



Smart Energy Management

Solutions

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Safe integration of smart meter

The challenge

The consumption data of gas, water and electricity are confidential and must be protected from being accessed by a third party. The sensitivity of the consumption data lies in the fact that it allows conclusions to be drawn about the user behaviour of the occupants and can indicate their presence or absence. They may therefore not be transferred unprotected via publicly accessible data networks. The system integrator Elektronik Innovativ set themselves the task of protecting the transmission in the building system technology from unauthorised access.

The solution

KNX secure has been developed primarily to meet the new requirements of safe data transmission in a smart building. KNX IP Secure and KNX Data Secure offer the possibility of transferring the KNX consumption data via a KNX TP line or KNX IP Ethernet backbone, no longer transparently but encrypted with AES.

Practical implementation

The represented application simulates the typical building technology with a KNX installation for management and industry as well as a residential complex. It consists of three lines with different meters for gas, water and electricity.

A Hager KNX energy meter has been installed as well as a conventional meter with a KNX SO interface. KNX IP Secure routers have been installed to safeguard the public KNX IP infrastructure. As the new KNX Data Secure binary interface Tapko TAI 4-gang can be used as an SO interface, the consumption data of this KNX TP application are likewise secured.

Functions

The data of different consumption meters is collected, encrypted using KNX Data Secure and made available to the central energy management system ICONAG-EnMS via secured KNX IP Secure transmission media.

Benefits

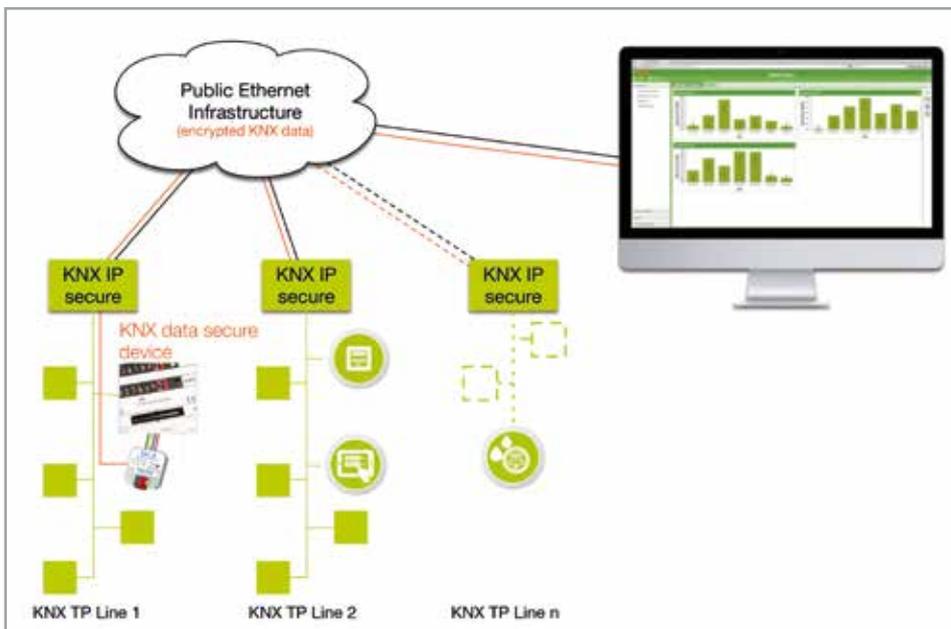
Previously, consumption data was largely transferred using a time-consuming and expensive method via proprietary data networks – not least due to the argument for guaranteeing data security. With KNX secure, sensitive smart metering applications can now be safely integrated in a comprehensive KNX system.

KNX secure components

- KNX IP Secure Router, Enertex
- KNX IP Data Secure binary input 4-gang, Tapko

Further KNX components

- KNX energy meter, Hager
- KNX power supply, Busch-Jaeger



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Smart Metering as a KNX application: consumption data and its transmission via the common building network is fully protected and illegible for a third party.

