

Energy Saving Project for Datacenters

Yutaka Hiramatsu
 Masaki Ito
 Koichi Koyano, Dr. Eng.
 Hiroshi Hanyu
 Toshiharu Usuki

OVERVIEW: In regard to datacenters, which support business information systems, as the power consumption of datacenter equipment increases and demand for such datacenters spreads, power consumption of all datacenter equipment and facilities — namely, not just IT equipment such as servers and storage but also other devices such as air-conditioners and uninterruptible power supplies — is becoming an urgent issue. Accordingly, the Hitachi Group is expanding product commercialization of the IT equipment and facilities needed in these datacenters, and by applying our collective efforts, we have established and are actively promoting a datacenter power-saving project — called CoolCenter50. The aim of this project is to cut power consumption of an entire datacenter by 50% over the next five years. What’s more, aiming to vigorously promote power saving for the IT equipment that lies at the heart of these datacenters, we have established the Harmonious Green Plan. This plan prescribes the technological-development fields for strengthening power saving in datacenters at the operation, equipment, and component levels. Through these activities, we are also targeting significant reduction of CO₂ emission.

INTRODUCTION

WHILE the increasing trend in the number of datacenters continues unflaggingly, the increasing density and electrical power consumption of IT (information technology) equipment are creating urgent issues regarding measures to deal with electricity and heat in datacenters. According to a forecast by the US Environmental Protection Agency, if present circumstances continue as is, the electrical power consumption of datacenters in the USA will double in five years time (see Fig. 1). Under these circumstances, various industry groups such as “The Green Grid” (promoting electrical-power saving for datacenters) and the “Climate Savers Computing Initiative” [promoting electrical-power saving for PCs (personal computers)] have been set up in quick succession, thereby raising the energy-saving consciousness of governments, vendors, and users alike.

In Japan, likewise, the drive towards energy saving in regard to IT — exemplified by the Ministry of Economy, Trade and Industry’s “Green IT Initiative” — is intensifying. Above all, it is in datacenters,

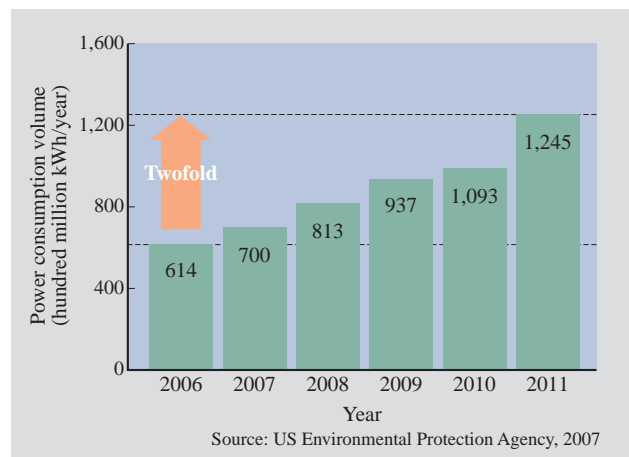


Fig. 1—Forecast Total Power of US Datacenters (2006–2011). In the USA from 2006 to 2011, total power consumption in datacenters is forecast to double, so drastic measures are needed.

which contain IT equipment in large quantity, where such energy-saving measures are imperative. According to a breakdown of power consumption of a typical datacenter in Fig. 2 (top), air-conditioning

