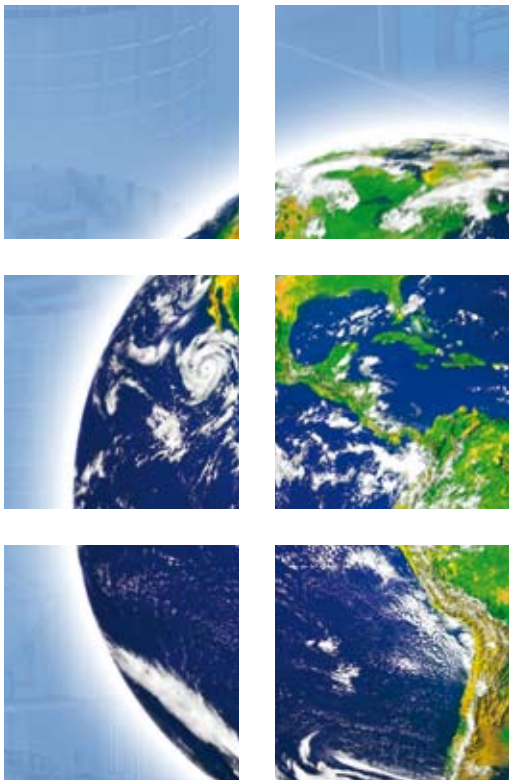


Energy Efficiency with KNX

Contents

KNX is Green

Energy Savings with KNX
- up to 40 % with KNX shading control
- up to 50 % with KNX individual room control
- up to 60 % with KNX lighting control
- up to 60 % with KNX ventilation control

Climate change and ever-depleting resources mean that efficient energy use is a key social issue. Because they account for 40 % of total energy consumption, buildings represent considerable energy-saving potential. KNX meets the requirements of the top Energy Performance Class for building automation as per EN 15232. This means that KNX is ideally suited to fulfilling the tightened energy consumption requirements for buildings. KNX allows up to 50 % energy savings.

Buildings that are energy efficiently planned and operated are no longer unique. Even the description "an intelligent building" is beginning to lose its exotic nature. Both trends are presently revolutionising the increasingly ambitious architecture and setting a course in the worldwide fight against climate change.

In reality, energy conversation in the building sector has, to a great degree, become a trend and has slowly become an everyday concept for architects as well as for building constructors. Due to the recently recurring annual natural disasters, both large and small, we can see the impact of the increasing imbalance. We are, therefore, forced to look to the future and take responsibility for the actions of our society.

During the construction of a building, as well as during its operation, large amounts of energy are used, for this reason targeted usage in this area is especially effective. This does not necessarily mean the ultimate goal should be a "zero-energy house"; alone the intelligent networking of all devices to a decentralised complete system brings unforeseen savings. The networking of all electrical functions in a single installation bus system provides the opportunity for optimal coordinated control. The operation of heating, air-conditioning, lights and blinds for example can be aligned with external climate conditions and be controlled from an interface. Energy consumption is thereby kept within minimal boundaries. Since all electrical driven equipment and installations can be flexibly combined with one another and can be controlled by touch panels or by public networks (telephone, Internet), in the area of design and comfort this opens up almost unlimited possibilities – from efficient building management through intelligent security control to the storage of different light, noise and air quality requirements which can all be realised without great effort.

The creativity of the designer is now called upon, thereby bringing closer the goal of creating expressive and thrilling architecture which is both ecological and profitable.
One thing is clear – we control climate change!

Study University of Bremen (Germany)

KNX Standard enables significant Energy Savings

When one thinks of building system engineering, one thinks of KNX. This includes the comfort of controlling shutters, blinds, lighting system, audio system, heating system, air-conditioning system and more. However, the fact that this comfort also comes with an additional advantage, the energy savings of up to 50 %, has not been proven reliably so far.

Current studies prove that the application of KNX technology can significantly reduce the energy budget.
The achievement of a higher comfort standard through bus systems in buildings has been a long known fact. The fully automated home is often mentioned in this context controlling all energy consuming building systems like lights, heat and ventilation to the users' demands. Studies which were presented at the KNX Scientific Conference 2006 in Vienna showed additional potential of the building control system.
To prove this, the University of Trento in Italy and the University of Bremen in Germany equipped buildings and rooms with KNX controls for the heating and lighting. The logged data was evaluated and a "normal" case was compared to the "KNX" operation. To explain in more detail, we will take a closer look at the KNX project at the University of Bremen. The following numbers and results are taken from the presentation of Prof. Dr.-Ing. Manfred Mevenkamp, project manager and dean of the faculty of electrical engineering and information technology at the University of Bremen.

Energy Savings with KNX
up to 50 % with light and heating

***Figure 1**. Heat meters with M-Bus interface and M-Bus-KNX-Gateway*

Energy Savings up to 50 %

About 33 % of the entire energy consumption of residential and commercial buildings is used for heating. From a certain point on, this high energy demand can only be reduced with an intelligent control system – like KNX. In structurally weak buildings high energy savings can be achieved with constructive measures like a better building envelope insulation. In a list with the different energy demands of buildings types, building which are built to „passive building" standards lead the way. The project of the University of Bremen is based on a modern building infrastructure, the center for Information and Media Technology (ZIMT) in Bremen which was constructed in 2002. The building has a specific energy demand of 60 – 75 kWh/m²a. Prof. Dr.-Ing. Mevenkamp's project

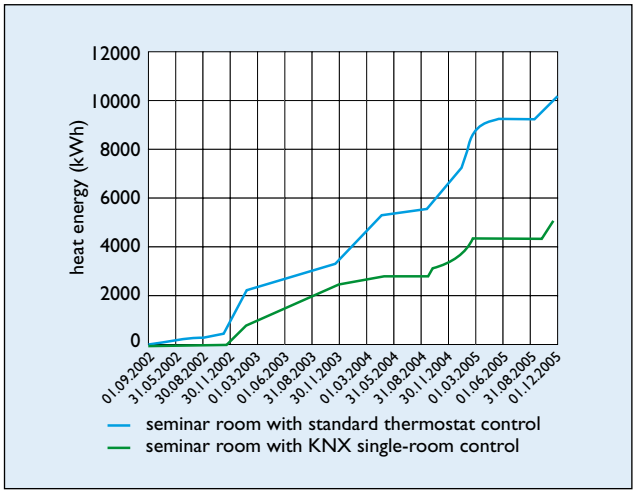


***Figure 2**. The logged data of the comparison test covered the periods from the beginning of 2002 until the end of 2005. However, the rooms weren't fully used until the middle of 2004. The "KNX controlled" room could save up to 50 % of the energy as compared to the „normal" room.*