The secure way to replenish energy

The challenge

With the introduction of electrical mobility, charging devices have also become part of building system technology. It should be possible to integrate them in a KNX installation in the same way as other functions. The “CleverHome4you GmbH” in the KNX IoT city shows how communication with a conventional charging station can be implemented and how data about the charging processes can be monitored, managed and visualised with KNX. An essential element of the application is the protection of the communication paths and data from manipulation when importing energy.

The solution

With “Agentino Mobile”, an intelligent IoT solution is available for integration. The logic and visualisation software has been conceived for control

and visualisation devices in building system technology. Specific applications for the management of charging stations can be configured using the corresponding modules.

Practical implementation

A charging station from Walther Werke is used to provide a realistic demonstration. A LAN connection and web browser enable communication with the KNX installation via a KNX IP router. As a KNX Secure device, the router protects against unauthorised access. The KNX system is based on the usual components and is supplemented by KNX energy meters, KNX operating and display units, a KNX RGB controller and KNX LED luminaires. Using smartphones and tablets, it is not only possible to operate the applications but also to monitor the

charging processes. With the help of the Agentino Mobile software, the data about the charging process can be used in many different ways.

Functions

With modern charging stations, there are important protocols available. It is therefore possible for example to check a right of usage, monitor a charging process and even regulate the energy import. KNX makes the corresponding evaluation units available for this purpose. The charging station can thus be controlled dependent on personal user behaviour. A visualisation with graphics and diagrams provides an overview of the amount of chargeable energy, the charging levels expressed as a percentage as well as personal usage. The available energy from a photovoltaic system can be displayed for example.

Benefits

Integration of public, semi-public and private electrical charging stations in the existing KNX installation. Charging processes can thus be visualised, monitored and controlled in many different ways. The operating interface of mobile devices such as smartphones and tablets also enables transparent recharging processes for electric cars and bicycles.

KNX secure components

- KNX IP Secure Router, Enertex

Further KNX components

- Logic and visualisation software, Agentino
- Power supply, Enertex
- Energy meters, Enertex
- Operating and display units, iddero, VERSO, Enertex, MeTa
- LED luminaire, arcus-eds



Smart charging stations with access protection

Secure networks of distributed facilities

The challenge

For efficient building management, it is advisable to combine the technical monitoring of geographically dispersed facilities of residential buildings, factories, commercial or public buildings. Transmission paths outside self-contained buildings and properties can however be exposed to unauthorised access. Safety functions and confidential data are therefore threatened and demand additional protection against hackers. GePro mBH rose to this challenge with a model KNX installation.

The solution

The KNX systems of the individual, dispersed buildings generally communicate via an internet protocol based for example on Ethernet using an unsecure point-to-point connection. Now that KNX IP Secure devices are available, the KNX IP communica-

tion can be protected cost-effectively using additional encryption and authentication of telegrams along the entire IP transmission path.

Practical implementation

To simulate the situation of distributed facilities, KNX IP backbone and control centre, the sample installations are equipped with KNX IP Secure routers from ABB and Enertex. In the buildings, KNX sensors simulate the building functions for temperature, humidity, CO₂ sensors, leakage sensor, valve drive and switch actuators. Various KNX control panels adopt central operating and control tasks buttons and LED displays as well as a KNX alarm and signal panel.

Functions

Room functions, vents, access control and alarm systems can

be controlled and operated from a central location. Status signals, faults and alarms are displayed and evaluated centrally via the building control system. Signals can be acknowledged and switching commands can be triggered via central panels.

Benefits

The IP communication between distributed KNX installations can be better secured against malicious tampering with KNX IP Secure. All the IP telegrams which are transferred here on the basis of LAN/Ethernet are authenticated and encrypted.