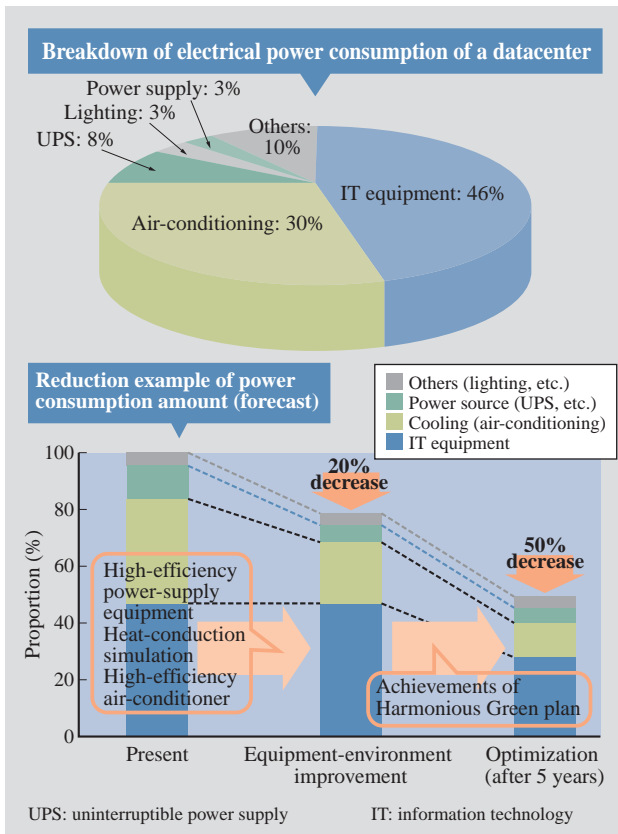


Fig. 2—Breakdown of Power Consumption of a Datacenter and Power-consumption Reduction Model.
 As for a datacenter, power consumption of IT equipment does not exceed about half of total power consumption, so it is also necessary to boost efficiency of the whole center, including equipment such as UPS, transformers, and air-conditioners. Hitachi is pursuing energy saving for improving the equipment environment as well as IT equipment.

equipment, power-supply equipment, lighting, etc. as a whole consume a similar amount of electricity to that consumed by IT equipment. Accordingly, comprehensive energy-saving measures that cover all equipment, that is, not just IT equipment, are needed.

In the rest of this report, the Hitachi Group’s energy-saving project for datacenters — CoolCenter50 — is described (see Fig. 3).

A POWER-SAVING PROJECT FOR A DATACENTERS: COOLCENTER50

In response to the call for comprehensive energy-saving measures for datacenters, Hitachi (which commercially produces all kinds of devices and facilities for datacenters) is combing our collective commercialization efforts in setting up the CoolCenter50 project, which has set a target of reducing total datacenter power consumption by up to 50% over five years. At present, we are speeding up development of the energy-saving technologies to meet this target.

In regard to main IT products, priority areas for power reduction and a technology roadmap were established as the Harmonious Green plan, and product development is instigated by the research and development sector as a whole in the manner described in the following.

As for facilities, air-conditioning efficiency of server rooms is being optimized, and, for example, energy-saving technology for air-conditioning and power-supply equipment and technology for