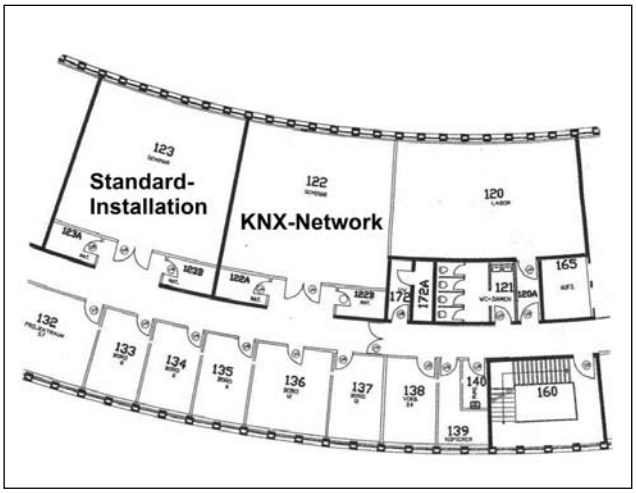


***Figure 3**. Seminar rooms, ZIMT, first floor*

group chose two identical class rooms for their experiments. One of them was equipped with standard thermostats for the heaters and the other one was equipped with KNX control. The KNX controlled room was installed with window switches, valves on the heaters, a room temperature control system and a heating meter with M-Bus interface and M-Bus-KNX-Gateway. The logged data of the comparison test covered the periods from the beginning of 2002 until the end of 2005. However, the rooms weren't fully used until the middle of 2004. The result of the data analysis is very positive as the KNX controlled room could save up to 50 % energy as compared to the room with standard installation.

Heating Comfort Remains

Critics who think the KNX system is slow reacting and could not provide the same heating comfort as a standard system which runs continuously are mistaken. As part of this test run, the average and actual room temperatures were also analyzed. The KNX room had 0.3°C higher average temperature even though the heating energy demand was just half of the room with the standard installation. The dynamic heating behavior of both rooms do not differ that much, which means the on/off curves are almost identical with regards to temperature and time. To increase the effectiveness and efficiency, the heating periods were controlled by a schedule, which depended on the occupancy plan of the room. Therefore, no heating energy was wasted for a room that was not in use. But that was not all: savings potential of up to 50 % was possible with the lighting system.

Energy Savings of the Lighting System

The yearly energy demand for the lighting system in the same building is 500MWh/a and is therefore higher than the heating energy demand with 435 – 485 MWh/a. Additional energy costs of the University of Bremen could be reduced with the application of KNX controlled lights. Factors that influenced this test series were the following: presence of occupants, the daylight level, glare and the necessary illumination at the student's work desks. The same rooms that were used for the heating energy comparison were equipped with presence sensors, two light sensors (for two groups of luminaires) and dimming actuators. The two light sensors were necessary as the area closest to the window was treated differently than the area closest to the interior wall. As compared to the standard operation (manual on/off switching) energy savings of up to 50 % could be reached. There was no energy demand base line, i.e. there was always a steady but small power demand because the sensor technology required energy.

Choosing the right Components

With regard to the choice of components, it is important to mention that the use of the combined sensor with presence detector initially seemed to be the most attractive solution. However, it did not deliver the exact illumination values of a dedicated lux sensor because the value can be influenced by incoming daylight or other light sources.
Therefore, the project team decided to use the slightly more expensive alternative and installed two dedicated lux sensors that delivered promising results. In addition, the people responsible for the project noticed a lack of standardized guidelines for daylight controlled lighting systems. This concludes that KNX building controls not only increase the living comfort but also play a significant role in reducing energy costs. The tests provide the proof: the use of KNX may reduce the energy for lighting and heating demand of up to 50 %. This strong argument should convince even the last skeptics of the KNX building control system. If one considers rising energy prices, the small investment into a home and building automation seem to be very reasonable, especially if they pay off within a few years and offer the expandability for additional comfort functions.

www.iia.hs-bremen.de/KNX-Energieeffizienz

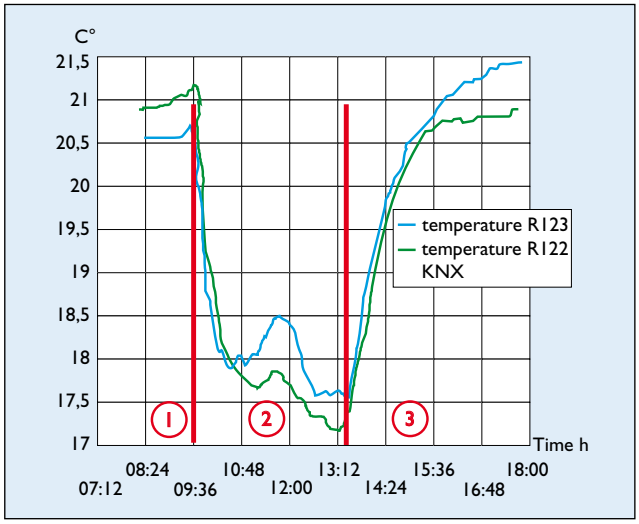


***Figure 4**. Room temperature dynamics*

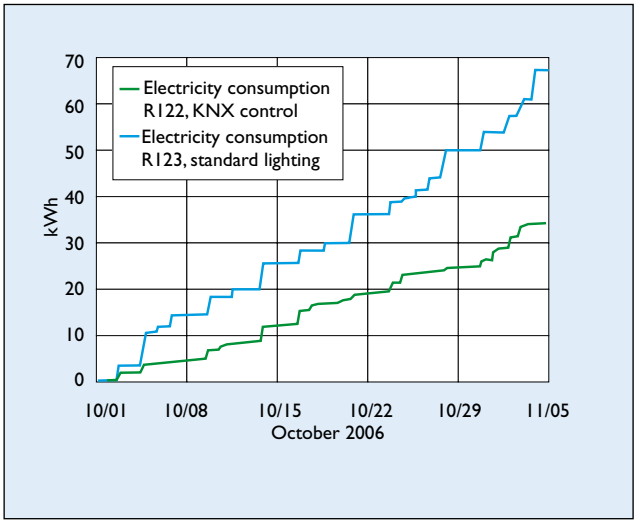


***Figure 5**. Comparison of electricity demand*

New "SciTec" Building at Oundle School, Peterborough (Great Britain)