KNX secure components

- KNX IP Secure Router, Enertex
- KNX IP Secure Router, ABB

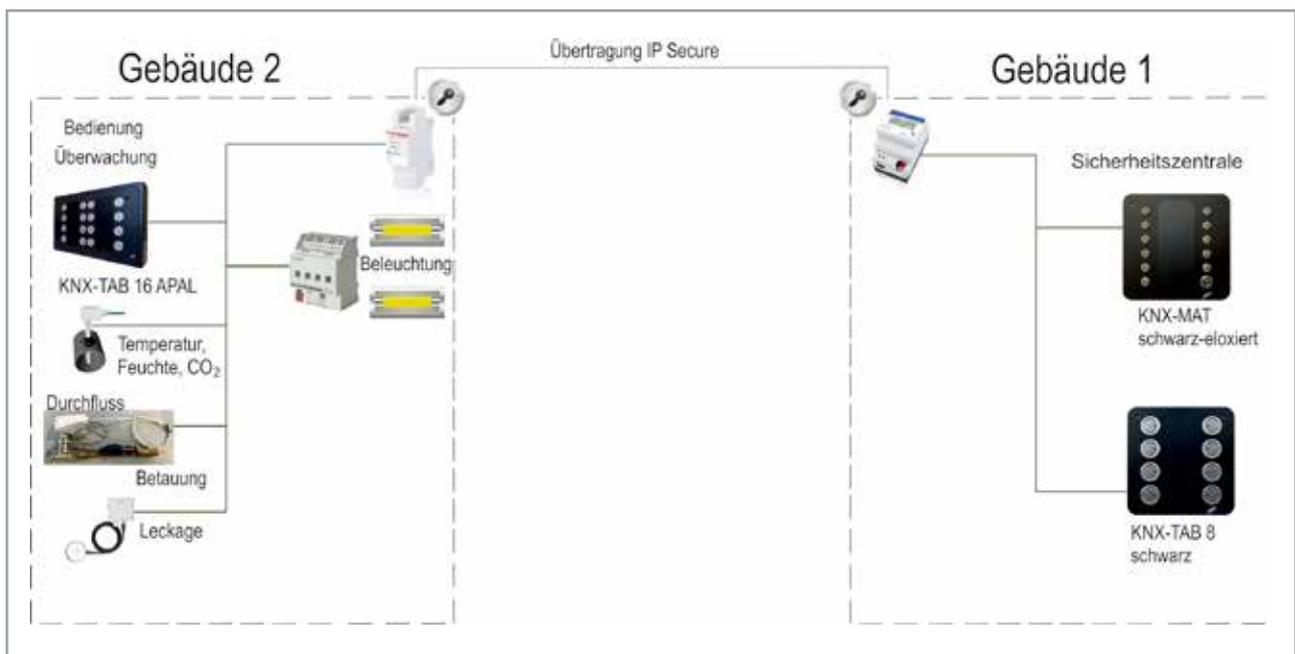
Further KNX components

- KNX signal and alarm panel, GePro
- KNX panel, GePro
- KNX sensor, Arcus Control
- KNX leakage sensor, Elsner
- Dew formation sensor, Insta
- KNX motor valve drive, Jung
- KNX switch actuator, Siemens



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The routes between facilities can be far-reaching and dangerous, at least for confidential data. The Ethernet connection with KNX IP Secure protects simply and cost-effectively against unauthorised access.



Data protection of digital energy transition

The challenge

More than a third of the energy produced is consumed in residential buildings. The energy efficiency in your home is therefore very important. Digital energy transition within your own four walls is based on KNX and intelligent electricity meters - this is the vision of HSEG, the engineering office for electrical planning and building system technology. The sample installation has the task of controlling the flow of energy in the house dependent on consumption, costs and time. The temporary storage of energy should provide a certain level of independence from energy suppliers.

The solution

Surplus generated energy can be stored in batteries. It would also be feasible to charge electricity from the public network if energy suppliers offer incentives in terms of tariffs. In a similar way as

maximum surveillance, it is also possible to regulate energy applications using KNX logic. The use of KNX secure meets the increased safety requirement of this application.

Practical implementation

At the core of the installation is an E3/DC solar power storage unit and the KNX Connect interface. The KNX installation illustrates how the IP backbone is protected with KNX IP Secure against access and how all the communication between the terminal devices is secured with KNX Data Secure using authentication and encryption. The IP Secure backbone between two KNX IP Secure Routers links two TP Lines. One is equipped with KNX secure devices such as Line Couplers, push-button interfaces, touch sensors, KNX room temperature controllers and switch actuators. The other conventional TP Line with

KNX Connect integrates the E3/DC home power station with battery. The mixed installation documents the possibility of simultaneous secure and unsecure communication. An IP visualisation panel supplements the system.