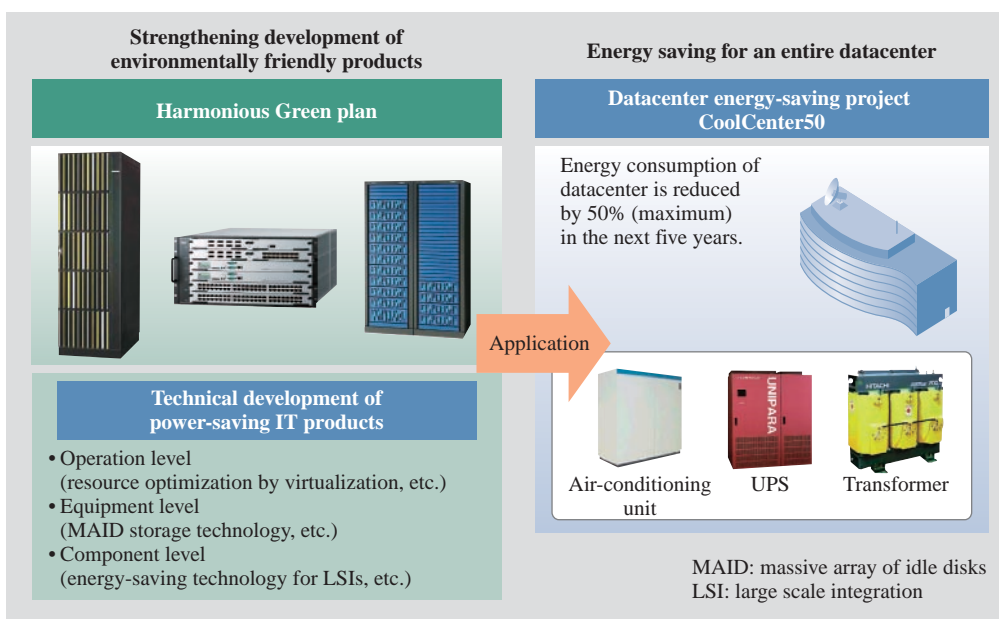


Fig. 3—Activities of the Hitachi Group Concerning Energy Saving for Datacenters.
 Setting a target of a maximum 50% reduction in electricity consumption of datacenters over five years, Hitachi is promoting the CoolCenter50 project for power saving in datacenters (beginning with electrical power saving for main IT products).

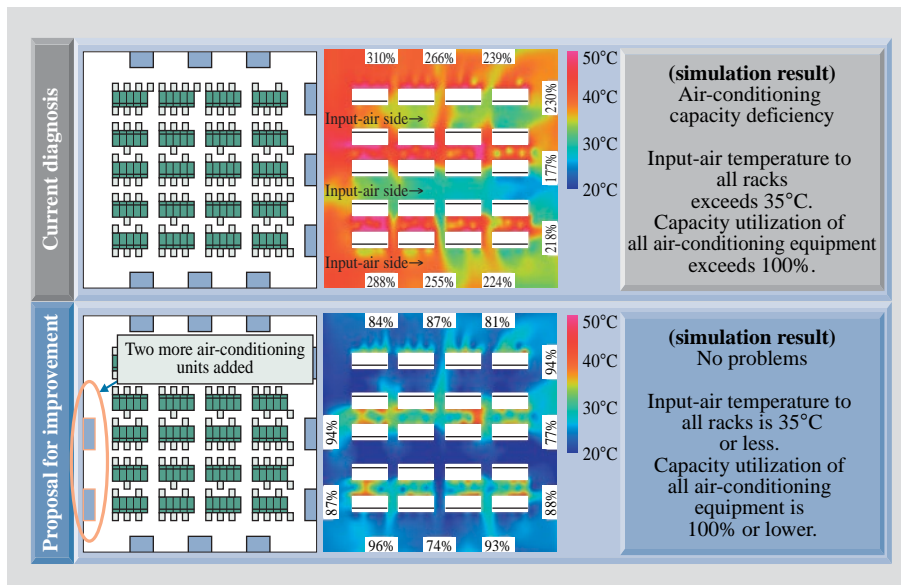


Fig. 4—Air-conditioning Environment Consulting Service. By means of simulation, temperature distribution in server room, airflow distribution, and air-conditioning utilization rate are calculated, and air-conditioning efficiency can be optimized.

optimizing control of air-conditioning units en masse (in response to load on IT equipment) are being developed.

Applying these energy-saving technologies and optimizing the power consumption of an entire datacenter are expected to cut power consumption by 50% (at most) over five years in comparison to present-day consumption. As for datacenters within Hitachi, these energy-saving technologies are already being applied, and while the results of these applications are being verified, foundation of new datacenters — based on these results — is going ahead.

Such know-how gained within Hitachi is bundled together as solutions, and our approach for datacenter power saving is systemized in five steps, namely, “diagnosis,” “improvement,” “operation and management,” “optimization,” and “construction,” and each step is presented as a “construction and improvement solution” targeting customers’ datacenters. Each of these solutions is described in the following sections.

Diagnosis

As for the diagnosis step, power efficiency of a datacenter (including IT equipment, power-supply equipment, and air-conditioning systems) is diagnosed in total. In particular, regarding server rooms, a consulting service for air-conditioning environments is being provided. This service uses a three-dimensional airflow and heat-transfer simulator, calculates temperature distribution, airflow distribution, and air-conditioner operation ratio. From that data, for

example, it then determines whether or not the cooling performance of an air-conditioning facility is sufficient and whether local “hot spots” are occurring.

