More energy efficiency and more comfort in hospitals
# Table of contents

Preface 5

**Trends in hospitals and out-patient departments**
The healthcare sector is changing 8

**Energy optimization in buildings**
- Energy-intensive processes in hospitals 12
- Reducing CO₂ emissions 14
- Energy optimization for new and existing buildings 16
- Energy optimization of partial and overall systems 18
- Energy-saving performance contracting 24
- Electrical energy distribution with Totally Integrated Power 26

**Highest standards of hygiene in the hospital**
- Hygiene 30
- Hygiene in the operating room 32
- Validation 34

**Focusing on the patient**
- Comfort and efficient operation 38
- Operation in modern operating rooms 40
- Integral operation of other rooms 42

**Ensuring security through traceability**
- Security as a major challenge 46

Summary 48

Do you have a need for action? 50
Those responsible for operation and building technology in a hospital or clinic have a great responsibility for patients, staff and visitors every day. Supply of all forms of energy, climate control and cleanroom conditions for the surgery rooms have to be ensured 24 hours a day.

Increasing energy efficiency, reducing CO₂ emissions and saving costs have already become mandatory daily tasks of those responsible. In addition to this, technical malfunctions have to be detected on time and reported so that appropriate measures can be immediately carried out. Furthermore, constantly increasing requirements have to be met with the same number of employees or even less. This is impossible without integrated building automation systems. After all, hospitals are one of the most complex buildings.

The construction and maintenance of all these facilities require comprehensive knowledge when it comes to hospital building management.

This report describes the important jobs of modern building technology and integral building automation in hospitals for energy supply, energy efficiency, hygiene, comfort and efficient operation. It is intended to help you determine improvement potentials in your business and define priorities when renewing your systems.

We are one of the world’s largest health-care solution providers. Our customers profit from a global technology network and local support due to many branch offices with comprehensive experience in the hospital sector. You too can reap the benefits of this knowledge!
Trends in hospitals and out-patient departments
The healthcare sector is facing a big dilemma. On one hand, the medical offering and patient care options are constantly being improved and new technologies are being introduced on an ongoing basis. On the other hand, the associated cost explosion is an increasing burden on both public and private investors, which is having a negative impact on health insurance premiums. The situation is amplified by the increasing life expectancy. In the western world life expectation is almost seven years higher than it was 50 years ago.

Challenges

- Constant cost pressure forces ongoing streamlining of operations to meet the face of increasing requirements.
- In addition to this, conscientious use of energy has become a global responsibility, while at the same time becoming an economic issue in hospitals. The true task consists of combining energy efficiency with comfort and secure energy supply.
The increasing privatization of financing hospitals and clinics also serves to increase competition. The fight for solvent private patients has already started. Many facilities have to be renovated to gain leverage in this competitive environment in order to offer the required comfort and keep costs under control.

Those responsible for building technology in hospitals and out-patient departments are thus faced with having to prove themselves in this environment of increasing competition. Their objective is to ensure the best possible patient care (patient satisfaction) within a high-performance motivated organization (staff satisfaction) at justifiable costs (profitability) and a high standard of reliability (quality).

**The answer: integrated building solutions**

Building technology is a key to success. It secures comfort, hygiene and the safety of patients and staff while allowing for streamlined operation and a high level of energy efficiency. Therefore, modern building and security technology is an important cog in hospital and out-patient department operation.

In order to continue meeting increasing requirements with regards to energy supply, comfort, security and profitability, the systems increasingly have to be integrated in a building. Networking all systems within the technical infrastructure such as heating, ventilation, air conditioning, access control, video surveillance, intrusion and fire detection, alarm and evacuation, ensures the highest level of comfort, optimum security and maximum energy efficiency. The systems can only reveal their true potential when all building technology systems work together in harmony.

With our Total Building Solutions, we provide a comprehensive solution from a single provider, which is precisely customized to fit the respective building and processes.
Energy optimization in buildings
Energy-intensive processes in hospitals

Climate change necessitates new solutions for energy optimization. Among other things, these solutions are required to reduce greenhouse emissions. The European Union (EU) has set as its objective to reduce the energy consumption of buildings by 27 percent by the year 2020. In order to achieve this, modernization has to be accelerated and effective measures for increasing energy efficiency have to be implemented.

Electrical supply, media supply and air conditioning technology are all part of what makes a successful hospital. In addition to this, work that protects resources and cost savings contribute considerably to achieving business objectives.

The following figures clearly show the relevance.