KNX drastically reduces Energy Consumption and CO_2 Emissions

Figure 1. *Oundle School's SciTec centre, which brings together science, art and technology, and which has been built with the help of future-oriented sustainable technologies such as KNX. Source: Andromeda*

Oundle School's new "SciTec" centre brings together science, art and technology. Thanks to integrated building and room automation with KNX, the English school's vision for the future has become a reality. The project won the KNX Award 2008, category: Energy Efficiency.

The new science, art and technology centre is a superb example of a "green building". The system integrator, Andromeda, estimates that the building consumes 40 – 60 % less energy than conventional school buildings. It is calculated that the building's "as-needed" lighting system alone will reduce annual CO_2 emissions from 8 m tonnes to 2.8 m tonnes!

The peaceful market town of Oundle, where the famous school is based, is located about 120 kilometres from London. Here, over 1,000 pupils are educated in more than a dozen buildings spread across the whole town. The school caters to pupils between the ages of 10 and 19, who can be either boarders or day pupils. The history of the school can be traced back to 1556. Despite its long history, the school is not tied down by tradition, but looks very much to the future. The management of the school reasserted its confidence that it will remain one of the top schools in the British Isles when, at the beginning of the new millennium, it commissioned the planning of a new centre for science, art, design and technology. The resulting modern, bright building, known for short as "SciTec", was completed in 2007.

Sustainable Development is the top Priority

Right from the start, the project aimed to adhere to the principles of "green building", be environmentally friendly and sustainable, and use energy-efficient technologies. This aim was never neglected throughout the design/planning and construction phases, and in the management of the project. The building automation system used was chosen on the basis of these aspects, but economy and flexibility also played an important role in decision-making. Other key criteria influencing the decision were that the system should be sufficiently standardised, reliable and robust to ensure a high level of investment security, that it should be simple to install, and that it should require a minimal amount of cabling work. The KNX system ideally met all of these requirements, and thus the company Andromeda Technology Ltd., which is highly experienced in the use of KNX and its integration

Energy Savings with KNX

Thanks to integrated control and regulation via KNX, in this project the following reductions in energy consumption were possible:

- 78 % due to use of natural ventilation
- 50 % due to regulation of underfloor heating in 16 zones
- 60 – 70 % due to constant light regulation and additional presence sensors
- 40 – 60 % energy saved in total compared to a conventional school building

Figure 2. *Energy efficiency 1: constant light regulation with KNX in the laboratories. Source: Andromeda*

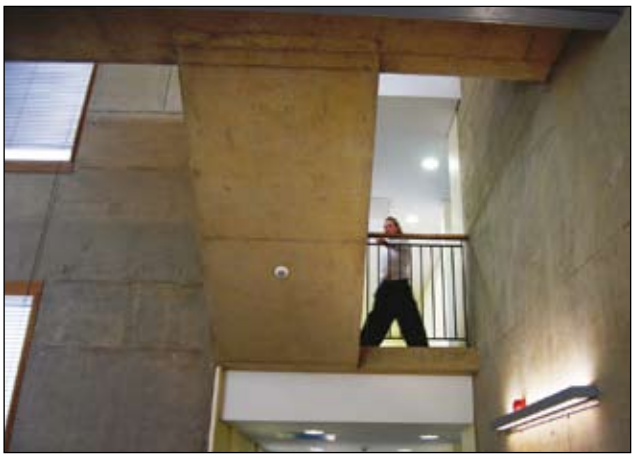


Figure 3. *Energy efficiency 2: plenty of daylight and presence sensors controlling the lighting. Source: Andromeda*

Figure 4. *Sustainable resources: solar panels for the hot service water supply. Source: Andromeda*

Use of KNX in this Project

- A very high level of energy efficiency and a drastic reduction in CO_2 emissions thanks to "as-needed" control and regulation of all facilities.
- Reduced installation costs and embodied energy consumption due to the use of KNX for all trades.
- Integrated operation and visualisation of all subsystems via a building management system, via any PC inside or outside the building as system is Web-based.

Technical Highlights of this Project

- Integration via KNX of all decentralised, energy-optimised heating and ventilation systems, including components such as gates, valves, zone regulators, window drives etc.
- Integration, via KNX/IP gateways, of all KNX controls and regulators with the Web-based building management system in order to optimise total energy efficiency and allow easy management of the system by the in-house building systems engineering team

Parties involved:
Architect:
Fielden Clegg Bradley, London, UK
Electrical design: Max Fordham, London, UK
M & E:
Briggs & Forrester, Northampton, UK
KNX system integrator:
Andromeda Telematics Ltd, Byfleet, Surrey, UK

Info:
Andromeda Telematics Ltd.,
www.andromeda-telematics.com,
darren.burford@andromeda-telematics.com

into overall systems, was entrusted with the project. The fact that all of the installation work could be carried out by just one supplier as part of a single order meant that further considerable cost savings could be achieved.

Control of all decentralised building engineering systems KNX is used to regulate the natural ventilation, which itself allows an energy reduction of 78 % compared to conventional ventilation systems. The natural ventilation is achieved with automatic window ventilation and mechanical ventilation using small air quantities, regulated by air quality sensors. The underfloor heating is automated in 16 individual zones, thus allowing a saving of 50 % compared to a conventional heating system. During the summer, hot water is heated exclusively via solar panels on the roof, and during the winter it is at least preheated in this way.