Functions

KNX adopts the logical control of energy management, dependent on solar power generation, on tariffs in the public electricity network and on current energy consumption. The KNX logic queries performance and energy values, controls the battery charge or discharge, switches loads, reports faults and can even control an in-vehicle charger. Charging states, battery power, energy consumption and other values can be displayed via a visualisation screen.

Benefits

The battery storage in connection with KNX lowers

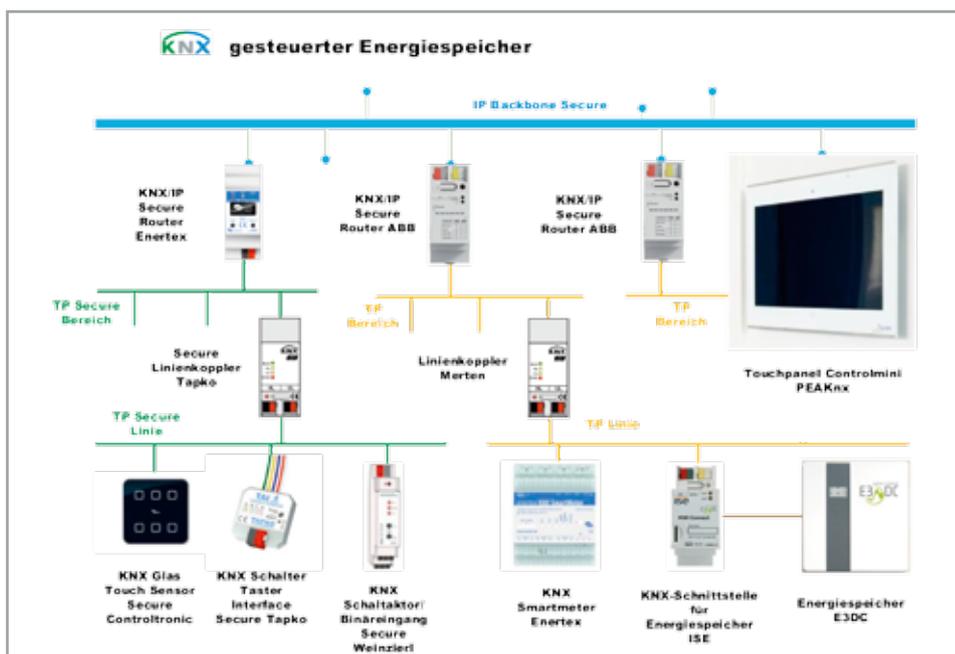
energy costs, enables flexible energy usage and provides safety against power failures. KNX secure protects functions and confidential data against hackers and saboteurs.

KNX secure components

- KNX IP Secure Router, ABB
- KNX IP Secure Router, Enertex
- KNX Data Secure Line/ Backbone Coupler, Tapko
- KNX Data Secure 4-gang contact interface, Tapko
- KNX Data Secure glass touch sensor, CONTROLtronic
- KNX Data Secure switch actuator IO 51 I, Weinzierl

Further KNX components

- Line Coupler, TP, Merten
- KNX Connect, ISE
- KNX smart meter, Enertex
- Touch panel, PEAKnx



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Energy management without snooping: sample installation with new KNX Data Secure devices and KNX IP Secure routers protect energy and consumption data against espionage.

Energy efficiency in retrofit

KNX as an advantage when retrofitting

The challenge

The KNX city is built on solid foundations. That includes not just the trusted KNX system itself, but also the experience gained over the past 20 years of equipping buildings with KNX bus lines, either as part of early automation efforts or as a far-sighted precaution. KNX connects the key technical features in buildings better than any other system. Ingenieurbüro Beyer shows how this trump card can be played to make existing buildings more energy-efficient. The first step is always a detailed consumption survey in order to observe and document the energy consumption.

The solution

The KNX system offers numerous solutions for surveying consumption both centrally and decentrally.

As well as single and three-phase KNX energy meters, KNX actuators with current detection and KNX modules with current transformers are also available. Although the measuring accuracy of the latter is not suitable for billing purposes, it is sufficient to give a general idea of the energy consumption in a building. They can be used, particularly in existing distributors, as space-saving replacements for the original actuators, or fitted in sockets.

