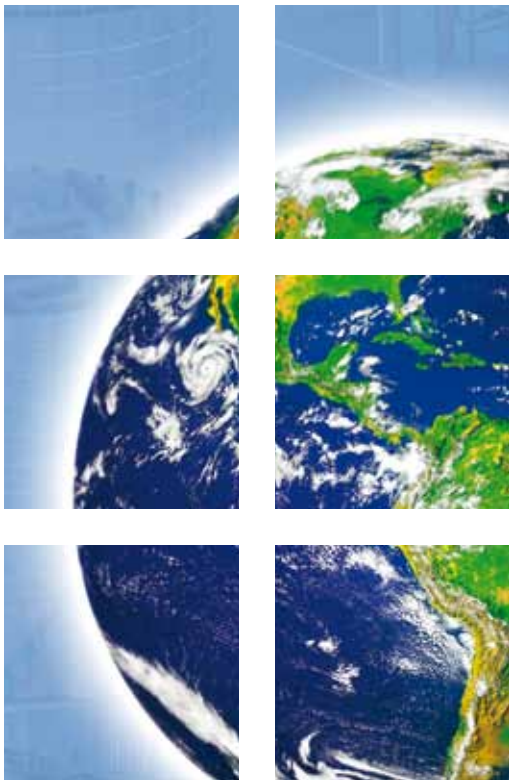

Energy Efficiency with KNX

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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!

Automation makes buildings more efficient

Adapt the demand for heating, cooling and lighting to day-to-day operations with KNX

In light of climate change and increasingly scarce resources, the energy-efficient operation of buildings is gaining in importance. Essential requirements for this are an energy-efficient architectural design, an insulated building exterior and modern installation engineering with a high level of efficiency. Ultimately, the consumption of energy for lighting, heating and cooling depends on both the building use and user behaviour. These are indefinite factors for determining the level of consumption which can scarcely be met using conventional methods. However, with a dynamic management system, the energy usage can be optimally matched to demand during operation. Building automation with KNX offers the best preconditions for this. It ensures the economical use of energy and thus increases the energy efficiency of the building.

Bus devices regulate and control the generated heating and cooling capacity in line with demand. Lighting installations are operated more efficiently using sensors and timer programs. The integrated automation system spans all the trades and also enables links with daylight systems, sun protection systems, ventilation flaps and other systems whereby further energy-saving potentials can be exploited. Intelligent capture of consumption data (Smart Metering) as well as coupling with intelligent networks (Smart Grid) opens up new possibilities for further optimisation and increased energy efficiency both today and in the future.

Persuasive savings rates

Since the building system technology is available for the electrical installation, KNX functions guarantee savings in energy costs for artificial lighting, heating, air conditioning and ventilation systems as well as other loads. With the further development of the system which has already been in existence for 20 years, the open- and closed-looped control systems have been refined and thus increasingly better results are achieved. Nowadays, the savings rates that have been achieved in practice are up to 60 percent and more for the lighting while up to 50 percent is possible for individual room control as a practical study shows. Of course these types of comparisons assume a connection to conventional methods. In the case of renovations in which the building has been improved in terms of its energy efficiency and the installation engineering has been modernised, the control technology contributes to the efficiency gain by at least 5 to 20 percent.

As often occurs in practice, if optimisation of the energy consumption has only been carried out some time after the initial occupation of the building and after experiencing day-to-day operations, the concrete results are persuasive.

Rapid amortisation

In the case of at least two projects, direct investment costs for optimising the energy flow are amazingly low compared to the results. An amortisation was carried out immediately. This is linked to the integrated approach and multiple use of the system. Building automation with KNX offers all kinds of benefits: a flexible electrical installation for changes of use and extensions, more efficiency in the management and maintenance of the building, increased security for material assets and people, a higher level of comfort and well-being in the workplace, both in public and residential buildings. The management of

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

New „SciTec“ Building at Oundle School Peterborough / *Great Britain*

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

Central Control of public Lighting via KNX means / *Austria*

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

energy savings is therefore only one of these. The total investment costs are thus spread across many benefits. Once the installations and functions have been integrated, further reductions in the energy consumption can often be achieved simply through programming, without the need for additional hardware and installations.
In the projects that have been put forward, almost all of them feature possible savings measures with KNX which often simultaneously serve comfort, safety and economical operational flow.

Switching off and dimming

Saving energy means switching the light off when you don't need it. This sounds so simple but it is rarely achieved in practice in more extensive buildings with large numbers of people coming and going. In office buildings, schools, factories, warehouses, hotels, car parks and many other buildings, artificial lighting is left switched on for many reasons. In the case of building automation with KNX, the duty cycle can for example be adapted to the actual lighting requirement with the help of a timer program. This measure alone can achieve high savings which can be further optimised depending on the room use and building type, for example through using daylight and automatic cut-off when there is sufficient external brightness. A further enhancement of the automation is constant lighting control which guarantees a comfortable lux value at the workplace through optimum use of daylight.
Presence-dependent and thus accurate demand-based control systems are increasingly being applied – ideal for staircases, corridors or other spontaneously used areas of the building. Lights with presence detectors can also be operated with increased energy efficiency in offices, schools etc. They then become elements of the room automation, are integrated with the blinds, room temperature control and ventilation and thus offer multiple benefits.