<table>
<thead>
<tr>
<th></th>
<th>In hospitals</th>
<th>At home</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generation of waste/day</td>
<td>approx. 7 kg/person</td>
<td>approx. 1.7 kg/person</td>
</tr>
<tr>
<td>Consumption of water/day</td>
<td>approx. 600 liters/person</td>
<td>approx. 120 liters/person</td>
</tr>
</tbody>
</table>

- Fuels are used primarily for heating and for producing warm water. Electrical energy is primarily used for lighting and ventilation. Together they are responsible for approximately 75 percent of a hospital's total energy costs. On average, German hospitals consume approximately 300 kWh thermal energy and over 100 kWh electrical energy per square meter.
Most hospitals share specific features that significantly impact energy consumption. Among other things, these include:

- Heat requirements for producing warm water throughout the year with a temperature level that sometimes exceeds 60°C.
- Often simultaneous requirements for heat and power.
- Constant power requirement distributed over the course of a day and throughout the year.
- Continual requirement for air conditioning.

However, many hospitals have old systems in need of renovation. Thus, considerable savings potentials are left untapped. Practical examples show that savings of 25 to 40 percent are realistic after implementing the appropriate renovation measures.

Due to the fact that fossil fuels will only be able to be used to a limited extent in the future, hospitals are also faced with the issue of future energy availability. Running hospitals and out-patient departments require an uninterrupted supply of energy every day. This is even necessary to prevent life-threatening situations, as can be the case during surgery.

We support hospital operators when it comes to the energy issue: by providing secure energy supply and distribution, via energy-saving contracting, via precise knowledge of consumption and optimization options with building management systems as well as via new, energy-optimized systems.

Lowered consumption of resources, longer system operation as well as better maintenance and repair of a device usually result in lower operating costs. If all these factors are taken into consideration, then the right decision has a positive impact on both the ongoing costs and the environment.
Global warming is presenting the world population with new challenges. In December 1997, the United Nations specified in the Kyoto Protocol that, in the period between 2008 and 2012, the industrial countries have to jointly reduce their greenhouse emissions by at least five percent compared to values from 1990.

**GreenBuilding program**

We support the GreenBuilding program: This is a voluntary program initiated by the European Commission to improve energy efficiency and use of renewable energies in non-residential buildings. According to the "green book of energy efficiency", buildings make up 40 percent of Europe’s energy requirements. Optimized systems alone represent a considerable energy-saving potential. This results in a reduction of energy costs and to an increase in competitiveness.

To be recognized as a GreenBuilding, operators must improve the energy efficiency of their building by at least 25 percent.
Energy optimization for new and existing buildings

New buildings

For new buildings, a comprehensive energy concept including costs, benefits, regulations and environmental friendliness should be created in the planning phase.

In this process, the costs should be viewed as part of the life cycle costs: procurement costs as well as the costs for system operation and upkeep. Therefore, an investment calculation has to be made for each component with consideration of the system’s serviceable life.

In addition to this, when planning a new building, current developments in building technology and regulations should be taken into consideration, especially when it comes to developments in the energy sector and the environmental friendliness of the materials used.

An overall building automation solution can serve to save energy both in the short-term and long-term. Additionally, modern technology improves comfort, operating costs and the fire safety and security of the building.
Existing buildings

In an existing building, energy cost savings can primarily be achieved if a sustainable energy optimization process is implemented with the customer. In Germany, for example, there is an energy cost saving potential in all hospitals of just under 232 million euros.

The energy optimization process mainly consists of monitoring, analysis and optimization. This process has to be carried out throughout the entire building life cycle so that achieved savings can be maintained and optimization potentials can be determined on an ongoing basis.

Services for energy optimization

- **Energy monitoring**
  In order to be able to reduce energy consumption in a hospital, consumption first has to be measured. The measured data is subsequently consolidated and provides useful consumption values. In addition to this, the data provides information pertaining to costs and emissions. This, in turn, provides the foundation needed for making optimized decisions for long-term profitability.

- **Energy analysis**
  Progressive technologies for energy savings have to be developed on an ongoing basis. We have the knowledge and the experience required to analyze a hospital’s energy results in a meaningful manner comparing values to generate benchmarks, which can be used as the foundation for optimization.

- **Energy optimization**
  Energy optimization is customized to meet the requirements of each hospital. It is based on the results of the energy measurements and subsequent analysis. This includes the optimization of hospital operation business processes.
Energy-optimized operation requires automated control and regulation as provided by modern building and room automation systems. Modern sensors such as gas mixture sensors for room air quality, and actuating elements for dimming lights instead of switching on and off are constantly being improved.

Sensors and actuators can be networked using modern bus systems, which serves to simplify installation. In addition to this, users and operators can simply change target values if needed.
Integration

Modern building automation and control systems such as DESIGO™ allow for permanently optimized individual processes such as ventilation, air conditioning, shading or lighting in hospitals. At the same time, DESIGO supports efficient management of the individual components with regards to both economical and ecological aspects by networking partial systems within an overall system.