Practical implementation

The project application uses various different energy meters: KNX meters for overall consumption (Gira), KNX energy actuators (ABB) and actuators with current detection for the consumption in consumer circuits, and a

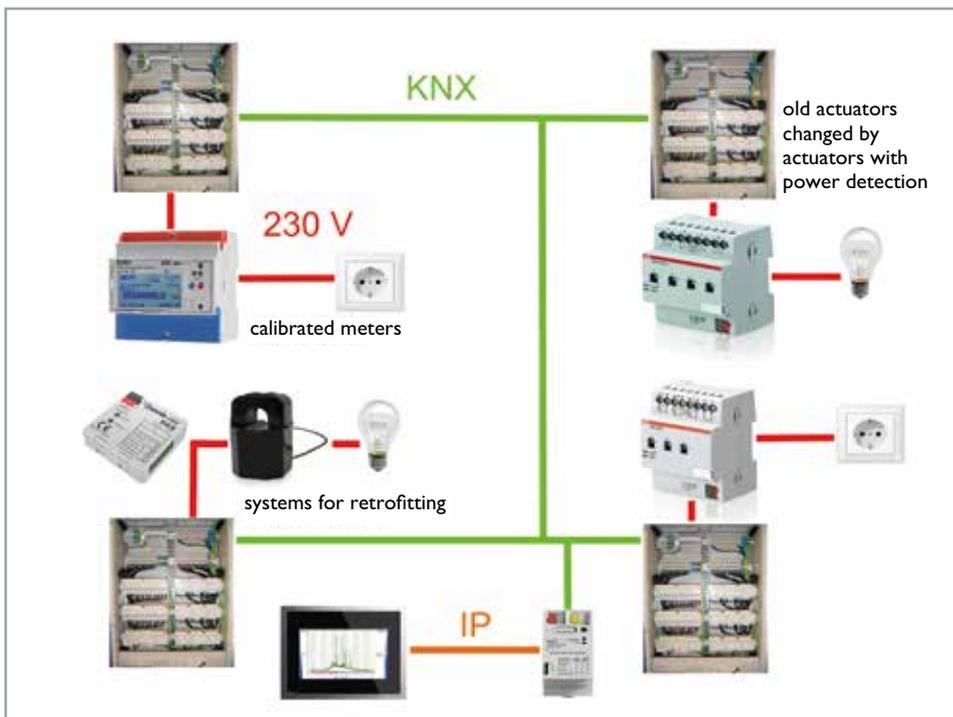
KNX ammeter with current transformer (Zennio) for individual appliances. Additional consumers can be switched on using KNX push buttons.

Functions

All the KNX energy data can be recorded, documented and visually displayed at a central location, as preferred by building operators in real life. The data are then available for processing with Excel or for access by a superordinate energy management system. Charts and graphics can reveal the energy consumption of a building over the course of a day. Individual consumers can be shown if desired, and photographs of distributors in existing buildings provide a convincing argument in favour of retrofitting with KNX measuring equipment and of how easy it is to carry out.

Benefits

- Use of the existing KNX bus line for retrofitting existing buildings with measuring equipment
- Centralised and decentralised energy consumption measurement
- Overview of energy flows for the optimisation of energy consumption
- Historical energy data for monitoring the effectiveness of energy-saving measures
- Database can also be used by other programs



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Demand Side Management

Use solar power instead of paying for peak power

The challenge

It makes sense in economic terms if urban electrical power requirements are matched to the power being generated at the time. The incentive for this is provided by energy supply contracts dependent on peak loads, or 'differential electricity tariffs'. Intelligent demand side management systems are growing in importance, especially as a way of complying with the conditions of these kinds of contracts and tariffs, particularly as a consequence of the increased contribution by solar and wind power. The company Gebäude-Programmierer-Service e. K. Helmut Haßenpflug, Frielendorf, shows how commercial consumers can use KNX to avoid expensive peak loads and benefit from low-cost tariffs or even self-generated solar power, taking a canteen kitchen as an example.