Regulating the heating and cooling

Electronic individual room temperature control promises a clear saving potential. It is therefore the most efficient method of using the heating and cooling energy generated via the heating system or air conditioning system. Demand-based energy use can be achieved via a timer program with a temperature profile or even via the presence signal. As the temperature variables of all the rooms are available centrally throughout the KNX system, heating and cooling energy can be generated according to demand and with a high level of efficiency.
In modern, purpose-built buildings with glass facades, fully-automatic sun protection systems are indispensable. Their primary tasks are shading and cooling to ensure the well-being of the people in the building. As these are likewise controlled with KNX, additional functions for improving the energy efficiency are provided in combination with room temperature control and lighting control. For example: daylight redirection, use of solar energy in winter and automatic night cooling in the summer.

From the perspective of energy consumption

The interaction of all the trades in room and building automation contains a high optimisation potential. All the functions are linked in an energy and building management system. KNX offers optimum solutions with management and visualisation systems for this purpose. Further building technology systems are integrated via interfaces. All the data that is required for efficient building operation can be recorded, archived and visualised in a central location. The energy consumption data which has been processed is particularly interesting and forms the basis for further optimisation of the energy consumption. Moreover, all the functions can be operated and monitored centrally via the visualisation. A fault indication system increases the availability of the installation engineering. High energy consumption caused by faults can also be quickly rectified.

Summary

The KNX worldwide standard offers the best prerequisites for improving the energy efficiency in buildings. System integrators can choose suitable KNX bus devices for energy-saving functions in the different trades from almost 7,000 certified products from more than 225 international manufacturers. Interconnected energy and building management systems are thus formed which allow energy flows to be controlled, regulated and monitored according to demand during operation. Practical applications are persuasive due to clear savings in energy costs. In comparison, measures for energy optimisation often pay off immediately.

A low Energy Standard single Family Home / *Austria*

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

A new bioclimatic Office Building in Huesca / *Spain*

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

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 exterior. 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 group chose two identical class rooms for their experiments. One of them was equipped

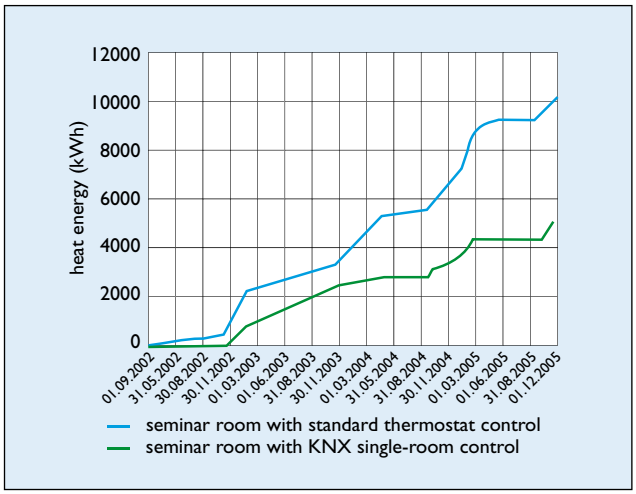


***Figure 2**. The logged data of the comparison test covered the periods from the beginning of 2002 until the end of 2005. However, the rooms weren't fully used until the middle of 2004. The "KNX controlled" room could save up to 50 % of the energy as compared to the „normal" room.*