The lighting system, which uses constant light regulation with additional presence sensors to ensure that a target value of 400 lux is adhered to, uses 60 – 70 % less energy than lights that are switched on and off by hand. All light fixtures are activated via DALI/KNX gateways, and the emergency lighting also uses this technology. A photovoltaic system on the roof generates enough energy to heat the building's hot water supply during the summer, while any excess power produced is used for the lighting.

Uniform Operation and Management

Thus all facilities in the building are controlled and regulated via KNX – in the case of the lighting, via gateways to DALI. The various system components are integrated into the overall system via KNX/IP gateways. The consumption data for gas, water and electricity are captured at various measurement points and transmitted via KNX to the building management system. The Web-based building management system allows control and parameterisation, as well as detailed energy monitoring. Monitoring is also possible online with Internet Explorer from any PC, as the system functions on an IP basis. Thus, when required, modifications and updates can also be made directly from the offices of Andromeda Technology Ltd. Because the system is fully integrated and easily manageable, on a day-to-day basis the school's own building systems engineering team can reliably control and optimise the level of comfort, energy efficiency and CO_2 emissions of the building.

KNX for Comfort, Safety and Energy Efficiency (Sweden)

A former Factory becomes the new Stockholm Stock Exchange

Figure 1. *The blinds act as both shading and design elements.*
Source: Energoretea

In the same building in the Swedish capital where Ford cars were once produced, now dealers trade in securities. 1,800 new, contemporary jobs have been created following the conversion of the former factory building in Stockholm. All of the building functions are linked via KNX, thus ensuring a reliable power supply and a high level of comfort for workers.

The historic Ford factory building, which dates back to 1932, has been occupied since 2005 by the company OMX AB. OMX AB operates the Swedish Stock Exchange. The old building was converted and renovated with a great deal of respect for the existing building fabric. In this way, the existing building shell was used to house a state-of-the-art centre for international stock trading, which has won prizes from a variety of institutions, including the ROT Award and the Swedish Lighting Award. In addition to the office areas, the building also includes a staff restaurant and a gym and sports centre. This was made possible by the addition of new floors, meaning that the useful area of the building was almost doubled, and now covers some 40,000 m^2. Because of the highly sensitive work that takes place at the stock exchange, a permanent supply of electric power is essential. This is guaranteed thanks to a normal and an emergency power supply, which are accommodated in the former boiler house. The process of switching between the two supplies is fully automatic.

Flexible, rational Management with KNX

The owner chose KNX because of the flexibility it offers in terms of application and expansion of the system, and the small amount of cabling work involved. It can always be adapted to the needs of new tenants by making just small modifications. The entire KNX room automation system is linked via an OPC server to the central building management system of the Stockholm Stock Exchange. The building management team are thus able to rationally monitor and control interval timers, alarms, current and limit values, energy consumption and the status of shading and lighting equipment. The main messages from fuses, lifts, smoke detectors and residual current devices are summarised in an alarm management system, which immediately sends all important data to the responsible locations.

Automatic and individual Settings

In the open-plan offices and throughout the building complex, the lighting is adapted via KNX to the natural light level as measured by light sensors, and controlled and regulated by motion sensors or interval timers, depending on the respective zone. However, if an evacuation alarm is triggered, these automated functions are overridden and all escape routes are immediately bright-

Figure 2. *View of a two-storey, open-plan office in the former factory building, with constant light regulation.* *Source: Energoretea*

Figure 3. *The electric and natural light in the atrium can be adjusted as required via remote control.* *Source: Energoretea*

Figure 4. *The state-of-the-art Stockholm Stock Exchange office building was created from an old Ford factory building. Source: Energoretea*

ly illuminated. In conference, meeting and training rooms, the ventilation is controlled by timer, but can also be requested via local KNX switches, and the target temperature can also be modified by the user.

Sophisticated shading System

Data relating to sunlight exposure, wind and rain are transmitted via KNX from the building's own weather station to the control system for the blinds. The outer blinds are for shading purposes and are intended to ensure a pleasant indoor temperature on hot days. But the blinds also have an aesthetic function: thanks to their harmonious colours, they make the classic facade shine with a new radiance. The vertical blinds inside the building can be adjusted by individual users to protect them against glare, according to their respective requirements. They automatically return to their initial position every evening, with the help of KNX. In the meeting and conference rooms, there are a variety of special KNX lighting scenes to choose from, to allow the right atmosphere to be created for a particular activity. The atrium is used for meetings, film showings and other events. Via KNX, speakers and trainers can quickly and simply adjust the level of electric and natural lighting in order to create the optimum conditions for themselves and their audience.

Use of KNX in this Project

- Maximum energy efficiency thanks to as-needed control of lighting, shading, heating and ventilation.
- Comfort for office users, who can adjust a variety of factors in their working environment to their individual needs.
- Flexibility and cost reduction thanks to the use of KNX for the entire room automation system and its incorporation into the building management system.

Technical Highlights of this Project

- All important functions, e.g. automatic cutouts and lift faults, are monitored by the building management system via KNX.
- In certain rooms, the ventilation system can be switched on via local operating switches with individual temperature selection.
- A display in the lobby shows outdoor temperature, brightness and wind speed.

Parties involved:

Owner:
Fabege AB, S-169 24 Solna, Sweden
Automation Consultant:
Energoretea, S-131 26 Nacka Strand, Sweden
Electrical design: STEA, S-127 25 Skärholmen, Sweden
KNX System Integrator:
Energoretea, S-131 26 Nacka Strand, Sweden

Info:
Energoretea, S-131 26 Nacka Strand, Sweden

KNX allows Savings to be made by reducing Energy Consumption

The as-needed control and regulation of lighting, shading, heating and ventilation make it possible to operate the building highly energy-efficiently, and to massively reduce costs. Lighting in passageways is dimmed to 10 % at night and at weekends. This helps the building to look its best from the outside, while reducing energy costs and extending the life of the light sources. Automated control and regulation of heating, cooling and ventilation with KNX additionally helps to reduce consumption of electrical and fossil energy.