The solution

The consumer load consists of two boiling pans of 18 kW each, one tilting fry-top (20 kW), and three steamers (19 kW each). The aim is to control these heavy-duty units so that the total of their individual loads does not exceed a preset value. This set value is represented by energy values valid for 15 minutes at a time. In consultation with the chef, rules are drawn up setting out priorities so that the units can be switched off for short periods without any noticeable effect on performance.

Practical implementation

The electrical consumers are represented by KNX energy meters (Hager, ABB) or an S0 tap on the main meter. As the canteen kitchen units are fitted with potential-free contacts, their contactors can be operated directly by KNX

switching actuators. The logic connections are implemented via a KNX visual display. The demand side management system also takes into account the power generated by the installation's own photovoltaic system (installed power: 30 kWp).

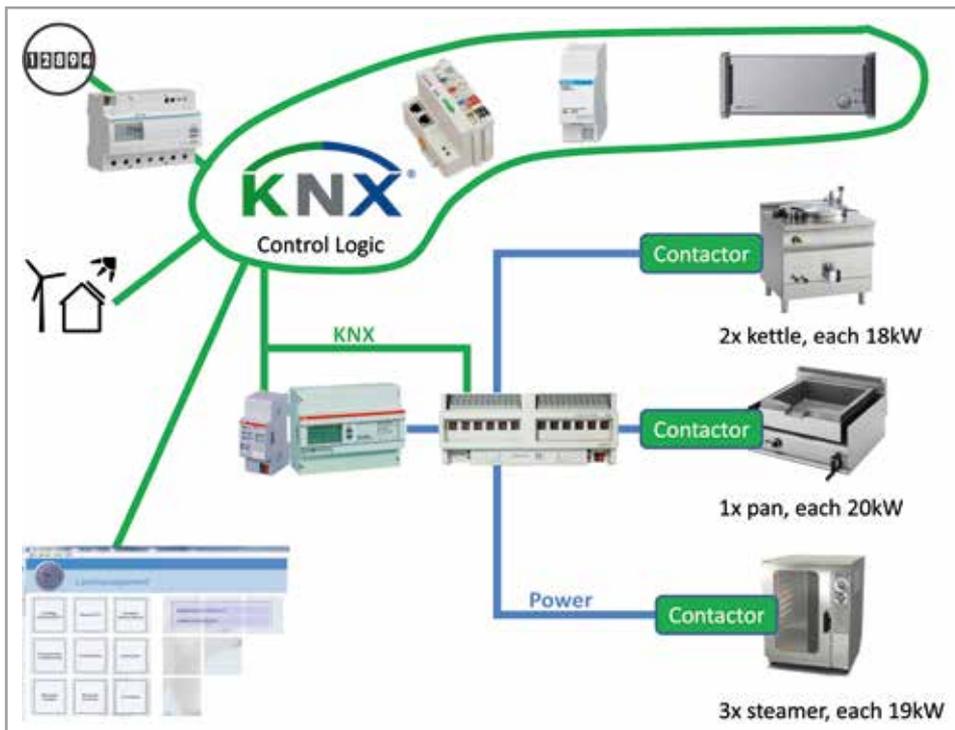
Functions

The demand side management system programmed using KNX software works in a more differentiated way than conventional maximum-value monitoring, and is based on a coordinated set of rules and setpoints. In order to be able to react at an early stage during the 15-minute intervals, the demand side management system continuously calculates the trend in demand. Furthermore, surplus solar power raises the setpoint, so that switch-offs that would have been necessary are avoided and

self-generated energy consumption increases. One of the purposes of documentation of demand side management is to provide evidence of any manual intervention in demand side management (override switching) by the chef.

Benefits

- Demand side management integrated in the KNX system
- Prevention of peak loads
- Coordinated switch-off rules
- Increased use of self-generated solar power
- Expandable for tariff management purposes (high and low tariffs)
- Visual displays and documentation



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Renewable Mobility

Driving around town with your own solar energy

The challenge

Electric mobility will play an important part in sustainable cities such as the KNX city. A key aspect of this is that electric vehicles used in private transport will be charged using renewable, carbon-neutral energy. As the timeframe for charging electric cars at charging stations in car parks or garages is usually flexible due to long standing times, the charging operation can be adapted to the building's own solar collectors or wind turbines. The presentation by Koyn-System-Elektronik, Berlin, shows an intelligent solution to this problem based on KNX.