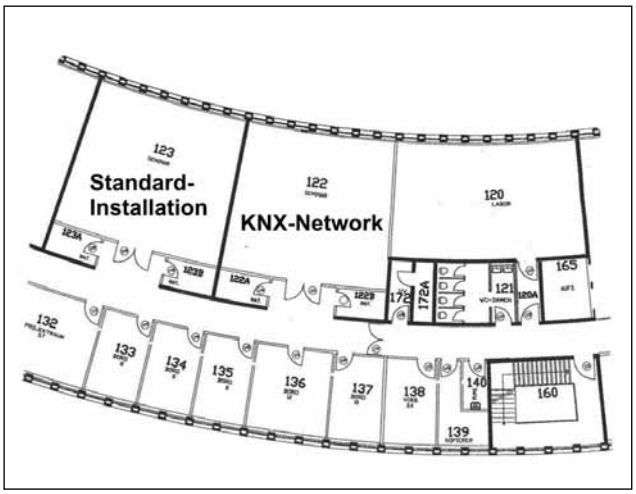


***Figure 3**. Seminar rooms, ZIMT, first floor*

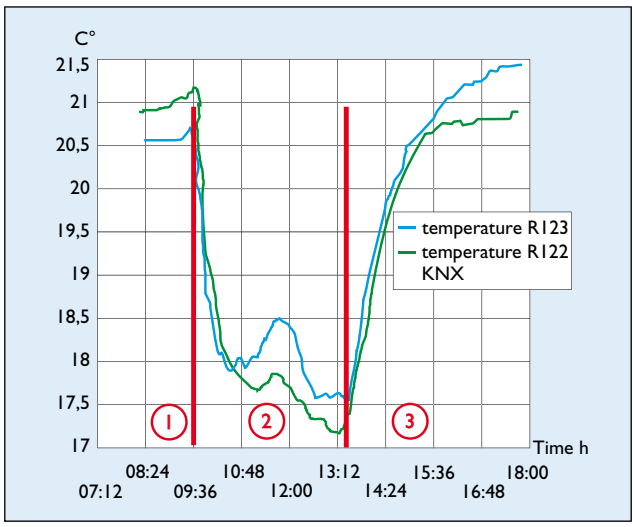


***Figure 4**. Room temperature dynamics*

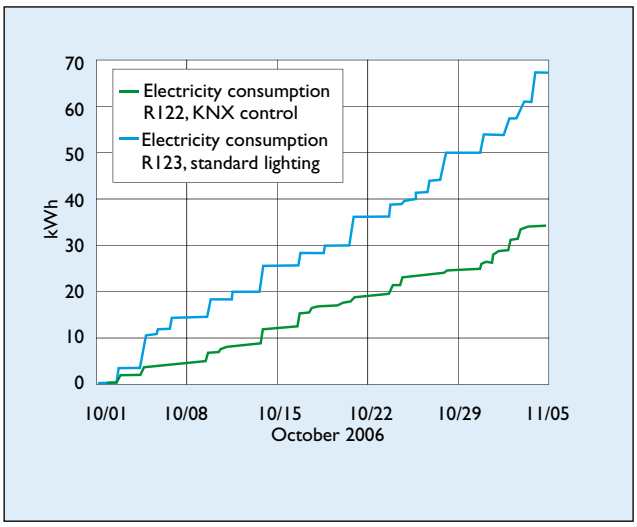


***Figure 5**. Comparison of electricity demand*

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

More efficiency can be programmed

KNX shows flexibility in reducing energy costs at Infineon

In the lighting installations between the building complexes, a clear energy saving potential can be opened up with KNX. *Foto: Infineon/Heinemann*

"Campeon" is the name of a new type of office complex, nestled in a landscape garden with lakes and sports facilities, located in Neubiberg near Munich. The evocative name derives from the fact that the semiconductor company Infineon Technologies AG has set up its new administrative centre in the campus-type buildings: Campus + Infineon = Campeon. Around 6,500 people work on the 150,000 square metre floor space. State-of-the-art building technology also contributes to the pleasant working conditions. The control technology with KNX ensures good lighting and an agreeable climate – and with efficient energy use.The worldwide standard was therefore selected because the company already had good experiences in the past in other buildings. The programmable bus system also showed its best side in Campeon: through optimisation measures, 117,067 Euro could be saved in energy costs in 2009 alone compared to the year before.

Higher energy consumption

The building was first occupied in 2006 and from the start, the lighting, sun protection and other technical systems were controlled via KNX. 10,300 bus devices were installed and programmed for this purpose. To maintain a clear topology as a basis for a consistent management system with visualisation, the installations were divided into six independent KNX worlds according to the six buildings. The system integrator solved the tasks by installing a Gira Homeserver 2 in each one. One of them functions as a "master" to which all the relevant information is transmitted on the TCP/IP route. The central operation and monitoring is carried out using an individually created, specific visualisation on centrally installed touch screens.

In the first years of use, it was observed that the estimated energy consumption was too high. A sophisticated lighting management system should help to reduce costs.The first measures related to the general lighting on around 40,000 m2 with 353 corridors, 69 staircases, 297 toilets and 182 adjoining rooms. The lighting was often superfluous or even switched on round the clock, partly inadvertently and partly because the lamps that were switched on could hardly be noticed during the day.

Automatic cut-off

It was then necessary to find timeframes in which lights can be reduced or switched off completely without disrupting the working day. A complex timer program developed whereby the incidence of daylight into the building was taken into account.The cut-off times are calculated via the Homeserver based on the external brightness. The higher the lux value, the longer the cut-off phase. This period can be optimised by setting the lux value. By contrast, the lighting in the corridors and stairwells is always switched on fully at the start and end of the working day when there is a higher number of people in the building.

In the toilets, lights are likewise automatically switched off after a time delay, once it has been manually switched on via a bus push-button. In the adjoining rooms with a manual light switch, the lighting is switched off cyclically and also automatically at the end of the working day. It is therefore guaranteed that the lights do not remain switched on round the clock. Where necessary, staircase lighting functions which flash to indicate a prewarning are used for security purposes.

