

Energy Savings in the Datacenter

> Sun Professional ServicesSM Sample Case Studies

Common problems affecting energy efficiency in the datacenter today include:

- Oversized air conditioning systems
- Excessive outside air introduction
- Poorly calibrated sensors
- Inappropriate setpoints
- Breaches in the vapor barrier
- Excessive humidifier operations
- Inappropriate reheat
- Inappropriately sized electrical infrastructure components
- Old infrastructure technology
- Inefficient air distribution
- Obsolete controls and monitoring
- Inappropriate rack/cabinet design or implementation
- Inappropriate hardware configuration

These and other factors can greatly reduce energy efficiency, increase costs, and impact availability.

Fine tune your datacenter environment to maximize energy efficiency and reduce operating expenses while maintaining a high availability environment. Carbon footprint and greenhouse gas generation are directly related to energy utilization in your facility. Whether designing a new facility or re-evaluating your existing space, Sun has the experience and solutions to help you achieve your goals without affecting hardware availability.

Balancing efficiency with availability is a challenge in every datacenter. Sun Professional ServicesSM has been helping customers with this problem for over 25 years.

Through a full suite of assessment, optimization, and design and build services, Sun Professional Services helps customers identify issues, get the most out of their existing infrastructure and plan for the future.

The following Case Studies are based on actual customer facilities and represent real solutions. These examples are based on data from comprehensive assessments, and are the summary highlights for the recommendations and savings.

Case Study # 1

Enhance datacenter design to accommodate growth.

Case Study # 2

Over-sized UPS Systems for a new datacenter.

Case Study # 3

Unnecessary supplemental cooling and calibration problems.

Case Study # 4

Inefficient cooling from contradictory A/C functioning.

Case Study # 5

Elimination of excess cooling capacity and external influences.

COMPANY Mobile communications company

SITE LOCATION Malaysia

- ISSUES**
- Aging infrastructure technology
 - Inefficient rack design
 - Previous consultant suggestions not “green” enough

The customer faced the prospect of running out of space and power at its datacenter within three-to-five years. Failure to overcome this problem would affect the business and also reflect poorly on management performance.

The company realized it needed a next-generation datacenter design that followed best practices and would be energy-saving, eco-friendly, and cost-effective. The company was looking for ways to enhance its Average Revenue Per User (ARPU) and reduce its Total Cost of Ownership (TCO), so the prospect of a more efficient datacenter with good Power Usage Efficiency (PUE) was very attractive.

Site managers discussed possible “green” features and design options with many leading suppliers and consultants, but their suggestions did not go beyond traditional standards. The customer saw drawbacks to these limited options and continued to look for a new design solution.

- RECOMMENDED RESOLUTION**
- Implement an innovative new datacenter design with a total floor area of 60,000 square feet
 - Replac existing traditional raised-floor design with a slab floor design
 - Architect a group of racks in a modular “pod” design to optimize power, cooling, and connectivity systems
 - Address density loads from 4-30kW with the pod architecture
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- SAVINGS CALCULATION**
- Implementating of these recommendations reduces the energy required to operate the datacenter. This solution is also more cost effective and eliminates the need for more space.
- Anticipated total CAPEX savings of US \$5.8 million
 - OPEX reductions of at least 20% with the potential for Power Usage Efficiency (PUE) of 1.9 to 2.5, depending on zoning
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ADDITIONAL BENEFITS By moving the network racks, cabling, and equipment to the pod itself, flexibility is increased and the amount of cabling is reduced. The slab floor is a simpler, cheaper, and stronger solution that eliminates the concerns associated with an elevated floor, such as moving heavy equipment and safety issues.

COMPANY Provider of internet access, phone, and email services

SITE LOCATION USA

- ISSUES**
- Initial hardware operating load of 180kW
 - Estimated three-year growth to 460kW
 - Estimated six-year growth to 820kW
 - Estimated ten-year growth to 1250kW

The customer originally had their system configured to meet 10-year growth numbers and planned to install systems to meet this capacity. The base system was configured as a redundant (N+1) system sized at five-year and ten-year load estimates planned with 1 step growth.

UPS systems have poor performance at loads below 25% and efficiency is lost in the process of keeping the larger components energized and online.

- RECOMMENDED RESOLUTION**
- Design electrical distribution for phased growth.
 - Sub-divide distribution to smaller modules.
 - Modularize UPS system to closer match growth profile while maintaining redundancy.
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- SAVINGS CALCULATION**
- Implementing these recommendations eliminates the energy required to operate the oversized UPS units. This also results in a reduction in cooling for the energy utilized.
- Energy Savings = 67,338,000 kWh over ten years
 - Monetary Savings = \$5,387,000 USD over ten Years
 - CO₂ Savings = 46,127 tons over ten years
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ADDITIONAL BENEFITS

Reduces initial cost for installation. Capital expenditures are matched against business requirements. Reduces system maintenance costs through smaller components. Significantly reduces the total life cycle consumption of batteries and the energy/carbon required to produce and operate them. Additional savings are realized by the installation of smaller generators and electrical components with smaller modular distribution.