The solution

The project shows a single family home with its own photovoltaic system, the power from which is both fed into the grid and consumed on site. If a lot of solar power is produced

and not much is used in the house itself, it makes sense to charge the electric vehicle using the surplus solar power as far as possible. The KNX system calculates an output target value from the difference between the current grid feed-in and private consumption. This is used for calculating the charging capacity.

Practical implementation

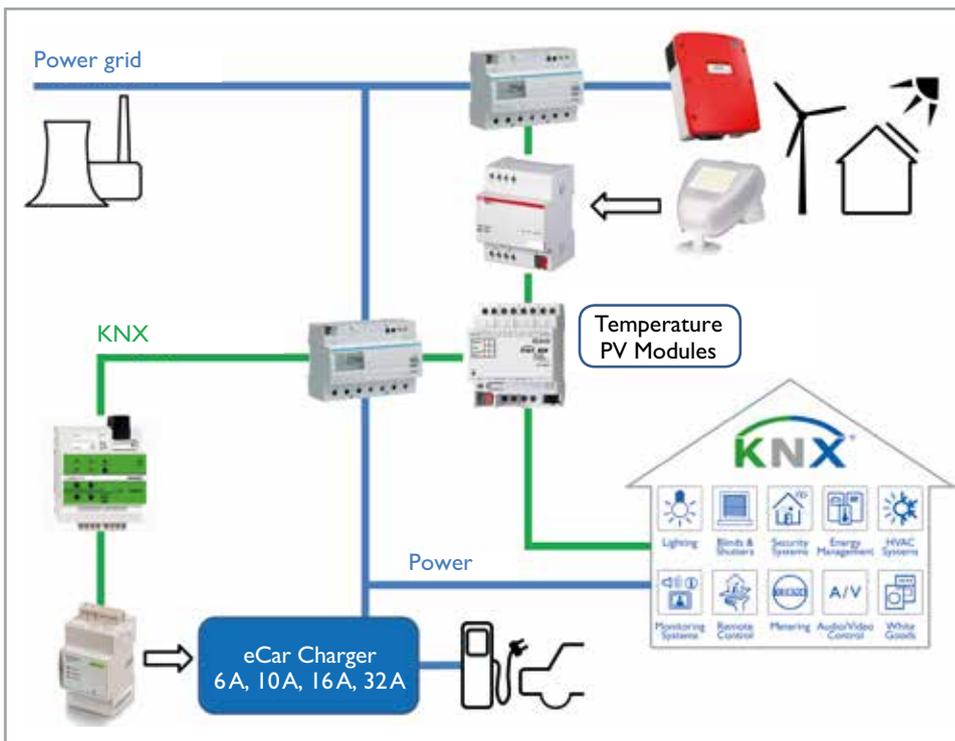
KNX meters (Hager) measure the consumption and generation figures. A KNX weather station (ABB) supplies data on wind, rain and solar radiation. Temperature values are sent to the bus by the KNX analogue input (Jung). The charging post is controlled using KNX logic and a KNX actuator. Current solar radiation values and the temperature of the solar modules measured by KNX are used for monitoring and control.

Functions

The particular technical refinement of the presentation is the interface between the electric vehicle and KNX. The charging post is fitted with a charging control unit (Wago Pilot-Box). This starts and stops the charging process and can automatically set different charging currents (6 A, 10 A, 16 A, 32 A) controlled by KNX. This is regulated using the set value calculated from the energy surplus. The underlying logic is: small surplus = low charging current, large surplus = high charging current. The channels of a KNX actuator drive the potential-free inputs of the Pilot-Box accordingly. The connection to the electric vehicle is via standardised pulse-width communication.

Benefits

- Use of carbon-neutral energy for private transport
- Increasing private consumption from solar power
- Solution is simple to implement
- Use of the KNX system which is already installed
- Based on the calculated energy surplus, KNX enables other consumers to be activated, further increasing the amount of power consumed on site.