Flexible for the future

The success of these measures quickly became apparent through the power consumption. The underground car parks, meeting rooms, conference rooms, data processing centre and even canteens and rest areas were therefore included in the lighting management in a second expansion stage. The cost savings acknowledged by the company (see table) of 23.4 percent in 2009 are impressive. Further optimisation of the energy efficiency will further increase these costs. The exemplary project for flexibility and future compatibility was given the Energy Efficiency Award.

The cost savings at the end of 2008 and 2009 reflect the progress of the energy-efficient optimisation but also the particularly effective impact of the automatic lighting management during the brighter months with more use of daylight.

Months in 2008	Costs in 2007 €	Costs in 2008 €	Savings in 2008 in € and %	
Oct./Nov./Dec.	138.471	124.034	14.437	10,4
Monaths in 2009	**Costs in 2008 €**	**Costs in 2009 €**	**Savings in 2009 in € and %**	
Jan./Feb./Mar.	136.396	116.922	19.474	14,3
Apr./May/Jun.	124.256	82.662	41.594	33,5
Jul./Aug./Sep.	115.465	83.619	31.846	27,6
Oct./Nov./Dec.	124.034	99.881	24.153	19,5
Totals in 2009	**500.151**	**383.084**	**117.067**	**23,4**

Highlights at a glance

- Infineon corporate head office, Munich
- 150,000 square metre floor space
- 6,500 employees
- 10,300 KNX components

Energy savings with KNX

- 23.4 % lower energy costs after optimisation

System integration:

EIB-TECH Helmut Lintschinger, Andechs, Germany

Efficient Polytechnic (Portugal)

Energy-efficient possibilities researched before general renovation

Evaluation of energy efficiency in the Guarda Polytechnic Institute

How can the energy consumption be reduced with the help of control engineering? What savings rates can be expected? The responses can differ according to the building and type of use. The people at the "Guarda Polytechnic Institute" in Guarda, Portugal wanted accurate answers. A KNX testing plant was installed before a total renovation to observe possible reductions in the consumption.

Research is part of everyday life for the School of Management and Technology of the Polytechnic Institute in Guarda. The institute, which was built in 1980, consists of four buildings on an area of 12 hectares. Four out of a total of 60 classrooms were selected at the School of Management and Technology to test and assess the energy efficiency and comfort of a planned energy-efficient renovation. To do so, the rooms were also fitted with new dimmable lamps and blinds for shading and daylight redirection.

An energy management system has been registering the energy data since September 2009. The standardisation of the KNX system, the large selection of components and the fact that the system fulfills all the functions required for this project were arguments in favour of selecting KNX as the automation system.

Reduced costs in lighting and climate-control

The general lighting in the classrooms was fitted with convenient and energy-saving constant lighting control. To do so, KNX sends dimming values which have been calculated with the help of light sensors via a Hager KNX/DALI gateway to the electronic ballast devices. Presence detectors ensure that the lightings which is not required when people are absent is not switched on unnecessarily but is switched off automatically. The latter function also applies to the manually controllable blackboard lighting.

An important cost factor for the energy consumption is the air conditioning. An intelligently controlled sun protection system can achieve savings. With measurements of the solar radiation, interior brightness and an astro program (Elsner/Suntracer), optimal conditions for incidence of daylight and shading are achieved. Indoor temperature sensors (Zennio/Quad) inside supply data to protect the room from overheating in the summer months. As a result of automatic constant lighting control, electricity costs for artificial lighting are kept low as well as the cooling loads due to precise slat positions.

Classroom with energy-saving lighting technology, sun protection, KNX automation and Smart Metering

Visualisation evaluates data

To assess the energy efficiency of the new lighting system in the classrooms controlled with KNX and the conventional parts of the building, the power consumption was measured separately. The system integrator used KNX metres from Lingg&Janke in connection with the FacilityWeb management system. The system enables the recording, illustration, switching, controlling and monitoring of the energy consumption in real time. All the values are brought together in the visualisation with the help of a KNX/IP gateway. Error messages from the electricity supply or the lighting installation are also processed and routed. The remote alarm is carried out through a GPRS gateway.