COMPANY Provider of employer-related business process management services

SITE LOCATION USA

- ISSUES**
- Unnecessary supplemental cooling
 - Unnecessary associated humidification
 - Unbalanced conditioned air distribution
 - Cooling deficiencies, including low subfloor pressure from excessive perforated tiles and air conditioner control issues

In a conventional datacenter with downflow air conditioning for primary cooling, the site personnel instituted the use of a central building air conditioning system as a supplement to address perceived cooling deficiencies manifested as hot-spots in the hardware areas. The central building air conditioning system blanketed the room with cold air from overhead supply diffusers, lowering temperatures unnecessarily in many areas. Humidifiers in the primary air conditioners were also running unnecessarily due to the influence of the central building system and poor sensor calibration.

The customer had already reduced humidifier operating costs 90% by replacing older steam humidifiers with new ultrasonic humidifiers.

- RECOMMENDED RESOLUTION**
- Balance and optimize the primary air conditioning system to eliminate the need for supplementary cooling from the central building air conditioning and eliminate the two large, inefficient air handlers with combined capacity of over 700 kWh.
 - Calibrate the in-room humidifiers to allow for more accurate control. This, combined with the elimination of the inefficient central air conditioning units, results in less humidifier operation.
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- SAVINGS CALCULATION**
- Implementing the recommendations eliminates the perceived need for the central building air conditioning units and the energy needed to operate them. This also results in a reduction in humidifier operations across all seasons.
- Energy Savings = 566,371 kWh per year
 - Monetary Savings = \$45,310 USD per year
 - CO₂ Savings = 388 tons per year
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ADDITIONAL BENEFITS Increases system stability and reliability through more balanced and appropriate temperature and relative humidity conditions. Eliminates the contaminant influence from excessive outside air. Reduces the maintenance and service requirements for humidifiers.

COMPANY Financial products and services institution

SITE LOCATION USA

- ISSUES**
- Excessive cooling capacity
 - Contradictory air conditioner operation (heating vs. cooling)

At the time of the assessment, the room air conditioner capacity was nearly three times the heatload of the hardware housed there. Despite the excessive capacity, inappropriate air conditioning design and implementation was actually resulting in thermal problems such as hot spots throughout the room.

In an attempt to fix this, the customer addressed the localized symptoms. Unconventional use of ducted-supply upflow, ducted-return downflow and conventional downflow air conditioning led to unbalanced air distribution. This, along with inappropriate setpoints caused units to operate in contradictory modes of operation. The downflow units were cooling at 100% while many of the upflow units were actually heating.

- RECOMMENDED RESOLUTION**
- Adjust air handlers to maintain appropriate conditions and eliminate contradictory modes of operation (multiple reheats had been running continuously).
 - Provide appropriate cooling capacity, while still maintaining necessary redundancy by turning off ten of the 23 in-room air handlers. (Due to size, shape, and hardware configuration of the facility, additional units could not be turned off without design adjustments.)
 - Re-balance and optimize conditioned air distribution.
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SAVINGS CALCULATION Implementing these recommendations eliminates unnecessary and inappropriate reheating. It also reduces the cooling load since some of the air conditioners were only cooling to counteract the units that were heating. The end result is the ability to shut down ten air conditioners while still maintaining appropriate redundancy.

- Energy Savings = 1,706,000 kWh per year
- Monetary Savings = \$132,630 USD per year
- CO₂ Savings = 1,169 tons per year

Additional savings result from reducing humidifier operations by eliminating vapor barrier breaches.

ADDITIONAL BENEFITS Increases system stability and reliability through more balanced and appropriate temperature and relative humidity conditions. Reduces maintenance and service requirements for air handlers. Creates the availability of additional air conditioner cooling capacity for future planning.

COMPANY Administrative organization

SITE LOCATION Spain

- ISSUES**
- Oversized primary air conditioning system
 - Oversized external air ventilation system
 - Inefficient air distribution

Because of poor implementation of the air conditioning system and inefficient conditioned air distribution, the site personnel had to oversize the systems serving the computer room in order to achieve acceptable conditions.

The primary air conditioning, provided by a downflow system, was extremely oversized (1136 kW sensible capacity versus 144 kW total heatload), resulting in unnecessary energy usage and inefficient cooling. The external air system utilized for ventilation was also extremely oversized (16,000 m³/hr of air supply).

Besides the additional and unnecessary energy usage, the external air system was also introducing a high volume of inadequately conditioned outside air into the room. As a result, the primary system was forced to condition the air being introduced into the room by the external air system. Additional issues, such as cooling short cycles and calibration problems also contributed to inefficient cooling.

- RECOMMENDED RESOLUTION**
- Turn off the six older air conditioning units.
 - Turn off four of the newer air conditioners. While it would be possible to turn off more of the units from a capacity calculation standpoint, the size and shape of the room and configuration of the hardware did not allow it.
 - Eliminate the existing 16,000 m³/hr external air system and replace with an appropriately sized introduction (less than 200 m³/hr) from the general building air system serving the rest of the building.
 - Re-balance air distribution, including adjustments to air distribution tile placement and number.
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- SAVINGS CALCULATION**
- Implementing these recommendations eliminates excessive cooling capacity. It also reduces the cooling load associated with conditioning of the external air introduction.
- Energy Savings = 261,570 kWh per year
 - Monetary Savings = \$22,365 USD per year
 - CO₂ Savings = 179 tons per year
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ADDITIONAL BENEFITS Increases system stability and reliability through more balanced and appropriate temperature and relative humidity conditions. Eliminates the contaminant influence from excessive outside air. Reduces in maintenance and service requirements for humidifiers.