Improvement

In the next step, based on the results of the diagnosis step, a plan for improving air-conditioning efficiency by reviewing locations of equipment, devices, and wiring and by eliminating hot spots is set up, and measures and policies for energy saving by properly setting the number of operating air conditioners are proposed. An example of such an improvement plan for deficiency in air-conditioning performance is shown in Fig. 4.

Optimization

Although the improvement step mainly aims at efficiently using existing equipment, in the optimization step, replacement with Hitachi’s energy-saving equipment is recommended. That is to say, while engineers with full knowledge of the features of each piece of equipment are collaborating, the power consumption of the entire datacenter is optimized. By applying virtualization technology in regard to IT equipment, Hitachi will, for example, continue to develop optimization solutions through power-saving operation and reduction of server number by server integration.

Operation and Management

Hitachi is providing solutions that visualize temperature and humidity of individual server racks

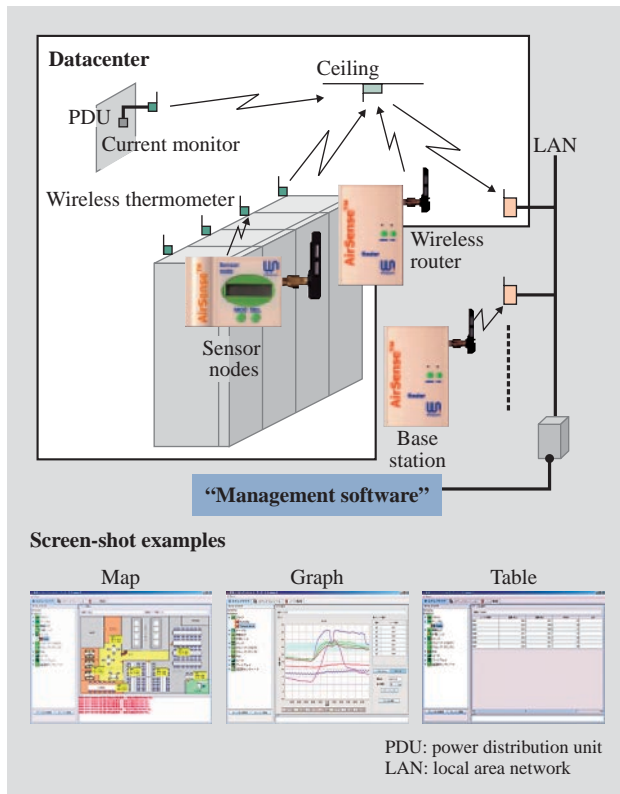


Fig. 5—Sensor Information System.
By carefully locating wireless sensors, “visualization” of energy-saving is facilitated, and optimization of equipment environment is accomplished.

by using a sensor-network information system. Connecting this system with an electric-power monitoring system makes utilization possible as an “energy management system” (see Fig. 5). Visualizing energy consumption makes it possible to attain stable server operation and cut management costs. From now onwards, we plan to offer solutions for connecting IT equipment and facilities and autonomously managing optimum conditions of an equipment environment.

Construction

Targeting datacenter operators either building new datacenters or extensively refurbishing existing ones, Hitachi plans to offer solutions that utilize energy-saving technologies and our extensive know-how on datacenter construction in order to provide total support — ranging from new datacenter construction to maintenance and repair.

HARMONIOUS GREEN PLAN FOR PROMOTING ELECTRICAL-POWER SAVING FOR IT EQUIPMENT

Aimed at the major IT products, such as servers,

storage, and network equipment, provided by Hitachi, the Harmonious Green plan provides a roadmap for development of power-saving technologies over the next five years, and it promotes power saving at three levels: parts level, equipment level, and system operational management.