Highlights at a glance

- Study for an energy-efficient renovation of a polytechnic
- Low costs with only 15 KNX components and 80 working hours
- Web-based energy management with FacilityWeb

Energy savings with KNX

- 10 to 30 percent energy saving through automation

Implementation:

Planning and system integration: Melo Rodrigues-Engineering, Guarda, Portugal

Interworking at Headquarters (Spain)

Efficient building technology at Canon

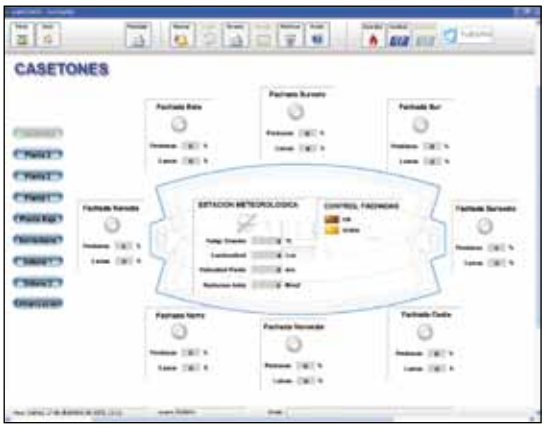
The curved architecture of the new Canon headquarters in Spain is energy-efficient

In 2008, Canon España S.A. moved into its new headquarters to the north of Madrid. Already during the building phase, the international environmental standard was observed in accordance with ISO 14001. Externally, this is expressed in the energy-efficient, curved architectural design. Inside, state-of-the-art building technology ensures efficient energy use. KNX plays an important role in this: lights, sun protection systems, heating, air conditioning and ventilation technology are automatically regulated and controlled with the worldwide standard.

Offices, laboratories, meeting rooms, an exhibition space and an auditorium are located behind the curved glass facades on four floors. High levels of daylight, supplemented by artificial lighting, automatic sun protection and regulated air conditioning create a comfortable ambience. The demands on building technology are also a challenge for the control technology. This must ensure comfort and safety, positively influence the efficiency of the energy consumption and also simplify management of the building. KNX shows itself here in its best light: an argument in favour of the worldwide standard was that the system integrator was able to select specific components for perfect solutions from the wide range of devices available from the various manufacturers. 664 KNX components, 30 different devices from 22 manufacturers were used in this project, from the weather station to sensors, actuators, logic modules and gateways as well as visualisation technology.

Cooling and solar gain

During the planning stage, it was assumed from the outset that high energy savings rates could be achieved with KNX automation, for example 50 to 60 percent for the lighting using constant lighting control with presence monitoring. Taking into account the amount of daylight that is streaming in, brightness sensors regulate the DALI lighting via KNX so that a uniform brightness level of 500 lux is always maintained. Unnecessary artificial light which is typical in conventional lighting systems is thereby avoided. This function is supported by a facade-based, precise daylight redirection of the blind slats. If people are absent, the luminaires are switched off automatically. In the case of the air conditioning, the planners assumed energy savings of around 40 percent if the HVAC system is regulated and controlled via KNX. Four functions ensure effectiveness: a timer with a day, week and seasonal program, provision of a standby temperature and presence monitoring for comfort mode. The meteorological blind control also contributes to efficient air conditioning. During the summer, presence-dependent shading provides cooling while the sun's heat can stream into empty rooms during the winter. Electrically operated windows are used for automatic night cooling or controlled ventilation, depending on the season.



Visualisation example: The menu page of the weather station provides information about the external temperature, brightness, wind speed and solar radiation as well as the status of the eight façade sections.

Interworking is the appropriate term for this function and points to a seamless interaction of all the components and trades – a further argument in favour of KNX for the system integrator.

Manager for peak loads

The building management system with visualisation and energy management is representative of the building technology at Canon España S.A. All the consumption data is brought together here and trends are evaluated for future optimisation. At the same time, peak loads are monitored and consumers are managed according to priority. The visualisation makes menus available for all the floors and functional areas. The monitoring and operation of local areas is also possible via the 12 touch screens in total that have been installed. In this project, KNX is also used for monitoring the energy supply, security technology, access control and for heating water and shows its strength in connection with further building technology systems such as Ethernet, BACnet, Modbus and in the remote maintenance capabilities.

Highlights at a glance

- Modern administrative centre, built according to the environmental standard ISO 14001
- 664 KNX components from 22 international manufacturers
- Costs for devices and installation – 400,000 Euro

Energy savings with KNX

- 60 percent energy saving, for the lighting
- 40 percent lower energy costs for the air conditioning

Implementation:

Fudomo Espacios Inteligentes, S.L. - Alcobendas (Madrid), www.fudomo.com

Insured Energy Balance (Czech Republic)

KNX makes work areas more efficient in the Prague headquarters

The sun protection systems controlled with KNX help to improve the energy balance considerably

The "Ceska pojistovna a.s" is the oldest and largest insurance company in the Czech Republic. Since it occupies this lofty market position, the company sees it as its duty to run the new headquarters in Prague according to strict environmental standards.
The building complex was completed in 2009 and the office space alone measures 23,000 square metres. The 2,300 employees who are located on three floors behind the glass facades bathed in daylight have very pleasant working conditions. The lighting technology, sun protection system and air conditioning which are controlled by KNX are factors in this comfort. Sophisticated functions ensure that energy is used sparingly and thus achieve a clear reduction in the energy balance.