Central Control of public Lighting via KNX means (Austria)

Big Savings in Electricity for the City of Salzburg

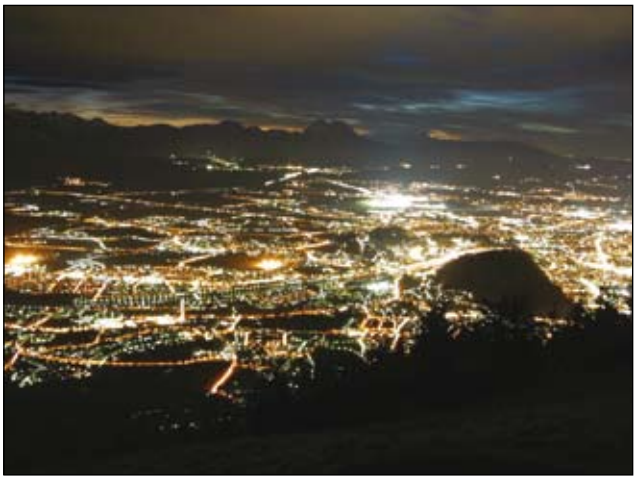


Figure 1. *Salzburg city centre by night, viewed from the Gaisberg.*
Source: Schäcke

Some time ago, the City of Salzburg drew up a concept for improving the energy efficiency, safety and security offered by the control system governing the city's public lighting. A KNX system was chosen for this demanding task, as it represented a very cost-effective solution. For this, the system integrator, Schäcke, earned itself the KNX Award 2008, category: Special.

Salzburg extends over an area of 65.65 km² and has a population of 150,269 (2007 data). The public lighting (street lighting) system for the city of Salzburg consists of 19,000 fixtures using 2.9 megawatts of electrical power. There are 200 floodlights illuminating 30 different sights, including the fortress Hohensalzburg, various buildings, and the hills immediately surrounding the city. The Department of Public Lighting for the Municipality of Salzburg, as operator of the street lighting, applies a number of cost-reducing measures. From midnight onwards, for example, the voltage along entire streets and at major junctions is reduced to 180 volts, which results in a dimming of the lights. The lighting in the various zones is switched on and off on the one hand via ripple control on the 230/400 V line network, and on the other hand via radio transponders. The entire system, with a total line network of 600 km, is overseen by 33 employees.

Energy Savings with KNX
The City of Salzburg reduces overall energy consumption for street lighting by approximately 2,5 % and hence saves 750 tons of CO_2.

An Emphasis on Energy Efficiency, Safety, Security and rational Management

The operators of the street lighting in Salzburg wanted to further improve a number of properties of the system, and thus set the following requirements:

- Energy efficiency: with a total power of 2.9 megawatts, the cost of one hour of lighting (at € 0.11 per kWh) is € 319. Every minute saved reduces the total annual cost of operating the public lighting system. In fine weather, the control system should switch the lighting on at exactly 180 lux in the evening, and off at 40 lux in the morning. A so-called "long delay mode" should be available to prevent the lamps from being switched on again in response to poor weather (thunderstorms, snow clouds) shortly after being switched off.
- Longer lamp life: the lamps used are mercury-vapour lamps and sodium burners with an average power of 150 W. These need a burn-in period after being switched on of about 8 – 10 minutes before they reach full lighting power. This needed to be taken into account in the system's switching thresholds, in order to extend the life of the lamps. Before the lights are switched on again, a cooling-down period is therefore always necessary.
- Maximum reliability: the system must have a highly redundant design.

The task of implementing these specifications was entrusted to the company Schäcke AG, which offered a solution involving a combination of KNX and function modules (programmable logic control with KNX telegrams as inputs and outputs). The main argument for choosing this particular supplier was its sensationally low price: the cost for the entire KNX system setup including engineering work was just € 10,250. Equivalent quotes involving the use of an industrial PLC system were many times higher. Although it would have been possible to program the algorithms using an industrial PLC system, the cabling work would have been excessive. Between the measuring room on the top floor and the control system service room on the ground floor of the headquarters of Salzburg state's energy utility Salzburg AG is an estimated 300 m of cabling. It was possible to retain an existing bus line. Prior to implementation of the system, measurements of light curves were taken at dusk and dawn over the course of several months in order to establish the necessary parameters for ensuring a perfect combination of energy efficiency, preservation of the lamps and public safety.

Figure 2. *The heated measurement container with the light value sensors.* *Source: Schäcke*

Figure 3. *KNX components in the measuring room on the top floor.*
Source: Shäcke

Use of KNX in this Project

- Because the switching-on and -off of the public lighting is automated, big savings in electricity and longer lamp life are possible.
- This failsafe KNX system was used for the automation because, according to calculations, an industrial PLC system would have cost many times more. The value of the investment, which included components and engineering work, was € 10,250.

Technical Highlights of this Project

The combination of a decentralised KNX system for sensors and actuators with a function module allowed tough demands to be fulfilled in terms of automation, such as:

- Short delay for the first time the lights are switched off in the morning and on in the evening
- For subsequent occasions where the lights are switched off or on, a so-called "long delay mode" applies
- The duration of the long delay mode itself varying according to the brightness curve over Salzburg
- A situated is prevented where the lamps are switched on again soon after being switched off
- Hot restrike of the 19,000 lamps is prevented, which helps to extend their life

Parties involved:
Operator:
Municipality of Salzburg, Department of Public Lighting,
A-5024 Salzburg, Austria
Designer/System Integrator:
Schäcke GmbH, A-5020 Salzburg, Austria

Info:
Schäcke GmbH, A-5020 Salzburg, Austria, www.schaecke.at

Complex Functions achieved economically thanks to KNX

The KNX system has a redundant design. The two systems, which are not connected via line couplers, each function completely independently and are self-monitoring. Cyclical data transmissions pass from one component to the next in intervals of 30 seconds, ending with a switching actuator which operates according to a step function, whose cycle is repeatedly restarted. If just one component in this cyclical chain fails, then the step time (1 minute) elapses and a fault signal is relayed to the switch room of Salzburg AG. System 2 runs in the background, parallel to the first system, in order to ensure the uniform deterioration of the two systems, and is likewise self-monitoring. The switch room is notified in the same way if there is a fault in system 2. If system 1 goes into fault mode, system 2 replaces it as the control system for the entire city's street lighting.