A user-friendly interface can be used to monitor all partial systems such as heating systems, ventilation and air conditioning systems, lighting, shading and, when using our Total Building Solutions, fire safety, access control and security systems. The system is based on modern communication technologies and standard building automation protocols, which means third-party systems can be integrated more easily.

Changes of use, extensions or modernization of a partial system can be carried out incrementally and at any time. The systems grow with the requirements and can be extended as needed from a small system to complex and distributed building automation systems. Equipped with IP technology and open databases, these building automation systems are safe, value-retaining investments.

Our migration concept includes the various service lives of system components. This meets the requirements for step-by-step system renewal – modernization by replacing existing applications in several migration phases – as well as a long support time for existing systems. In addition to this, it allows the hospital business to increase its competitiveness by implementing new technologies. Minimizing the technical risk reduces down times and increases the hospital’s quality of business.

Standard protocols integrated in our building automation

Standards for building automation have existed since 1990 in Europe and more recently worldwide. The objective consists of securing product quality, specifying project specifications for building automation and allowing for proving the energy efficiency of building automation functions. Promotion of device interoperability is intended to enable a wider range of functionality with a better price-performance ratio. Building automation functions should be established as a new “construction task” and the costs for this should be paid appropriately. The result of this work is the EN ISO 16484: It serves to standardize building automation as a service in the member states of ISO and CEN. European regulations require that standards accepted by CEN have to be implemented in all European countries – not only in the EU countries – and national standards have to be withdrawn in cases of conflict.
We use international standards in our systems:

■ **BACnet™**
The Building Automation and Control Network (BACnet) is a data protocol used around the world for interoperable communication between building automation and security technology products and systems. Communication is carried out via standardized transfer media, which are primarily Ethernet, IP and MS-TP in Europe. BACnet became EN ISO standard 16484-5 in 2003 and this standard is continuing to be developed in various work groups. Our technologies support the use of BACnet.

■ **KNX**
The abbreviation (pronounced “Konnex”) stands for mature intelligent networking of modern building technology according to EN 50090 and ISO/IEC 14543 and is used throughout the world. KNX is implemented in integral room automation for local networking of sensors and actuators.

We also support other industry standards:

■ **LonMark®**
This is the interest group consisting of companies and institutions around the world, dealing with interoperable products based on the Local Operating Network LON from Echelon®. LON is implemented in integral room automation for local networking of sensors and actuators.

■ **Open Process Control (OPC)**
This is a standardized software interface, which allows applications from various different manufacturers to exchange data via Windows-based operating systems. It is now also supported by .NET, but this requires changing the application software for OPC.

Due to the multi-platform approach with BACnet, LON and KNX integration, the DESIGO building management system provides the information from all technical areas. This information can even be called up from remote locations using Web technologies. This enables the storage and reporting of energy consumption measurements on our Web server and the respective reports can be called up via a browser or via e-mail.
Integral room automation

Room automation describes the integral control and regulation of all systems in a room such as lighting, light directing, heating, cooling, ventilation and multimedia devices for audio or video. Integral means that the individual devices in a system are embedded, can exchange information and have a unified user interface. Conceptually, the process to implement an integral room automation system begins in the planning phase.

Today planning is carried out using room modules to meet the requirements for high flexibility in provision of the currently required room requirements. A room module represents the smallest possible unit, which is combined with other room modules to result in the actual rooms required.

In cases of room modifications, the building technology is adjusted to suit its new function solely by way of software changes. Practical experience has shown that even highly complex buildings can be reduced to a few types of rooms. This results in standardization and simplification of planning, execution and operation.

In addition to an increase in comfort and flexibility, integral room automation offers additional potential for energy optimization. Significant potential can be used via the interaction between the systems. Example: The lowering of blinds responds to data received from the weather station as well as the room temperature, which was previously used only for individual room regulation of heating and ventilation. Thus, the sun's thermal energy can be used more efficiently in the winter, for example.

DESIGO – for a feeling of well-being in the building

The requirements placed on advanced building automation and control systems are demanding: Reliability is a standard feature now and energy efficiency and cost optimization in buildings are mandatory. DESIGO – our building automation and control system – satisfies these requirements in superior style. DESIGO creates comfortable working conditions in a building while giving consideration to economical and ecological criteria.

The system performs its control, regulating and monitoring tasks automatically and elegantly in the background. DESIGO is not confined to heating, ventilation and air conditioning, but is also a comprehensive and integrated system for building management covering all kinds of building services, such as lighting, blind control, safety and security, access control and energy distribution.
Optimizations for electrical installations

Good building lighting and lowering of blinds can contribute to reducing energy requirements on a long-term basis.

