Data centers face diverse energy challenges

A few years ago, a 52,000 sq. ft. data center, located in Munich, Germany, set out to significantly reduce its energy consumption and associated costs by implementing modern efficiency measures. The data center, operated by one of the top five European IT service organizations, identified several business and technology challenges in its equipment, systems, processes, and facility infrastructure that were limiting energy efficiency in its operations, including:

Rapidly-evolving environment

IT equipment in the data center was continuously evolving to incorporate technological advances, as well as increasing capacity demands. At the same time, the average power usage per device was rising, leading the IT team to struggle to control the increasing power consumption growth in such a dynamic environment.

Information isolation

The IT team needed greater awareness of cooling costs, energy usage, increasing cooling requirements, and how to accommodate the need for ever-increasing capacity by leveraging existing cooling systems. Lack of centralized information limited the ability to share this knowledge and restricted collaboration between IT and facility personnel. They believed that if the information was contained or collected within a single enterprise system, each inventory asset could be centrally tracked and its energy properties and history monitored, allowing more proactive energy management and purposeful equipment decisions.

Electricity costs

On average, more than 30 percent of the data center's energy bill was going toward cooling the facility. Additionally, it had been observed that, each year, cooling costs were rising significantly faster relative to their equipment costs. The ability to increase the computer room air conditioner (CRAC) set point temperature by just 1.8° F would shave three percent or more off the data center's annual energy bill.

Temperature management

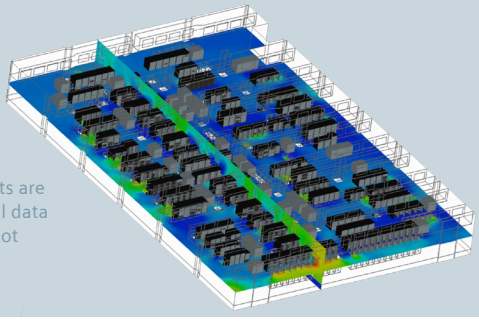
The data center operations group realized a need for the ability to manage and predict temperature and its impact on server performance and, more importantly, on temperature-sensitive equipment, such as data storage systems. Having thermal management capabilities – from design to build-out, operations, and expansion or retirement – was necessary in order to actively control energy costs and consumption.

Performance control

Downtime caused by poor energy management had to be eliminated. When the data center faced reliability issues, its uptime and service availability could have been sacrificed, potentially stopping revenue-generating business in its tracks. Hot spots, blocked airflows, and failed or poorly-designed cooling systems increased the risk of performance degradation. Greater visibility into these conditions would allow for proactive corrections. It was deemed insufficient to only rely on power-per-unit floor area for decisions about IT server and data storage equipment locations. Sharing IT asset and facility information across the enterprise is now accepted as a key element of any efficient performance control system.

Reporting requirements

The data center determined it needed a more accurate, reliable, and consistent method to track and report industry standard metrics, such as Green Grid's power usage effectiveness (PUE), a metric that represents the ratio of total energy used by the data center to the energy actually consumed by servers over time. Additional efficiency metrics that need to be captured include energy usage per square foot; carbon dioxide equivalent (CO_2e) levels, or carbon usage effectiveness (CUE); water usage effectiveness (WUE); and the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) allowable ranges of temperature and humidity. Interoperability with third-party software, including energy consumption monitoring and benchmarking tools, was also desired.



Servers and cabinets are visible in the virtual data center, as are the hot spots.

Audit support
Internal and external energy audits were subject to the limitations of disparate and distributed systems of the data center. A comprehensive system, such as a Data Center Infrastructure Management (DCIM) system, which also encompasses all aspects of asset lifecycle management, would facilitate energy audits and assessments, including those performed in accordance with the U.S. Department of Energy's Certified Data Center Energy Practitioner (DCEP) program.

External pressures
With increased awareness of the consequences of uncontrolled CO2e emissions on public health and welfare, the pressure to contain and manage emissions was growing from the general public, as well as through government legislation. The data center had a public and corporate image challenge – and a regulatory responsibility – to proactively address these concerns and document gains and achievements in efficiency initiatives. It needed the tools to simplify this process.

Design limitations
The process of adding, expanding, or changing the data center was hindered by information isolation and the lack of tools to effectively visualize the consequences of proposed changes. The IT team needed the ability to create virtual models with which to simulate various design considerations and analyze and optimize the design for maximum energy efficiency prior to procuring equipment and executing the design.

Management of requirements
The IT team sought to capture a historical record of changes to track cost, regulatory compliance, and other customer requirements throughout the entire data center lifecycle.

Engineering disparities
Varying engineering domains for mechanical, electronics, software, and electrical-interconnect technologies were limiting the design efficiency. Having a single, synchronized source of monitored data and process knowledge, as well as a common data model, would allow the various development teams to work collaboratively and expeditiously on efficient solutions.

Build processes
Design engineers and builders executing the design changes had separate sources of information for their respective tasks. Having a single repository of record for the required information would ensure that all stakeholders work with common goals and achieve the desired energy outcomes.

Approval chain
Tracking and validating the approval hierarchy – from concept through designing, engineering, and building – was cumbersome without a centralized system. The ability to easily capture and access or report on the chain of approvals and workflow for any set of data center improvements would increase the accountability of team members to ensure timely design and deployment of the IT organization's operational goals.