The control algorithms were implemented with two redundant KNX function modules. Two light value sensors are housed in a heated, temperature-controlled measurement container. When the light measurement system switches the lights off or on for the first time in the morning or evening, the energy utility's switch room is given a 4-minute advance warning. When the lights are switched on in the evening, this advance warning is necessary in order to allow a 4 MW generator to be started up and synchronised. On all subsequent occasions on which the lights are switched on, switching-on is delayed by 10 minutes, in order to bridge short-term drops in light level and to prevent hot restrikes of the lamps. In case of failure of the room temperature controller, the function module sends notification of this fault to the switch room. A special feature of the algorithms is the fact that they allow the weather itself, via changes in the lux values, to influence the control system.

Figure 4. *The headquarters of Salzburg AG, where the KNX control system for the city's street lighting was implemented.* *Source: Shäcke*

Possibility of monitored manual Intervention

In special cases, for example for inspection of the city's street lighting or if difficulties are being experienced in providing the required 2.9 megawatts of power, the Salzburg AG switch room staff have the possibility of stopping the street lighting from being switched on. If necessary, during inspection work, the street lighting can be switched on or off manually; manually switching the lighting off overrides the central control, effectively putting it temporarily out of operation. Meanwhile, in the background, the KNX control prepares for the switching-on of the street lighting, but does not execute it. Only when the switch room staff reactivate the system is the street lighting immediately switched on again.

For security reasons, there can be no IP connection to the state energy utility (Salzburg AG)'s network. Salzburg AG's control IT system and network are completely isolated from the Internet and any third-party systems, and function entirely independently. This prevents the invasion of viruses, which could theoretically cause the collapse of the energy supply throughout the state of Salzburg. For security reasons, the interface from and to Salzburg AG's IT system needed to be implemented using binary inputs and switching actuators.

A new bioclimatic Office Building in Huesca (Spain)

Superbly illustrating the endless Possibilities offered by KNX

Figure 1. *The new Marino López XXI building in Huesca.* *Source: ZVG*

The new branch office of the general contractor Marino Lopez XXI in Huesca, Spain, is a truly exceptional building. It is also a prime example of the flexibility offered by intelligent, KNX-based building services engineering – even after its initial installation. It was for this reason that the building won the KNX Publicity Award 2008.

Energy Savings with KNX
By the overall use of KNX, energy consumption in the building is reduced by 40 %.

Two main criteria were applied during the project planning for this building: firstly, that operation of all facilities should be intuitive and self-explanatory, and secondly, that the building should be as energy-efficient as possible. This KNX installation is clear evidence that comfort and energy efficiency are not mutually exclusive. Through the consistent use of a central bus system, the building saves approximately 40 % energy, while offering an increased level of comfort. The individual floors of the four-storey building are divided into up to 12 different temperature zones, while the entire heating and cooling systems are divided into 32 zones. The temperature in these zones is always ideal, thanks to the incorporation of parameters from other trades. All imaginable facilities in the building are linked together via a KNX bus system: these include, for example, the lighting, shading, HVAC, alarm, technical surveillance, energy management and audio/video (e.g. plasma screens and DVD players) systems, remote monitoring and control, and KNX visualisations. Appliances whose status as secret power guzzlers is often ignored, such as microwaves and coffee machines, are also integrated. The system also includes extensive technical surveillance systems, for example burglar, water and fire alarms in combination with 24 IP cameras, and advanced monitoring possibilities via a terminal, laptop, or any other Internet-capable device.

The magic Fingerprint

Linking together all of a building's trades via a single KNX system is one thing. Doing this in such a way that their operation is intuitive and self-explanatory is another thing altogether. At Marino Lopez XXI's new office, entire scenes are saved for individual users. The KNX system summons these via fingerprint readers. With just a single touch the user can control a number of facilities, such as shading, lighting and temperature. And different predefined scenes can be assigned to each user. As well as operator comfort, this fingerprint system also offers a high degree of security. When employees leave the building, absence scenarios can automatically be activated. The system also knows exactly when an employee has entered his or her office. In this case the temperature will be switched from standby to comfort mode, the lights will be switched on, and the shading will be adjusted appropriately. When employees leave their room, the system automati-

Figure 2. *Via the KNX system access control interface (fingerprint), all facilities can be monitored and controlled as required.* *Source: ZVG*

Figure 3. *Visualisation start page: easy monitoring and control of all facilities.* *Source: ZVG*

Picture 4. *Thanks to the interface of the access control system (fingerprint) to the KNX system, a customized control of all systems is possible.*

Picture 5. *Start page Visualization: Simple monitoring and control of all systems.*

Use of KNX in this Project

- Maximum comfort with minimal energy consumption, thanks to differentiated detection of current needs: in this way, energy consumption can be reduced by at least 40 %.
- Simple, intuitive operation of all building engineering systems – with no need to read a manual – from various locations via user-friendly interfaces, e.g. fixed or portable touch panels, or from any PC via an Internet browser.

Technical Highlights of this Project

- The integrated access control (fingerprint) system lets the KNX system know whether or not there is anyone in the building. Additional interfaces for the burglar, fire and gas alarm systems and heating/cooling systems allow for greater security and safety, better energy management, and enhanced comfort.
- Automatic activation and deactivation of the alarm system via fingerprint reading; activation of absence scenarios such as e.g. presence simulation.

Integration of all Facilities is an intelligent energy-saving Solution

Thanks to the KNX system developed by Ingéneria Domotica, the building saves approx. 40 % energy. This is possible due to the clever way in which all systems are linked together. Even appliances such as coffee machines, which are often forgotten as energy guzzlers, are integrated into the overall system. The intelligent control system keeps room temperatures in standby mode, only switching them to comfort mode if people are present in the room.