Lighting

The efficiency of lighting can be increased by using the appropriate lighting elements such as replacing tungsten bulbs by fluorescent lamps and the use of LEDs is also becoming increasingly attractive in this regard. Additionally, efficiency can be increased using modern operating devices such as electronic ballasts as well as highly effective lamps.
Furthermore, energy-saving potential can be found in the switching and classification of lighting groups to meet specific requirements. Halls or similar rooms, which are rarely used, should be equipped with motion detectors. In addition to this, the use of light guidance systems allows for better use of daylight, which can reduce the artificial lighting required in a room.

Building automation can be used to control lighting sources so that they are automatically dimmed when more daylight enters the room. This ensures that the brightness meets the respective requirements and reduces power consumption to a minimum.

Additional energy reductions can be achieved using light room design: A high degree of reflection from ceilings and walls results in less energy consumption with the same amount of light.

**Lowering of blinds**

The facade of a building contributes to its heat and provides protection from environmental influences. For a room in the building, the lowering of blinds should provide optimum sun protection, while using the light without a blinding effect and ensure that heat is obtained without overheating. These requirements, some of which are contradictory, require good control systems which master the interaction between room and facade.

**Impact on energy savings of high-quality room controllers**

(Climate zone, e.g. South France, new office >1000 m²)

Compared to the EN standards, the energy savings with DESIGO RXC products are up to 14 percent due to their excellent control accuracy. Source: CSTB France

**DESIGO RXC – the integrated room automation solution**

The room management system DESIGO RXC enables individual comfort requirements for the building occupants. The room controller and the room devices regulate, control and monitor the comfort conditions in rooms and closed zones.

Open communication based on LonMark technology allows for integration in any building automation system. The building technology applications for heating, ventilation, air conditioning, lighting and blinds for example can be modified on a project-specific basis. Simple installation and wiring offer saving potential with a high-quality standard.
Operators can multiply their benefits with energy-saving performance contracting: Modernization and optimization of the building technology save energy and operating costs, increase operational safety, raise the level of building efficiency and make a positive contribution to environmental protection. Return on investment is guaranteed by savings on energy and operating costs.

**Financing model**

The financing model guarantees that, from the beginning of the guarantee until the end of the contractual period, all required saving measures are financed and additional savings are distributed among the partners. We assume responsibility for savings that are not attained. After the end of the contractual period, the hospital profits 100 percent from the reduced costs.
Energy-saving performance contracting in practice

The out-patient center Bremerhaven-Reinkenheide GmbH in Germany was built in 1975. At the beginning of 2006 it sought an energy-saving performance contracting partner throughout the EU. The reasons: aged building technology, increasing energy costs and the health reform, which increased the requirements of quality, profitability and intensification of competition.

We invested approximately 7.2 million euros in renewing the energy systems. This served to decrease energy consumption on a long-term basis and the energy costs compared to the year 2004 were reduced by 40.5 percent.

In addition to an entirely new building automation system, the out-patient center acquired new air conditioning and ventilation systems, and optimization of the heating systems. Further efficiency measures were carried out in the area of steam and water, and the main low voltage distribution, the cafeteria kitchen dishwashers, the steam sterilizers, the medical compressed air supply and the cooling system were fully replaced.

The out-patient center achieved part of the savings using two block heating power generators, one module of which operated using vegetable oil. The investments finance themselves over a contractual twelve year period from the saved energy costs. “This more than met our expectations. We are not only getting modern system technology, but we are also saving the environment more than 3,200 tons of carbon dioxide emissions”, says Jürgen Breuer, technical director of the Reinkenheide clinic.

Facts and figures Bremerhaven-Reinkenheide

- Components: investments, maintenance, servicing and financing
- Contract duration: 12 years
- Guaranteed energy savings: 520,000 euros per year (40.5 percent)
- Emissions savings: 3,200 tons of CO₂
Secure and consistent solutions are required for electrical energy distribution in buildings. Our offer is called Totally Integrated Power. This consists of consistent, interface-optimized products and systems, which are ideally matched to one another and complemented by communication and software modules, which connect the energy distribution to the building automation.

The portfolio ranges from planning tools to suitable hardware: from switching systems and distribution systems for medium voltage, transformers, switching and protection devices as well as switching systems and track distribution for low voltage through to small distribution units and power outlets. Both the maintenance-free medium voltage and the low voltage switching systems as well as the track connections are matched. Overall protection systems ensure protection for people and systems at all times.