Strong arguments in favour of KNX

Three arguments can be used to convince customers in favour of building automation with KNX: the flexibility of the system for changes of use, the simple and thus convenient installation and the versatile functionality for comfort, safety and energy savings. The unfavourable energy balance which is typical in glass constructions was a particular challenge. The planning office calculated that this could be improved by 60 percent from 3 MW to 1.2 MW using KNX control systems and central energy management compared to conventional technology: this means 543 W, per work station.

For the practical implementation, this pointed to savings rates of 50 to 70 percent. It was therefore simple for the planners and system integrators to guarantee the client an energy balance that has been improved by at least 50 percent.

Functions with (energy) gain

The particularly efficient lighting makes is impressive. Constant lighting control in the offices in conjunction with variable daylight redirection of the blinds ensures that a consistent level of brightness is maintained. So that the lighting in each work area only uses the level of energy required, the differentials of the light values are calculated with the help of brightness sensors. KNX sends these to the local lighting components with digital DALI ballasts.
The savings potential of an automatic sun protection system should also not be underestimated. In the summer, rooms that are shaded at the right time protect the cooling load. Vice versa, heat energy can be saved in the winter by using the direct solar radiation. During the cold months of the year, closed blinds improve the building insulation after office hours.
For heating and cooling in the offices, zone-based convector fans are installed which work autonomously. Through this division, the building user has the flexibility to decide on an open-plan layout or individual offices. To avoid loss of ventilation, the closed-loop control systems are linked with the contacts on the ventilation slots.
It speaks for itself that the functions that ensure individual comfort in the workplace and security have prio-

Sun protection precisely according to the daily routine: schematic from astro control

Highlights at a glance
- Largest insurance company in the Czech Republic
- 8000 lamps with digital lighting control (DALI)
- 3985 installed KNX components

Energy savings with KNX
- Energy balance improved by 60 percent through building automation

Implementation:
- Planner: Lighting Projects Consulting s.r.o, Radlická
- System integrator: Intelligent systems s.r.o, Radlická

A Decision With Foresight (Belgium)

Increased efficiency year after year based on KNX

rity. The web-based visualisation makes manual operation available for employees. A menu can be consulted on each PC with Internet access, via which the perfect temperature, individual shading and lighting conditions at the workstation can be selected.

Calculation with sun and shade

The operation of the entire building technology is carried out via the central building control. Timer programs for the lighting and room temperatures or setpoint values can also be set or modified.
An astro program is used to control the sun protection of the facades. It thereby precisely calculates the solar radiation and shadows that move through the winding building complex during the course of the day. The shutters are protected against storm damage via wind sensors.
The energy management system makes an essential contribution to the energy efficiency based on visualisation. It calculates the current cooling and heating demand for an effective generation of energy from climatic values and the heat requirements of the convector fans for an effective generation of energy. For this task, KNX communicates with the HVAC system via the SQL interface. The energy flows can be observed, documented and analysed via Smart Metering in order to use the determined values for further optimisation of the energy efficiency.

A sensor-controlled sun protection system reduces the cooling load

Everyone knows Hartmann bandaging materials. When the German textile manufacturer Paul Hartmann decided in favour of medical products in 1877, little did he know that his factory would someday become a multinational corporation for medicine and health care. When the Belgian branch office "N.V. Paul Hartmann AG" built its new logistics and administrative centre in Saintes in 1998, engineers at the corporate head office also showed they had foresight. They specified KNX (at that time still EIB) as the standard for the electrical installation. They realised that the flexible bus system had a future. The fact that high energy savings could be achieved on this basis at a later date with only a modest investment, was probably not taken into account back then.

Successive expansion

The first automatic functions monitored and controlled the lighting in the offices, corridors and outside areas partially via movement detectors. The blind drive mechanisms were likewise integrated in the bus system. Five years later, the engineers and system integrators of the Belgian site determined the versatile possibilities of the more sophisticated worldwide KNX standard for more efficient facility management. From 2006 onwards, the KNX functions were gradually extended: the lighting in the warehouses was given energy-saving constant lighting control. With the incidence of daylight, the lighting is no longer switched on at 100 percent but just with additional dimming values. Comfortable lighting conditions are thus achieved using less energy.
In 2007 the blind controls were combined into a central system with weather

History of the investments and the resulting energy savings

Year	Functions	Costs €	Total annual saving in % and €	
1999	Lighting and blinds	55.000.00	k.A	k.A
2005	First consumer analysis		0	0
2006	Lighting in the warehouse, constant lighting control	1.246	-10,3	4.500
2007	Automatic sun protection with weather station	2.000	-12,9	5.517
2008	Central management Timers	4.000	-17,9	7.452
2009	Optimisation of the central management	1.000	-25,00	10.087

Weniger Stromverbrauch im Lager durch automatische Lichtsteuerung

stations. Unwanted heating of the rooms can be avoided through automatic shading. This in turn reduces the cooling load. At the same time, optimum daylight redirection in combination with constant lighting control reduces the need for artificial lighting. In addition, three wind detectors protect the shutters automatically against storm damage.