Parties involved:

Owner:
Marino López XXI S.L., E-22004 Huesca, Spain
Architect:
Conchita Ruiz Monserrat / Francisco Lacruz Abad,
E-22001 Huesca, Spain
Electrical Design:
Alfonso Rodríguez, E-50002 Zaragoza, Spain
KNX System Integrator:
Ingénieria Domotica, E-31192 Mutilva Baja, Spain

Info:

Ingénieria Domotica,
http://www.ingenieriadomotica.com,
alberto.salvo@ingenieriadomotica.com

cally switches back to standby mode to ensure that as little energy as possible is consumed. However, if a colleague enters an employee's office in his or her absence, the system will recognize this, because it can naturally also determine when someone is not present. The system will not expect the room to be used now, thus will not begin heating or cooling it when in fact the respective colleague has long since left the office. The light will furthermore automatically be switched off again after 30 seconds. If the colleague who has entered the room wishes to remain there for an extended period, however, then he or she simply needs to press the appropriate button on the operator panel, upon which the control will switch back into comfort mode. The entire system is operated via touch-sensitive screens, touch sensors, Internet browsers and mobile terminals. Although there are preset parameters in place, users can modify scenes and adjust facilities according to their individual needs. They can also easily change preset schedules at any time, for example for the coffee machine.

The Lego Principle

It might appear that the entire KNX system was planned all at once, from scratch right down to the finer details, but this is not the case. At first, only the shading, ventilation and a number of lights were controlled via KNX. It is thanks to the flexibility of KNX that the system was able to grow and grow, until eventually it controlled all of the lighting, the entire air conditioning system, and all access systems, alarms, remote maintenance systems and much more. Indeed, this is one of the reasons why KNX was chosen in the first place. The system is open to all trades, can be extended at any time, and is manufacturer-independent. Nor does the owner's decision to use a future-oriented, innovative KNX system of this kind come entirely as a surprise. This is not the first office that the company has had equipped with KNX. And in its role as a developer of construction projects, over the past few years it has also developed more than 5,000 residential units in Aragon, Madrid and Catalonia: and it installed innovative building systems in all 5,000 of these units.

This project was the obvious choice to win the KNX Publicity Award. It clearly shows how all trades can be fully integrated using KNX, and it demonstrates the openness of KNX: the majority of the trades integrated were added to the system gradually. This means that it is no problem to extend the building, or to modify it to take account of changing user behaviour in the future. And were it not for the simplicity of KNX bus installation, the retrofit installations would never have been possible in the first place.

A low Energy Standard single Family Home (Austria)

Efficient and intelligent with KNX

Figure 1. *Single family home with low energy standards*

The control of environmentally friendly heating technology with KNX turns out to be a key factor for profitability.
Efficient heating systems like the heat pump are further optimized through KNX.

A single family home with low energy standards was implemented with KNX technology by Riwitec from Innsbruck. The building is a residential home with a gross area of 150 m² that was constructed to meet the lowest energy standards (figure 1). Numerous functions were implemented with KNX:

- Lighting control
- Shading control
- Heating, air-conditioning and ventilation control
- Data monitoring
- Energy management
- Visualization
- Interfaces to other systems
- Remote control and data logging

Energy Savings with KNX
The yearly costs for heating of this 150 m² home are incredibly low; between € 250 to 300.

Heating Costs of € 300 are possible

The building owner had a clear idea of what he wanted from the beginning. He wanted to invest into a modern, comfortable and energy saving technology that would stand the test of time. It was important to him to have central control functions and a heating control system that would allow standby operation. The expandability of the system with audio and video control was also one of the customer's demands, along with access control of certain areas with visual display, automatic sun shading control, the individual room temperature control of the radiant floor system and a controlled ventilation system. The yearly costs for heating of this 150 m² home are incredibly low; between € 250 to 300.

Optimized Control of Environmental Energy

The south-facing facade is an important characteristic of this home. It helps to reduce the heating demand in the winter but demands a good shading system during the summer. Depending on the time of the year, there are solar gains for up to 14 hours a day. The building is heated with an air/water heat pump, which is directly connected with KNX, and heat storage within the floor slab (figure 2). The heating system not only provides the ventilation, but also the domestic warm water heating and the heating supply. A cross flow plate and frame heat exchanger recovers 90 % of the energy from the mechanical ventilation system. The challenge for the KNX control system was the interaction between the shading and the heating system. The low heating energy costs of this building could only be reached through the smooth interaction of these systems.

KNX joins Trades

The lighting, shading, heating, ventilation and cooling system functions are integrated with KNX products. Dimming and switching actuators were used for the lighting system and were installed in subdistribution cabinets. Lighting scenes can be accessed via push button sensors, touch panel or PC. The sun tracking and temperature controlled shading system control is ensured with a weather station by Theben (figure 3). The control of the blinds into the lighting scenes and the presence simulation are included. The individual room control can be set to comfort, standby, nightreduction or party mode.
The radiant floor heating system covers the base load of the heating system. Push buttons sensors with integrated room thermostats were used. Actuators from Theben were chosen for the radiant floor heating system. The Gira Homeserver provides an interface to the Internet which allows the use of Email and SMS functions for the building control system. The access control and the visualization of the system was implemented with the Homeserver.
A multi-room system for audio control was prepared.

Figure 2. *The integration of the air/water heat pump into the room ventilation controlled via KNX is the basis for the low energy demand*

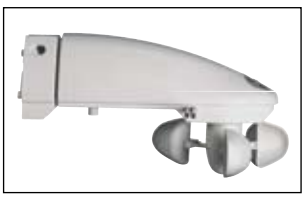


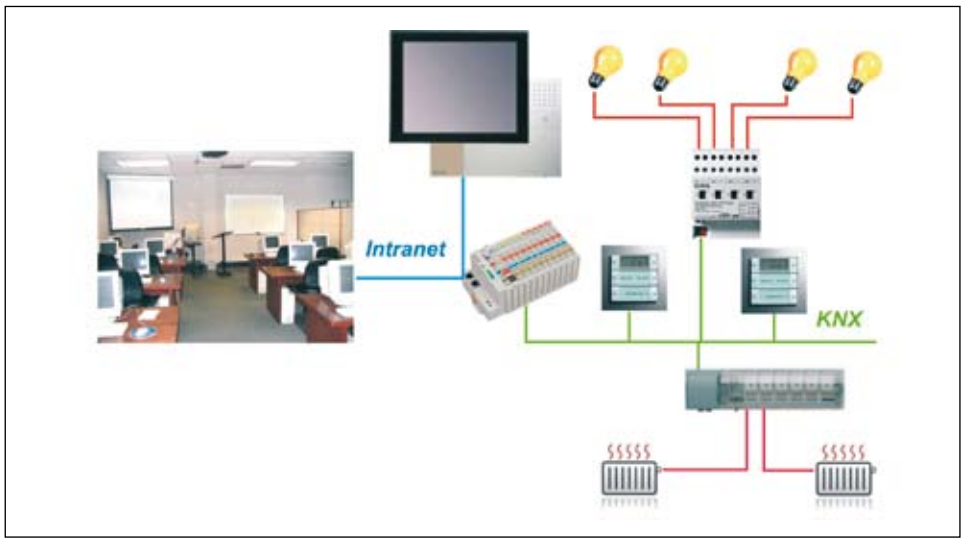
Figure 3. *Meteorological station from Theben*