Energy Saving for Components and Equipment

As for components, electrical-power saving in power-supply modules and LSIs (large-scale-integration devices) are given priority. As some specific examples, highly efficient power-source circuits and devices as well as high-speed and high-reliability semiconductor power-saving technology (which is accumulated in the LSIs on which peoples’ livelihoods depend, including leak control and power shutdown of selected areas according to multiple-power-source categorizations) are being developed.

As power-saving technology for equipment, an assortment of storage media and cooling is drawing attention. For example, we are developing MAID (massive array of idle disks) technology, for restraining or stopping disk rotation in groups of HDDs (hard disk drives) and “heat-sink technology,” based on technology cultivated in supercomputers, for improving cooling efficiency. In particular, application of MAID technology, which is already implemented in mid-range storages, will be gradually expanded to other products.

Energy Saving for IT-system Operational Management

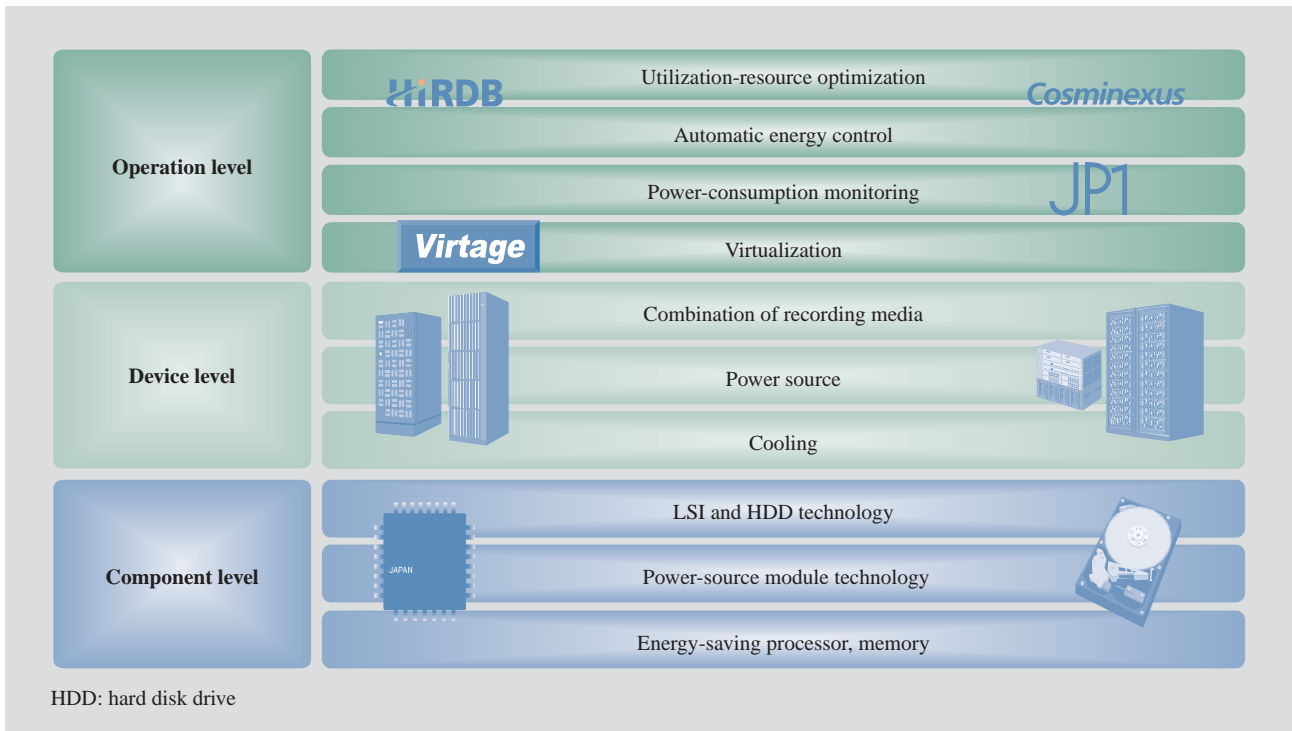
To enable a user to fully utilize power-saving functions of IT equipment, autonomous operation management is a key for power saving. Accordingly, Hitachi is expanding our unique server virtualization function “Virtage” and our volume virtualization function Hitachi Dynamic Provisioning, and continuing technical development on three levels (described below): power-consumption monitoring, power-consumption-control automation, and optimization of available resources (see Fig. 6).