In the same year, an interface to the fire alarm system was integrated. With this safety measure, in the event of a fire, the lights can be switched, blinds raised, gates opened and information relayed.

Highlights at a glance

- Global corporation decides early on in favour of the worldwide standard
- 256 KNX components
- Cost of initial installation – 55,000 Euro (1999)
- Extensions and optimisation – 8,646 Euro (2006 – 2009)

Energy savings with KNX

- Annual saving of 10,087 Euro (2009)

System integration:

Jerome Rouiilard, NV Paul Hartmann AG, Saintes, Belgium

Central management

In 2008, a building management system went into operation using a Homeserver (Gira). Further saving measures can now be programmed and optimised from a central location e.g. timers and the central cut-off of the lights. Setpoint values and time profiles of the room temperature control can be programmed via the visualisation. The generation of the heating and cooling capacity is controlled by creating a link to the HVAC system.

The adoption and processing of error messages also belongs to the central functions. Maintenance intervals for the lights can also be managed such as acute error messages from the air conditioning system or heating system or in the event of water damage. Smart Metering applications with KNX are important for integrated energy management. With the capture of consumption data, defects in the systems can be quickly detected and signs of wear can be analysed; it is also used to optimise the energy consumption. Records made since 2005 show the impact of the energy-specific functions to date. The annual savings of 25 percent of the electricity costs or the resulting 10,000 Euro clearly exceed the investment costs.

Intelligence in the black dice (Italy)

KNX supports the hotel business with many useful functions

Atmospheric lighting is switched on when you enter the room

The shape of the dice and black facades characterise the architecture of the business and design hotel Nerocubo – an eye-catching sight near the A22 at Roveredo on the route to Northern Italy. Travellers here find stylish apartments and rooms, for example for holidays in the famous region of Trentino, for meetings or simply for a stopover. Everyone feels comfortable and at ease in the hospitable and artistic ambience. The fact that state-of-the-art technology contributes to this feeling is a well-kept secret. The benefits of building automation with KNX are primarily interesting for the hoteliers: efficient organisation of the hotel business, comfort and security for the guests and not least economic efficiency through the economic use of energy. The lights, sun protection system and room temperature control for the 110 rooms and suites, meeting rooms and restaurant are controlled and regulated using KNX building system technology. The accomplishment of the system integrator Domotic Italia who brings together all the distributed functions of KNX and other systems in one visualisation is outstanding. A clear and easily understandable operator interface is available to the hotel staff.

Exclusive ambience with artificial lighting

Economical and convenient

The functions in the allocated room are already activated when the guests check in: the setpoint value of the room temperature is set to the comfort level, the telephone and TV are ready for operation and the blind control system goes into presence mode. If the guests then enter their room, the basic lighting is switched on and their presence is simultaneously visualised via the menu. You therefore always know at reception whether the guests are in the room. Technical functions are indicated simultaneously and alarm signals are received.
The building automation with KNX can meet various requirements in the hotel: it saves the staff from being briefed on the room functions, enables the presence of the guests to be monitored which is beneficial for room service, forwards technical error messages and controls energy-based

Highlights at a glance

- Modern business and design hotel with around 110 rooms and suites
- Central management of the room functions
- Effective sun protection with solar heat gain in the winter

Energy savings with KNX

- Up to 50 % saving in electricity consumption by the lighting through KNX automation
- Up to 15 % less heat energy required due to KNX temperature control in all the rooms

System integration:
Conserzio Domotic Italia, Firenze, Iltaly

loads according to demand. The latter means the economic use of electricity as well as heating and cooling energy. The guests do not have to forgo their wishes for comfort. A room manager makes individual operation possibilities available: setting the room temperature, switching the ventilation on and off, operating the blinds and informing the hotel staff when the guests do not wish to be disturbed. Using TV remote control, media such as music and video can be retrieved, service packages or the internet can be used.

Efficient energy use

By locking the room with the electronic door opener, the lamps in the rooms and suites can only be switched on when the guests or service staff are present. Unnecessary light is avoided. The coupling of the room occupancy with the room temperature ensures that the exact optimum temperature prevails and heat energy is saved. Room temperature control systems with KNX in the conference and meeting rooms and the offices ensure that energy is used carefully. The lighting in the public areas such as the corridors, foyer, meeting rooms, restaurant and bar are automatically controlled according to a timer program and depend on the incidence of daylight. Only energy-saving basic lighting is therefore available. If people enter the areas, the artificial lighting is automatically increased. A manually activated "cleaning scene" ensures maximum luminance. Redirection of the daylight through the blind slats also reduces the requirement for artificial light.

An automatic sun protection system should also support the energy efficiency in the hotel business: a distinction is made between the presence and absence of people. In the winter, when shading is not necessary for the guests, heat can be gained through the sun streaming in. In the summer, rooms can be kept cooler by fully closing the slats.

