, thereby improving operational efficiency. The advantages achieved by implementing the solution include; (1) 20% reduction in power consumption by lowering the power conversion frequency (AC/DC); (2) A seamless connection to the battery during a power outage; (3) Security with electric shock prevention and earth fault measures; (4) Affinity with recyclable energy (solar power); (5) Low cost.

From the 374 servers that operated with Alternate Current (AC), 154 were switched to HVDC+12V from December 18th 2013. This was achieved by connecting FUJITSU Server PRIMERGY RX200 S7 to NTT Data Intellilink Corporation's XECHNO Power HVDC power supply unit. The HVDC solution consists of two parts; the HVCD System and the Server Rack System. The high-voltage AC is converted to DC340V at the Rectifier (AD/DC), the current is then reduced from DC 340V to DC12V at the Intensive Power Supply and is finally supplied to the DC12V server rack. The previous system needed to convert AC/DC three times, while the HVDC+12V method only requires one AC/DC conversion. This ensures the power utilization efficiency (heat exchanging efficiency) of the AC power supply system to be increased to 90%, with a 10-20% reduction in power from the previous current supply system which operated at 70-80% utilization efficiency.

"Following the HVDC implementation, initial server efficiency improved by 5% compared to the previous AC method." Prof. Matsuoka

Prof. Matsuoka explains the reason HVDC+12V and the servers were chosen for this verification project. "The technical advantage with implementing the 340-380V direct current is the larger tolerance for stray current or voltage fluctuation, keeping the current at a minimum before it arrives at the server. While it costs to build security and an arc discharge system for using high voltage currents the power module also requires voltage conversion for each server, therefore we decided to work with this method and product." Prof. Matsuoka

The benefits

The datacenter aims to reduce power consumption by 70% through energy coordination initatives. "We plan to reduce power consumption by 30% by end of FY2013 and 40% by end of FY2014, with a long term goal of a 70% reduction in FY2015. Our objective is achieavable using the HVDC+12V approach and wall-mounted air flow system. Although by FY2015 the plan will require us to have all datacenter operations fully integrated to optimize overall power consumption." Prof. Matsuoka.

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