(1) Power-consumption monitoring

System behavior and electrical current are visualized, and the power supply to unused components is cut off.

(2) Automated power control

To actively boost the number of unused components and components with low capacity usage ratio (which are the targets of power reduction), scheduling is controlled in such a manner as to localize jobs and



HDD: hard disk drive

Fig. 6—Priority Areas for Electrical-power Saving.

For major IT equipment (like servers, storages, network devices, etc.) provided by Hitachi, priority areas aimed at energy-consumption reduction are drawn up, and product development in those areas is promoted.

Product type	Product	Energy-saving technology
Server	BladeSymphony 320 ecology server blade IA ecology server series	Low-power-consumption processor, memory, and HDD are adopted.
Storage	Hitachi Tape Modular Storage	Low-power-consumption tape device is integrated with disk array.
	Hitachi Adaptable Modular Storage Hitachi Workgroup Modular Storage	Adoption of MAID technology for controlling revolution of HDDs
Network	Router switch	By means of a “concentration engine system,” logic components can be significantly reduced and heat-generating components can be selected carefully.

TABLE 1. Example of Energy-saving IT Equipment
 Within the Harmonious Green plan, energy-saving technology is promoted, and the application range for products is expanded.

data access, so operational performance changes in response to load.

(3) Optimization of available resources

We will fully grasp the operation of the software and optimize the operational contents so that it only requires the minimum power consumption as an IT system according to the operation policy.

Products applying the three power-saving techniques described above are listed in Table 1. These products are just a few examples; from now onwards, products and operation technology based on our IT power-saving plan will be actively

promoted.

Through this cutting-edge technology, Hitachi is participating in and contributing to power-saving activities around the world (such as the “Climate Savers Computing Initiative”). We will continue to make maximum use of the know-how gained from these activities in our products and technological developments in order to provide power-saving IT products on the cutting-edge.

CONCLUSIONS

This report described the overall condition of

electrical-power saving in datacenters as well as Hitachi's power-saving project called CoolCenter50. As a partner concerned with customers' datacenters as well as our own, the Hitachi Group will vigorously promote power-saving projects and continue to lead the field in activities concerning power saving for datacenters.

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ABOUT THE AUTHORS



Yutaka Hiramatsu

Joined Hitachi, Ltd. in 1986, and now works at the Business Promotion Department, the Outsourcing Data Center, the Outsourcing Services Division, the Information & Telecommunication Systems. He is currently engaged in management and business planning and energy saving project of datacenters.



Masaki Ito

Joined Hitachi, Ltd. in 1989, and now works at the Harmonious Computing Management Center, the Strategic Business Development Division, the Strategy Planning & Development Office, the Information & Telecommunication Systems. He is currently engaged in product strategy and technological development of Green IT. Mr. Ito is a member of the IEEE and Information Processing Society of Japan.



Koichi Koyano, Dr. Eng.

Joined Hitachi, Ltd. in 1994, and now works at the Data Center Energy Saving Project Office, the Business Planning Operation, the Enterprise Server Division, the Information & Telecommunication Systems. He is currently engaged in development of energy saving technology for servers. Dr. Koyano is a member of The Japan Society of Mechanical Engineers.



Hiroshi Hanyu

Joined Hitachi, Ltd. in 1990, and now works at the Wirelesinfo Venture Company. He is currently engaged in marketing and business development of "wireless sensor network" solutions.



Toshiharu Usuki

Joined Hitachi, Ltd. in 2006, and now works at the Energy-Saving Center Promotion Department, the Outsourcing Data Center, the Outsourcing Services Division, the Information & Telecommunication Systems. He is currently engaged in promotion of the energy-saving business for datacenters.