The generation of energy is also integrated in the building management using a thermal power station and a solar power station. The visualisation shows self consumption and the supply of electrical energy to the mains.

Energy Management Inside (Israel)

First "Green Building" from INTEL equipped with KNX

INTEL Israel – The new development office in Haifa

Since 2009, around 1000 programmers and engineers have been working in the Israeli subsidiary of the US semiconductor manufacturer INTEL. The new development office in Haifa was built according to the LEED guidelines (Leadership in Energy and Environmental Design). INTEL has constructed a certified corporate "Green Building" for itself as well as the largest green building in the Middle East. Bound by strict standards but also living up to its image as a leading technology company, the planning office selected the KNX control system for the building technology. It convinced the building engineers from INTEL with concrete arguments: the worldwide standardisation of KNX, the flexibility and functionality of the bus system for all trades as well as the versatile control possibilities for increased energy efficiency in buildings. In particular, efficiency at the workplace achieved through comfort and ease was required. This can be achieved with KNX through demand-based shading and air conditioning as well as optimal lighting conditions. The automatic control and regulation with KNX promises energy-saving operation for all trades, lighting, sun protection, heating, ventilation and air conditioning (HVAC). The programmability of the lighting and HVAC functions also enables a quick and economic change of use for the rooms – such as moving to the safe floors on the underground car park level in the extreme case of a war breaking out.

Optimal lighting conditions

The lighting systems for the offices, corridors and staircases, meeting rooms, conference rooms, WC facilities and outdoor installations alone point to a high energy demand. If they are not switched on around the clock with 100 percent brightness but controlled automatically according to demand, it can be reduced by 10 to 50 percent. For this purpose, the planning office has introduced the combination of the KNX system with the digital addressable lighting interfaces (DALI) as an ideal solution. Together with the gateways (ABB KNX DALI gateways), up to 64 electronic ballast devices can be individually controlled and dimmed via KNX addresses. For the organisation of extensive lighting systems, up to 16 control groups can be formed per gateway. This flexible method enables, in addition, the monitoring of each individual lamp for malfunctions – the benefit of an economic maintenance service.

The perfect climate

For personal requirements, employees can set the lighting level individually in lux at their workstation. A room-based operator interface is available on the company computers for the visualisation. To avoid unnecessary energy costs, presence detectors monitor the presence of people and switch lighting off automatically after an adjustable time delay in the event of absence. The lighting is also controlled and regulated in corridors, on staircases and in other rooms. Brightness sensors ensure a comfortable and constant brightness level. In the conference rooms which are used infrequently, the air conditioning system is controlled according to requirements via movement detectors. The lighting conditions can be adapted via scene controllers at the touch of a button. The energy management for the building technology is implemented via a KNX visualisation. A KNX/IP gateway creates the link to the OPC server. From the central location, the building functions can be monitored, influenced and optimised. The energy consumption can be monitored and analysed continuously and the discovered savings potentials that are discovered are utilised: an investment in the future which pays for itself in four to five years according to the calculations of the planners. The system integration of the KNX installation was carried out by the Israeli company S.Kahane&-Sohns LTD.

The largest green building in the Middle East

Highlights at a glance

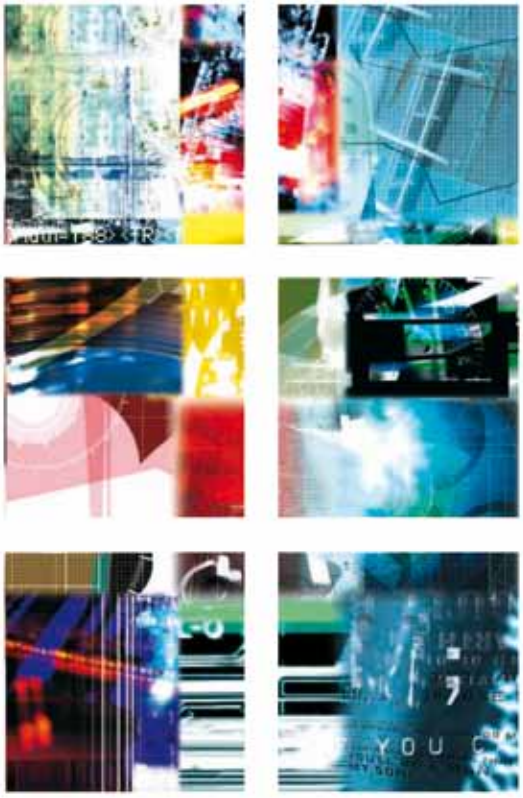
- Largest building with "Green Building" certificate in the Middle East
- 3160 KNX components
- Installation costs of 200.000 Euro

Energy savings with KNX

- 4 to 5 year amortisation period through energy savings.

The worldwide STANDARD for home and building control

KNX Members



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