Building operators can use Totally Integrated Power to optimize their operating costs while retaining a high level of flexibility for changes of use.
This is carried out by way of the following:

- Transparency of the energy consumption and thus optimization of the energy costs. Connection of power consumption devices to bus systems provides the required data. Energy management provides transparency of energy costs and subscription agreements can be negotiated optimally.

- A high level of operational safety and connection of the energy distribution to building automation. Central operation serves to reduce downtimes and keep costs to a minimum. In a selective design, only the affected units are switched off in cases of errors, and modular systems allow for simple and fast replacement.

**Consistent energy distribution at the workers’ compensation insurance accident clinic in Duisburg, Germany**

In the healthcare sector, “power quality” is a decisive element of patient care. Highly sensitive devices, the proper functioning of which can only be ensured by a high-quality power supply, are used for modern diagnosis and in life-saving measures. Poor power quality or a power failure would have disastrous effects. For example, a secure and reliable power supply could no longer be guaranteed. Totally Integrated Power ensures the highest standard of reliability in energy distribution.

We provided the following for the workers’ compensation insurance accident clinic in Duisburg:

- Dimensioning of energy distribution with SIMARIS design
- SIVACON low voltage switching systems with communication via Profibus DP
- Alpha low voltage sub-distributor
- Delta switches and power outlets
- Building automation including lighting control
Highest standards of hygiene in the hospital
In a hospital, hygiene is a daily challenge: New patients, visitors and personnel enter the hospital every day. They all bring invisible viruses into the hospital. Food and other goods are also delivered on a daily basis. It is impossible to keep a place with so much contact and motion free of germs! According to a specialist medical study eight to twelve percent of hospital treatment procedures are hindered by nosocomial effects or, in other words, infections acquired in the hospital.

Room ventilation systems in the hospital serve to maintain the required thermal room climate, extensive filtering of microorganisms and dust, anesthetic gases and odors in the air as well as the dissipation of heat loads. Here it is of utmost importance that the thermal effects and pressure effects remain under control at all times especially in surgery rooms.

Air currents traveling from one area to another can be especially dangerous for hygiene. For example, construction dust has a high percentage of fungus spores. Therefore, construction measures in hospitals have to be especially carefully planned. It pays to spend a bit more on construction separation measures.

Danger posed by legionella

Legionella are bacteria primarily found in water and damp environments, and thus they are found in building technology systems. They are a natural component of the microflora of water. Drinking water from the local water supply lines always contains a limited number of different bacteria. This could also include legionella in exceptional cases.

The multiplication of these represents a hygiene risk and this can be caused inside buildings if water stagnates and is warmed. Warm water systems are thus to be installed and operated so as to make legionella multiplication impossible.
Low turbulence displacement currents

Low turbulence displacement currents are supplied to the operating room via a ceiling vent. It is especially important here that the room temperature is higher than the temperature of the supplied air. This causes the supplied air to be moved down by the thermal effect and ensures a high level of hygienic safety. The operating and instrument tables are shielded from microorganisms in the air by the low turbulence displacement current. With this type of ventilation, the risk is low that germs from the outside will enter.

The highest level of hygiene regulations apply especially in operating rooms. The smallest particles of pollution can have the hardest consequences here, such as when contaminants enter a patient’s wound.

Hygiene in the operating room
The right temperature at all times

The temperature of the supplied air is important for the comfort of the team of surgeons. In operations requiring great physical effort such as inserting a hip prosthesis, the team of physicians often requires a cooler temperature than in relatively finer operations. In the past, the temperature in the operating room was regulated directly from the room and the guideline was 21°C +/- 3°C. Today, the temperatures are set from the control center. Key figures are individually allocated to each surgeon, so that each person can work in an environment matching their preferences.

Humidity and dust

Relative humidity also plays an important role in the air quality. Most people perceive relatively dry air to be uncomfortable: Studies have revealed that air with a higher level of humidity than the reference value of 30 percent can be experienced as too dry by tested persons. However, an increase in humidity can also prove to be problematic. If there is too much humidity, mildew develops at places where water stands and especially in showers and baths. Fungus spores are not dangerous for people with intact defenses. But patients in the hospital often do not have sufficient defenses. Therefore, good air exchange with clean filtered air is more important than humidity for health. Two outside air systems should be installed to ensure fresh air circulation during ongoing hospital operation. This increases the security in the case of failure and in cases of regular maintenance work.
The goal of the validation is to establish documented evidence which provides a high degree of assurance that a specific requirement or process will consistently produce a product meeting its pre-determined specifications and quality attributes. For example, the manufacturing of medicines has to result in germ-free products with a high level of reliability (1:1,000,000). The quality requirement for validating the sterilization process is specified in various different ordinances. For example, in Switzerland it is contained in article 19 of the medical product ordinance from the year 2001: The operator of a hospital is responsible for correct validation. This primarily means that the representative loads in routine operation have been validated.