Energy Consumption in the daily Operation of a School (Germany)

Energy Awareness

Task

A conscious approach to energy use is a prerequisite to protect the earth's climate. The concept of the engineering firm Beyer encourages energy awareness for students. For this the energy consumption and therefore the CO_2 emission of the daily school operation is clearly demonstrated. The teacher will be able to use this information as teaching material.



The Solution

The KNX controls system in the school building provided the necessary data. The energy consumption for the lighting and the heating system are measured and recorded in two class rooms. This data including the CO_2 emission and the energy costs are displayed through a visualization system. A motivating aspect is the fact that two different classrooms can compete in their efforts to reduce energy consumption.

Implementation

The energy consumption of the lighting system is recorded by power sensors of the KNX actuators. The degree of heating valves opening is used to calculate the energy consumption of the heating system. This value is the basis for calculating the energy consumption and the CO_2 emissions based on the current conversion factors (GEMIS data base, Öko-Institute e.V.).
In addition, the energy data of arbitrary loads can be determined with a special educational power outlet. A touch screen is used to input manual tests and for the visualization of the results.

Features

The visualization system in the background can simulate functions of the lighting and heating system in the classroom. The results are shown on the touch screen. Users can plug available electrical devices into the educational power outlet and enter run time estimates to calculate the annual CO_2 emissions.

Advantages

Promoting early energy awareness for youth serves to promote the social shift in awareness and to protect the earth's climate. KNX provides a basis for this task. The engineering firm Beyer offers to advise interested schools and optimizes the concept for individual applications.

Parties involved:
Ingenieurbüro Beyer
Gebäudesystemtechnik
Dipl.-Ing. Dipl.-Wirt.-Ing.
Dirk Beyer
Liegnitzer Straße 10
24537 Neumünster
Phone: 04321 / 9938-0 • Fax: -28
Mail: info@ing-beyer.de
Web: www.ing-beyer.de

Showing Energy Consumption with KNX (Germany)

Smart Metering

Task

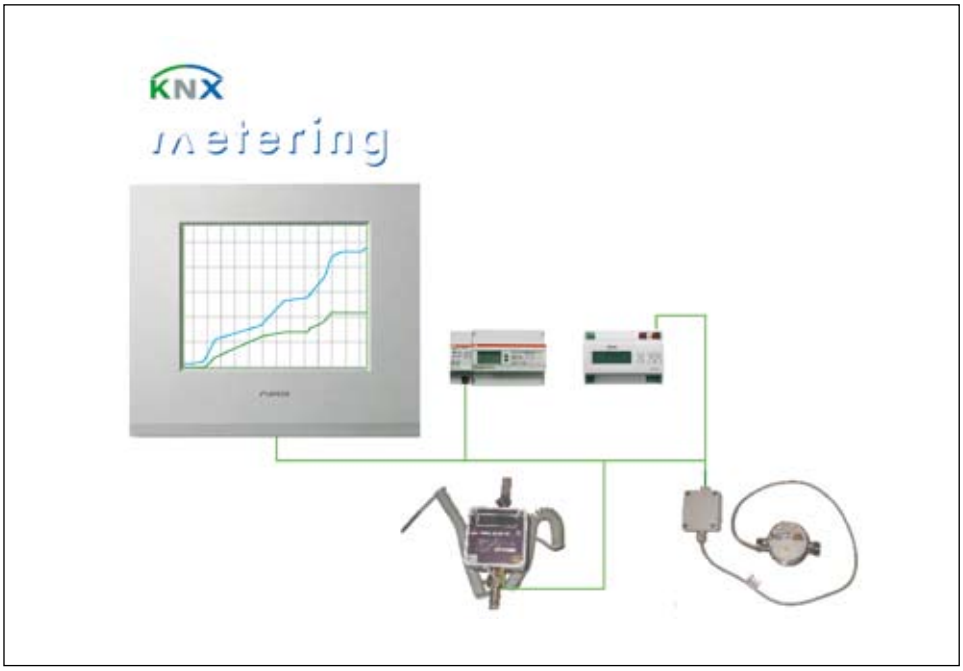
With new products KNX offers the chance to electronically record consumption data and to process this data for accounting and billing software products. The increasing variety of products from different KNX manufacturers in this market segment makes this possible.

The Solution

The utilization of energy meters for power, heat, fill level monitoring, water meters with electronic data recording and data backup during power outages offers a fail-safe system.

Implementation

Connection of the metering devices to the KNX bus system and coupling to IP allows the display and processing of the data on the touch panel.
The visualization can display the recorded and current data of every metering point. The conversion of the data with export functionality to Excel on push of a button from the visualization system allows post-processing for the various accounting and billing software products on the market.



Features

Recording of data for:

- Heat Consumption with heat meters
- Power consumption (different energy meters, flexible with IR interface)
- Water consumption (water meter with KNX connection)
- Fill level meter for tank content (oil, water, liquids)

Advantages

Development of a worldwide standardized system to electronically meter the consumption of different commodities and to convert data for external post processing. The customers can get an overview of the current consumption data at a push of a button and can identify irregularities faster and therefore save time, money and energy.

Parties involved:
KOYNE-SYSTEM-ELEKTRONIK
Intelligentes Wohnen
Marco Koyne, Dipl.-Ing. (BA)
Elektrotechnik Automatisierung
Alexanderstr. 9
(near Alexanderplatz)
10178 Berlin
Phone: 030 47 03 21 82
Fax.: 030 47 03 21 83
E-Mail: marco.koyne@
koyne-system-elektronik.de
Web:
www.koyne-system-elektronik.de

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