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Integrated planning approach for HVAC systems

Demand-based control at PUMAVision headquarters in Herzogenaurach

In the new PUMA headquarters in Herzogenaurach, Germany, all electricity comes from renewable energy sources; HVAC systems are operated based on the demand in each building or room; lights are turned off when there is sufficient daylight or the room is unoccupied. A sophisticated building automation concept designed by Desigo system house IPM – Innovatives Projektmanagement für Gebäudeleittechnik GmbH in nearby Feucht forms the basis for this high level of building efficiency.

Sustainable construction has become a major trend. Sportlifestyle company PUMA claims to have built the first climate-neutral corporate headquarters in its industry. The company's new PUMAVision Headquarters uses not only innovative HVAC technology with thermally activated concrete slabs, façade-oriented fan coils, district heating, switchable heat pumps for heating and cooling, partial air conditioning systems and individual-room controllers, but also electricity from several renewable energy sources: electricity from Lichtblick AG in Hamburg, from a 1,000 m² photovoltaic installation on the roof of the Retail building, another 140 m² of photovoltaic modules incorporated into the façades as well as a wind farm in Turkey as a carbon offset project. The PUMAVision Headquarters consists of three buildings: Office (administration building), Brand Center (company conference center) and Retail Building (PUMA Store).

Control experts actively involved

To use the renewably generated electricity as efficiently as possible, HVAC and electrical planners as well as control experts from IPM, a solution partner of the Siemens Building Technologies division, cooperated closely from the beginning of the planning phase. Experience has shown that the overall energy efficiency of a building largely depends on the size of the heating/cooling generators, the hydraulic components, the subdivision of the control loops and interdisciplinary interfaces, for instance to lighting and sun protection. IPM control experts also contributed to the design of the hydraulic system since the concrete core temperature control deployed in the administration building poses challenges as far as hydraulic and control technology is concerned.

Siemens-developed and lab-tested control modules based on the Desigo PX automation station are used to control the thermoactive building system in the Office building. Initial operational experience has shown that the concrete core temperature control heating system is turned off when the outside temperature reaches 12°C; the Office building then heats itself. To allow additional heating and cooling via individual room control, the concrete core temperature control system is switched from summer to winter operations on demand by sensing the room loads. As was the case for the concrete core temperature control system, IPM used pre-tested macros from the Desigo program, which can be customized as needed, for individual room control. In addition to demand-based heating, cooling and ventilation, most RXC room controllers also handle lighting and sun protection. Most office lighting is overridden by occupancy detectors and photoelectric switches; this means that the light is automatically turned off if a room is unoccupied or if there is sufficient daylight.

One special feature of the PUMA headquarters is the ability to adjust the throw distance of the air outlets in the multimedia hall. If cooling is needed, the conditioned air is diffused; if heating is needed, the warm air is blown straight down from the ceiling. Because of the high internal thermal load in the hall, the basic ventilation system is enhanced by four recirculating air cooling units. Multiple scenarios for event-appropriate heating and cooling are stored in the hall's control system to allow for a variety of applications. To ensure optimal HVAC control performance for the hall, which has a capacity of 1,500 people, IPM opted for four RF sensors from EnOcean. They were installed after the interior of the hall had been completely finished.

Demand control enhanced by energy management functions

Contrary to conventional buildings where HVAC systems run on the principle of supply, the provision of heating, cooling and ventilation at the PUMAVision Headquarters is based on actual demand in each room. All heat consumers are recorded and controlled via Desigo PX stations. Predefined and calculated setpoints are forwarded to the corresponding pre-control group where they are converted into matching "demand signals". The recirculating pumps for the heating groups and the chilled-water system are incorporated into the demand-based control strategy. The required water volume is calculated, controlled and monitored based on demand, either by sensors which detect the weakest spot in the system in terms of energy flow, or by the corresponding heating/cooling consumers. The control system is enhanced by comprehensive energy management functions which extend from the room level to the heating/cooling generators and ensure demand-based operation.

Conclusion

The overall energy efficiency of a building can be increased significantly by working with control experts right from the planning phase. This includes optimizing the hydraulic system, subdividing heat and refrigeration producers according to partial load criteria, defining the control loops, and interfacing heating, cooling, ventilation, sun protection and lighting systems at room level. To ensure that energy-saving features yield long-term benefits, it makes sense to enhance control systems with energy management features. This also allows malfunctions and faults to be identified as early as possible.

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For more information, please visit www.siemens.com/desigo.

Bildlegenden (Auswahl)

Abb. 1 (PUMAVision_Headquarters3.jpg)

PUMAVision Headquarters, with the Retail building shaped like a shoebox (left) and the administration building (right)

Abb. 2 (BT_Puma_Sponsor Rennsport_3324.jpg)

Vroom, vroom... PUMA also equips race car drivers, including Sebastian Vettel, Mark Webber, Fernando Alonso and Felipe Massa

Abb. 3 (BT_IPM_BKT-Steuerung_3297.jpg)

The concrete core temperature control system in the Office building is controlled using an application developed by Siemens and extensively tested in the laboratory

Alle Abb.: Siemens

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