The operator of the sterilizer has to have specified in advance how and to what extent the contents and the spatial arrangement of his production batches vary. The process owner is always responsible for the overall validation and the result of these batches, even if the validation work was done by an consultation or subcontractor.
The validation of sterilization processes is specified in the EU. In addition to this, hospitals are subject to the legal order to ensure patient care according to the state of technology and science.

The EU directive serves as a legal framework. Performance and security-related product specifications are not regulated by the law. This is regulated in the ordinances of the “general requirements of the EC medical law”, the fulfillment of which is to be proven. Within the framework of picking, a series of preliminary conditions have been specified as mandatory specifications in attachment 3 of the directive of the Germany Association for Hospital Hygiene for the validation and routine monitoring of sterilization processes. These basic requirements apply across products and processes and are based on the respective state of technology.

Based on the example of the sterilization procedure, success cannot be confirmed with the final product due to security requirements. It has to be ensured that the entire process and its important parameters beginning with preparation and packaging of the sterilization of the product through the required interim steps of sterilization, release, storage, distribution, documentation including the required devices, equipping and certifying personnel are carried out with quality assurance according to a validated procedure.
Focusing on the patient
Competitive pressure will increase and hospitals are increasingly trying to attract patients. This is especially true of the demanding target group of private patients. Upon making their selection, patients are paying more and more attention to the overall offering of a hospital: good medical care, the competence of physicians and care personnel and a high level of comfort are all included in their decision process. Key factors include room furnishings, care, communication and entertainment offering and individual support.

Patients covered by social insurance also require a certain standard when it comes to the infrastructures in hospitals. The patients want to have many of the conveniences of their daily lives in the hospital as well.
Means of communication available at all times

Means of communication, which are available at all times, have become a matter of course. For patients it is especially important to keep contact with the outside world. Many family members now have jobs and cannot always make visits to the hospital so that the telephone is often the only means of communication. A large percentage of patients do not want to lose the connection to their own workplaces either. They keep relationships with employees and customers afloat via telephone and e-mail contact. Hospitals, which take the aspect of comfort and comprehensive services into consideration, will win market shares in the long run.

Individual control

Integral room automation provides a high level of comfort. This is because it can be adjusted to suit patient requirements. In addition, it can be regulated individually for different processes such as operations for example. Depending on the function of a room, the requirements of the climatic conditions such as temperature, lighting, ventilation and humidity can vary widely.

An emphasis on people

On one hand, the function of the room determines the requirements and, on the other hand, people and their individual requirements have to be taken into consideration. A room automation system can be used to control the climatic conditions, the lighting and the sun protection of each individual room. If, for example, less light comes through the window, then the artificial lighting is automatically brightened. Thus, many of the human needs and the technical requirements in all rooms are automatically covered without the personnel having to take care of it.

On the cutting edge: the hospital da Luz in Lisbon – a complete integration solution

The most modern concepts of digital networking have been implemented in the hospital da Luz in Lisbon, Portugal. This includes patient terminals in all patient rooms. In addition to room control, the terminal provides access to patient files, which can be called up by the physician and care personnel after entering proper identification. In addition, telephone, television and e-mail are integrated as means of communication and the patients can also use entertainment options such as video on demand, Internet or radio and games.
In an operating room, numerous regulations and standards pertaining to building technology have to be adhered to. The rooms require the highest standards of hygiene and security of the technology as well as simple and safe operation. The schedule of an operating room, for example, has to be adjusted to the respective procedure each day and emergencies can necessitate changes to the plans. This task as well as other important coordination activities is often carried out in a central operating room control center.

In addition to implementing regulations and standards upon installation of the various systems, the operating rooms have to be simple to operate by various different users such as surgeons, assistants, operating room care and cleaning staff or technicians. Therefore, graphical user interfaces are increasingly being used in the operating room as an interface between people and technology. These can be adjusted individually to suit the different needs. Operating environments such as heating, ventilation, cooling, sanitary and power supply are displayed via a unified interface on a touch panel.
Scenarios defined for different types of operations can be used to operate all building technology. Thus, the operating room can quickly be switched from one scenario to another with regards to ventilation or lighting in a targeted manner such as when switching from an endoscopic operation to another operation.

