

Cool and green: Citigroup's Frankfurt Data Center

In Frankfurt, Siemens helps optimize Citigroup's data center. When it comes to building automation, security technology and power supply, the Siemens divisions Building Technologies and Energy Management deliver numerous customer benefits through seamless cooperation that goes beyond divisional boundaries.

Frankfurt: the city with the highest density of data centers in Europe. In 2008, the German branch of Citigroup launched a particularly energy-efficient model, the Frankfurt Data Center (FDC). Thanks in part to solutions from the Siemens Building Technologies Division, the building was awarded Leadership in Energy and Environmental Design (LEED) Platinum certification just one year after it opened, making the FDC one of the most energy-efficient data centers in the world. Citigroup, the data center operator, and Siemens have continually enhanced, modified and optimized the deployed technology to meet the highest standards of availability, reliability, protection and energy-efficiency.

Growing along with the FDC

Availability and reliability are the top priorities in a data center like the FDC. This requires an uninterruptible and redundant power supply, intelligent safety and security technology and reliable building automation that cools and conditions the air based on demand, thus keeping the servers from overheating. This is precisely why Citigroup has relied on the expertise and integrative solutions from Siemens for many years. "The request for proposal emphasized the importance of functionality and high availability," explains Dirk Hatzmann, Senior Vice President of Technology Infrastructure at Citigroup. "But it was also important that our technical partners be prepared to grow along with the data center and its evolving requirements and respond flexibly to our needs."

Redundancy, i.e. duplicate processes and data backups, high system availability and security as well as energy-efficiency are key elements for Citigroup when it comes to the operation of the FDC. “As IT director, reliability is especially important. It starts with seemingly trivial things such as clear and correct server rack wiring, which supports operational transparency and saves time during maintenance, and goes all the way to the major things, such as uninterruptible power supply,” says Hatzmann.

Redundancy in practice

Redundancy exists throughout the FDC. Processed data is stored in duplicate within the FDC and mirrored to other Citigroup data centers. In the building itself, a dual power feed from energy supplier Mainova, duplicate downstream medium- and low-voltage switchboards with duplicate switches and busbars from Siemens as well as dual cooling technology ensure maximum redundancy. If a power failure were to occur, two independent uninterruptible power supply units and the emergency power supply would take over, ensuring continued power for at least 72 hours. This means that the FDC meets the Tier IV standard awarded by the Uptime Institute for maximum redundancy and 99.995 percent availability.

To guarantee the safety and security of the building and the processed data, all the installed Siemens security and safety systems were aligned with Citigroup’s global safety and security requirements. In addition to the technical requirements for fire safety and security technology, the regulations also include emergency concepts and provide for regular evacuation and safety drills with the fire department.

The Desigo building automation system from Siemens plays a central role in maintaining high energy-efficiency and the standards of the LEED certification. “Our motivation was to continuously save energy,” underscores Norbert Heberer of Cofely Deutschland GmbH, the data center’s operator. “Building automation allows us to individually control and continuously monitor the heating, ventilation and cooling technology that is so vital to us.”

Ongoing technological enhancements

Since the Frankfurt Data Center went into operation, the installed technology has been continually enhanced. During ongoing operations, potential areas for optimization came to light that could be further exploited, such as in power supply and building and security technology.

The data center is designed for thirty years of operation. The deployed solutions are not rigid but continue to grow along with the data center's utilization. The planned power capacity of the FDC was 5 megawatts. In its current configuration, the Frankfurt Data Center uses 5,000 m² of its 10,000 m² for server operation.

When operations began, the data center used 900 kilowatts of electricity. With additional utilization and occupancy, the electricity requirement now far exceeds 1 megawatt. "One challenge was to continually adjust the power supply and cooling capacity to the demand, from the planned 5 megawatts of total capacity to the actual starting load of 900 kilowatts and then to the current level of about 1.5 megawatts," explains Heberer who supports the data center with ten employees over three shifts. "When operations started, we had a less efficient ratio of consumed energy to server energy demand, giving us a power usage effectiveness, PUE, of 2.8."

Lowering the PUE value

To adjust the power supply and cooling capacity, technicians analyzed the complete electrical supply. They then worked with Siemens to optimize the cooling control. "Now all the dependencies of free cooling, pumps and chillers operate together as a bundle and can be controlled as demand dictates," explains Heberer. To adjust energy efficiency based on demand and lower the PUE value, lighting was tied to access control so the lights would turn on only when the server rooms are occupied. In addition, air conditioning in the server rooms was set to the optimal operating point so now less cooling capacity is needed. Air pressure in the cold aisle was also lowered by 10 pascals. "During this project, we benefited from the experience and the commitment of the Siemens technicians. They were prepared to forge new paths and supported us quickly and competently, even with special solutions," praises Heberer. As a result of this collaboration and the actions taken, the current PUE of the FDC is 1.5. Over the next several months, Citigroup and its partners want to push it even lower.

In functional bids where individual disciplines are often considered separately, a certain amount of time is usually needed for adjustments, optimization and operating experience until the individual systems are harmonized and become an overall solution. All the FDC stakeholders now benefit from custom solutions that were developed collectively. “Everyone involved in this project learned a great deal”, sums up Hatzmann. “Technology, solutions and processes now go hand in hand, and we are very satisfied. Above all, the dedicated technicians from Siemens made essential contributions to the project’s success.”

Siemens technology at the FDC in brief

A general contractor issued a request for proposals for the individual disciplines. Solutions from Siemens were selected for building automation, security technology and power supply. This includes the following: a Desigo building automation system with two Desigo Insight management stations; 1,600 fire detectors with the associated Sinteso fire control panels; early fire detection via smoke extraction systems; fence sensors and sensor cameras for the 1,300-meter perimeter fence; a danger management system (GMA Manager) where the signals from the security and fire safety systems converge; 150 Sistrorage video cameras with an alarm system for the interior and exterior; an intrusion detection system with 168 door sensors; 150 Sivacon low-voltage switchboards; 104 NXAIR medium-voltage switchboards and 96 Sentron transfer control devices. Approximately 2.3 kilometers of busbars and 22 kilometers of medium-voltage cable were laid for the power supply.

Interview: “Energy efficiency is a top priority”

Three questions for Dirk Hatzmann, Senior Vice President of Technology Infrastructure at Citibank NA’s Frankfurt branch

What are the current trends for data centers?

In addition to the trend toward hardware and software virtualization, which has significantly altered the architecture of the IT landscape as well as server

requirements, increasing the efficiency of data centers is a top priority in the industry.

What are the most important measures to increase energy efficiency in a data center?

The IT infrastructure of a data center does require a great deal of energy, but things like intelligent lighting and cooling control can lower energy consumption appreciably. Other measures include cold aisle containment, which allows the cold air cooling the servers through the raised floor to be directed in a more targeted manner, thus reducing the air volume. In addition, the warm exhaust air from the server rooms, which has a temperature of approximately 30°C, can be utilized for local heating through the use of heat pumps.

What are you doing at Citigroup to improve cooling performance?

At Citigroup we've had great success with free cooling, i.e. relying on cool outside air, and we use our building automation system to adjust the cooling performance to meet our actual demand. In addition, we have lowered the pressure of the cool air which exits from the raised floor and cools our server racks by 10 pascals. This has allowed us to reduce our PUE, that is, the ratio between the total energy used in the data center and the energy needed by the computers.

This case study and press pictures are available at

<http://www.siemens.com/download?PR00372>

For further information on the Building Technologies Division, please see

www.siemens.com/buildingtechnologies

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