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European Union Energy Performance of Buildings Directive and The impact of Building Automation on Energy Efficiency

Buildings account for 40 percent of global energy consumption.
The European Union's 2002 Energy Performance of Buildings Directive takes this fact into account and formulates savings goals. A resulting European standard, and uniform certification, applicable throughout Europe, form the foundation since July 2007 for the concrete implementation of required measures. Siemens Building Technologies has taken a leading role in these activities and with its products and systems that meet the requirements at a high level of quality. Properly designed building automation and control and technical building management based on the same may provide a demonstrable contribution to EU savings goals of 20 percent by 2020.
The goal of European Directive 2002/91/EC on the total energy efficiency of buildings (Energy Performance of Buildings Directive, EPBD) is to improve the energy efficiency of buildings. The total energy efficiency of a building is defined as "the actual or estimated amount of energy consumed to cover the various needs compared to standardized utilization of the building". The energy consumers concerned are heating, water heating, cooling, ventilating and lighting; also included is the auxiliary electric power require to operate these systems. One of the basic requirements of the EPBD is a methodology for the calculation of the integrated energy performance of buildings.

New standard, energy performance ratings and certification

The EU commissioned the European Standardization Committee (CEN) to formulate standards and methods for calculating the energy efficiency of buildings and estimating their impact on the environment. The emphasis was initially on lighting, ventilating, heating and the thermal behavior of structural components as separate topics. On the initiative of the building automation industry, with Siemens Building Technologies (SBT) as the driving force, CEN also arranged for a standard to be drawn up for building automation and technical building management as a whole. Technical Committee 247 (CEN/TC247) under the chairmanship of this paper's author assumed the task. Standard EN15232 "Energy performance of buildings – impact of building automation and building management", adopted by the CEN in July 2007, specifies methods for assessing the influence of

building automation and technical building management functions on the energy consumption of buildings.

This resulted in four different energy performance classes for Building Automation and Controls Systems BACS:

- Class D comprises systems which are not energy efficient.
  Buildings with systems of this kind must be modernized, and new buildings may no longer be equipped with them.
- Class C corresponds to the standard,
- Class B stands for advanced systems
- Class A comprises highly efficient systems.

The standard also includes processes for calculating energy efficiency, taking user profiles for building types of differing complexity into account: offices, hotels, classrooms, auditoriums, restaurants, wholesale centers and hospitals. The combination of these elements from the standard produces clear stipulations for achieving a given performance class. For example: if the building automation system controls the specified temperature level of the heating in a hotel continuously to 22.5°C, this results in class D. However, if the level is regulated variably to 21°C during the period when the guest is present and to 15°C for the rest of the time, this results in top class A. Based on the classification of energy relevant building automation functions the standard confirms energy saving percentages for the individual energy performance classes compared to class C using BACS efficiency factors. Hence a system with class A functions in a office building may save up to 30% compared with a class C system.

The standard is intended for the authorities responsible for implementing the directive and for building owners, architects, planners or engineers who are planning new buildings or the renovation or refurbishment of existing buildings.

Uniform certification valid throughout Europe is crucial if the EPBD is to be fully effective in the challenging task of improving the energy efficiency of buildings. A large number of national certification systems would seriously jeopardize implementation of the EPBD. Based on this insight, the European Building Automation and Controls Association (eu.bac), founded in 2003, has taken the lead in product certification. The result is eu.bac Cert, a joint undertaking of eu.bac and various European certification bodies and testing laboratories in conformity with the relevant provisions from the EN 45000 set of standards.

Siemens meets and exceeds the highest requirements

Siemens Building Technologies has decades of experience and comprehensive know how on control technology for various HVAC applications as well as building automation and control which is why its products and systems meet the functions required by efficiency class A at a high level of quality.

Integrated room automation is the focus of efficient building automation and control since energy efficiency for an existing building is largely determined by the needs of room users and energy loss and gains in the room. As a result, rooms with changing use require demand-dependent closed-loop control (e.g. using a CO2 sensor) and open-loop control (e.g. via presence detectors) of consumers in the room and the integration in a superposed building automation and control system to meet efficiency class A.

A high level of control accuracy (CA) for individual room controllers is necessary so that the room user adjusts the system's preset optimized temperature setpoint as little as possible. Eu.bac tests and certifies this control accuracy. Siemens certified individual room controllers achieved consistent, excellent test results for control accuracy (for example, fan coil with motor actuators: CA for cooling = 0.1K; CA for heating = 0.2K).

Above and beyond these product characteristics, Siemens Building Technologies offers innovative automation and energy management functions that exceed requirements under EN15232. Of particular interest here are the following functions:

- h,x directed control considering actual energy demands and energy cost (heating and cooling, humidify and dehumidify)
- Predictive heating controller
- Control solution for Thermally Activated Building System (TABS)

Siemens subjects the “proven solutions” to rigorous testing for their benefits with regard to comfort and minimizing energy consumption in the HVAC lab and as part of numerous field test projects. The proven solutions also provide specific operating windows on the management station that provide easy-to-understand editing of all parameter settings that can be customized to the specific building and permit more in-depth monitoring of subsequent operation.

Siemens has developed a user's guide for all participants in a building's engineering phase and, in particular, building automation and control. The guide provides a general explanation of how to deal with EN15232 and specifically illustrates the functions that have a tremendous impact on optimizing energy consumption.

Summary: Building Automation industry can substantiate the value of BACS

Experts within the building automation industry in Europe have developed a coherent framework of standards as part of intensive cooperation over the past few years. The standards allow for more transparent and concrete project specifications.

Product standards that establish energy efficiency criteria (e.g. EN15500 “Control for heating, ventilating and air-conditioning applications - Electronic individual zone control equipment”) ensure a minimum of required functionality and quality. Moreover, the quality in general and energy efficiency criteria in particular are tested and certified by eu.bac.

The global standard ISO16484 defines uniform standards in parts 2 and 3 for system architecture and all important building automation and control functions and allow transparent, functional tenders, using the function list; including bill of quantity.

Standardized and tested and certified communication protocols are an absolute must for system-wide functions that integrate multiple system components. This type of interoperability is especially required for a few, important energy functions. For building automation and control, the communications protocols BACnet, KNX and LonWorks are the established international as well as European standards.

Finally, EN15232 “Energy performance of buildings – impact of building automation and building management” defines building automation and control functions required to achieve a high level of energy efficiency and classified into energy efficiency classes. It provides the building owners and engineers a simplified procedure for selecting automation and management functions for all electrical and mechanical installation in a targeted manner by energy efficiency classes.

The work on the part of experts as well as the experience gained from installed building automation and control system allow us to credibly confirm that building automation and control and technical building management can make an important contribution to EU savings goals of 20 percent by 2020.