The operating room solution in the municipal hospital Triemli in Zurich, Switzerland

The display of operating states such as HVAC alarming, temperature or humidity has been solved using a unified user interface on a touch panel. Predefined operations scenarios can be used to operate all building technology. Upon system construction, a KNX room automation with an Ethernet backbone and consistent redundant technology was installed. The solution allows the user to obtain an immediate overview of the situation in the operating room, fast adjustment of the environmental conditions and a high level of hygiene.
Integral operation of other rooms

Modern conference rooms and lecture halls are equipped with audio/video systems, which can include video cameras, PCs, microphones, systems for video conferences, projectors and plasma screens. However, a successful presentation not only requires modern media technology. The integration of building technology is required to make conditions for the speaker ideal. The media components and the building technology can be operated in the rooms directly via a touch panel, a PC or switches. At the tap of a finger, one can activate all switching and control procedures and view the current ambient status at a glance.
Depending on the system components, the user of a room can request help from the administrator by simply pressing a button. The administrator can respond to this call for help by sending a predefined message to the room or by immediately forwarding an e-mail to the person responsible for this room such as the janitor or technician. The administrator also has access to the devices at any time. Modern software logs all procedures, which simplifies the work required for system support.

**Music for relaxation**

Music in public spaces has a calming relaxing effect. The music server is connected to the central control unit. Thus, it is possible to select between music that has already been set or receiving digital radio. Depending on specific needs, the music, volume and sound can be set or switched off in individual rooms.
Ensuring security through traceability
Security as a major challenge

Safety is a major challenge in hospitals. This includes the traditional tasks of fire safety and security, but also several environmental conditions: data pertaining to the air quality, heating or cooling as well as the storage of critical and specific hospital items and medicinal products, e.g. blood, cell or tissue samples, have to be archived in a traceable manner. In addition to this, the temperature, humidity, pressure, and particle and gas contents in the air have to be controlled. In cases of deviation, alarms have to be sent and immediate intervention has to be ensured.
Knowing when an item was in a location

Data recording during preparation and actual deliveries is carried out with precise time entries about the procedure. Thus, it is possible to determine the exact path taken by the respective items or the process such as cooling and humidifying: When was the item ready for delivery? When was it received by logistics? When was it provided to the recipient? At which operating temperatures was it stored? How long was it stored? Target and actual values are compared and stored on an ongoing basis. This serves to protect patients and personnel and operate hospital processes in an efficient and safe manner.

The introduction of legal stipulations requires a need for action in logistics departments as well as in the hospitals’ integrated processes: declaration regulations require specification of origin and information pertaining to the means of production. Replicable and standardized quality as well as traceability serve as a foundation for so-called “Good Manufacturing Practices” and serve to make medicines more controllable.

In medicine therapy, there is a trend to return to patient-specific production. This has to be documented, reproducible, standardized and validated so that the security of the manufacturing process, the quality and the control can be guaranteed.

Traceability via the Siemens Infocenter

The Infocenter is an overall system designed to monitor hospital operation and its processes. All relevant hospital data is saved, which guarantees traceability. In the analysis process, all available data is processed to form meaningful information. The system offers data evaluation, statistical evaluation of values and customer-specific reporting options.

Among other things, the solution can monitor critical processes, storage of the hospital inventory such as food, blood or tissue samples as well as medicine and treatment research. If needed, the Infocenter triggers alarms and creates reports. Furthermore, this solution ensures that the data cannot be subsequently manipulated.
Modern technologies can significantly support the efficient and safe operation of a hospital: The supply security and comfort for patients and personnel can be improved. Energy efficiency can be increased by way of streamlining processes and resource management and system operation can be optimized using integrated management systems and professional facility management.

Danger alarm systems work even more precisely with new sensors and IT technology. Subsystems are linked intelligently by way of networking. All important systems have to be able to be redundant and data protection is subject to the highest requirements.

The systems can reveal their true potential when all building technology systems work together in harmony. Optimum security, maximum operating efficiency and the highest possible comfort are then guaranteed.

We enable full use of synergies with our integrated building solutions. We offer a comprehensive product range as well as proven services and solutions, which are exactly customized to meet the needs of each building and the processes integrated therein.

More than 1,500 reference systems in the European healthcare sector serve as evidence of our extensive practical experience with the requirements of hospitals – we provide well-planned customized solutions that are modular and scalable. With a tightly woven service network, we provide our customers with a long-term effective contribution to future-oriented healthy development of operations.

Use the support from a single source by our specialists with global experience in the hospital and out-patient care sector to find, install, operate and finance the best possible solution for your business.
Do you have a need for action?

In the following graph, indicate your company's current situation and contact us for a detailed analysis afterwards.
### Control of heat and cooling distribution for HVAC applications (excl. processes)

<table>
<thead>
<tr>
<th>1 (very poor)</th>
<th>2 (poor)</th>
<th>3 (satisfactory)</th>
<th>4 (good)</th>
<th>5 (very good)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual</td>
<td>Constant temperature and volume flow (24/7) according to outside temperature</td>
<td>Supply temperature and volume flow with room thermostats</td>
<td>Temperatures and volume flow controlled dependent on demand (of user) and weather with room thermostats and night setback</td>
<td></td>
</tr>
</tbody>
</table>

### Optimization of the light control

<table>
<thead>
<tr>
<th>1 (very poor)</th>
<th>2 (poor)</th>
<th>3 (satisfactory)</th>
<th>4 (good)</th>
<th>5 (very good)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual on/off</td>
<td>Time switches</td>
<td>Motion detectors and time switches with individual schedules</td>
<td>Individual day light control incl. motion detectors and centralized lighting control for common areas and outside lighting</td>
<td></td>
</tr>
</tbody>
</table>

### Energy transparency

<table>
<thead>
<tr>
<th>1 (very poor)</th>
<th>2 (poor)</th>
<th>3 (satisfactory)</th>
<th>4 (good)</th>
<th>5 (very good)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No consideration</td>
<td>Manual recording of billing data, e.g. energy and water, yearly resolution</td>
<td>Manual main-meter energy and water billing data, manual weather adjusted, monthly resolution</td>
<td>Automated main- and sub-meter data incl. weather adjustment, weekly resolution</td>
<td>As mentioned before plus energy budgets for dedicated areas or plants incl. automated alarming</td>
</tr>
</tbody>
</table>

### Control of air conditioning system

<table>
<thead>
<tr>
<th>1 (very poor)</th>
<th>2 (poor)</th>
<th>3 (satisfactory)</th>
<th>4 (good)</th>
<th>5 (very good)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual</td>
<td>Constant temperature and volume flow (24/7)</td>
<td>Constant temperature and volume flow, timer-controlled</td>
<td>Constant temperature and volume flow, timer-controlled, performance monitoring</td>
<td>Demand-controlled ventilation depending on CO₂ and temperature level incl. performance monitoring</td>
</tr>
</tbody>
</table>

### Efficiency components

<table>
<thead>
<tr>
<th>1 (very poor)</th>
<th>2 (poor)</th>
<th>3 (satisfactory)</th>
<th>4 (good)</th>
<th>5 (very good)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 60%</td>
<td>60 – 70%</td>
<td>70 – 80%</td>
<td>80 – 85%</td>
<td>&gt; 85%</td>
</tr>
</tbody>
</table>

### Degree of building technology

<table>
<thead>
<tr>
<th>1 (very poor)</th>
<th>2 (poor)</th>
<th>3 (satisfactory)</th>
<th>4 (good)</th>
<th>5 (very good)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not used</td>
<td>Rarely used</td>
<td>Used 3 – 4 times a week</td>
<td>Daily usage, regular updates</td>
<td>Pro-actively used, evaluation of trend data, deduction of optimization measures</td>
</tr>
</tbody>
</table>

### Optimization of the warm water consumption

<table>
<thead>
<tr>
<th>1 (very poor)</th>
<th>2 (poor)</th>
<th>3 (satisfactory)</th>
<th>4 (good)</th>
<th>5 (very good)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No consideration</td>
<td>Constant WW-recirculation</td>
<td>Electric tracing</td>
<td>Optimized volume flow with constant WW-recirculation</td>
<td>Optimized volume flow with electric tracing</td>
</tr>
</tbody>
</table>

### Efficiency cooling plant (chiller, pumps, cooling tower) – COP*

<table>
<thead>
<tr>
<th>1 (very poor)</th>
<th>2 (poor)</th>
<th>3 (satisfactory)</th>
<th>4 (good)</th>
<th>5 (very good)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 2</td>
<td>2.1 – 2.5</td>
<td>2.6 – 3.5</td>
<td>3.6 – 4.5</td>
<td>&gt; 4.5</td>
</tr>
</tbody>
</table>

### Efficiency heating plant (boiler and pumps)

<table>
<thead>
<tr>
<th>1 (very poor)</th>
<th>2 (poor)</th>
<th>3 (satisfactory)</th>
<th>4 (good)</th>
<th>5 (very good)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 60%</td>
<td>60 – 70%</td>
<td>70 – 80%</td>
<td>80 – 85%</td>
<td>&gt; 85%</td>
</tr>
</tbody>
</table>

---

*Criteria for the optimization of the building management system.

*COP: Coefficient of performance
The information in this document contains general descriptions of technical options available, which do not always have to be present in individual cases. The required features should therefore be specified in each individual case at the time of closing the contract.

Windows is a registered trademark of Microsoft Corporation.

Subject to change • Order no. 0-92127-en •
© Siemens Switzerland Ltd • Printed in Switzerland • 1,50806