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Saving heating energy costs

Efficient heating with fire and flame

The challenge

One single system to control all building services and components conveniently, reliably and energy-efficiently: that's KNX. One of the ways in which the KNX system increases energy efficiency is by making more efficient use of primary energy, thus benefiting the world's climate, the environment, the purity of the air in our cities, and last but not least the user's wallet. The project from the engineering company HSEG (Ingenieurbüro für Elektroplanung und Gebäudesystemtechnik Dipl.-Ing. Holger Schult) from Glienicke in Germany shows how KNX individual room control can be retrofitted in order to exercise direct control over the heating gas or oil burner.

The solution

Until now, consumption of primary energy has been

regulated entirely by boiler controls, which respond to the outdoor temperature, in contrast to thermostatic valves that respond to the temperature indoors. However, a holistic heating control system will also take into account the current heating requirements for the supply temperature, which will save primary energy. This is achieved by a KNX gateway to the boiler control bus protocol, which creates the necessary link to the heating system. Individual room control can be retrofitted as a wireless system, and linking the valves with window contacts optimises the energy efficiency still further.

Practical implementation

The presentation shows how KNX individual room control can be easily retrofitted via a wireless system (Weinzierl).

The connection between KNX and the boiler is provided by an OpenTherm/KNX interface (Theben), allowing the KNX system direct access and regulate the gas flame, control a circulation pump and request information about the boiler temperature. The gas consumption is determined by an S0/KNX converter (Arcus EDS). The existing alarm system can be used to monitor the windows – an example of the synergies offered by the KNX system.

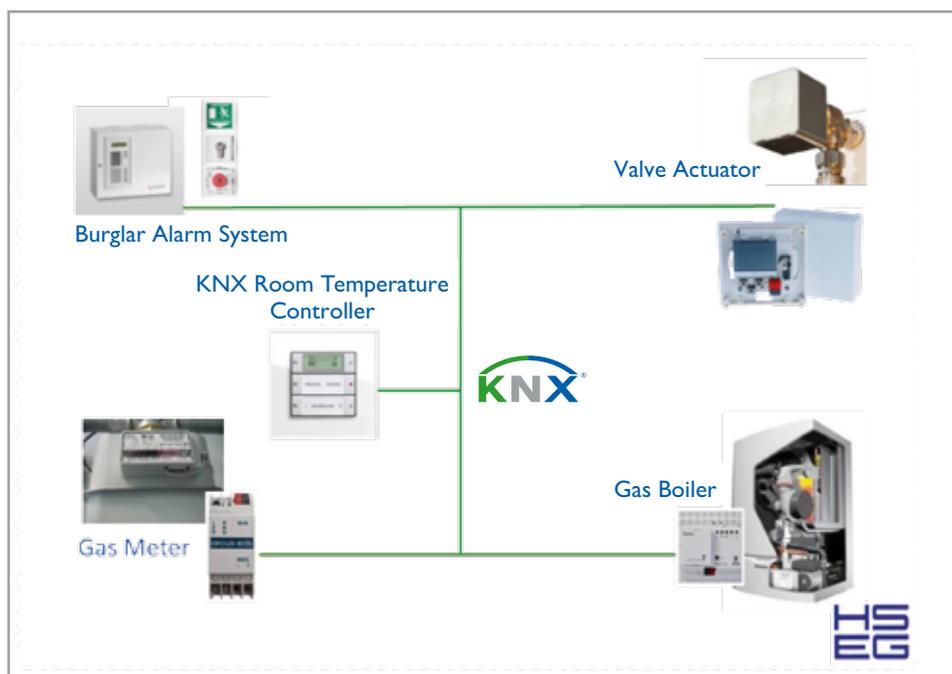
Functions

When heat is requested by a KNX room temperature controller (Gira) connected to the system, the request is transmitted to both the valve actuator and the gas flame. The intensity of the heat supplied is calculated on the basis of a sophisticated logic based on room sizes as a proportion of the overall building

surface area, so that the supply temperature is matched exactly to the requirements. Furthermore, timer schedules ensure economical heating by automatically switching the room temperature controller to standby or reducing the temperature at night. A visual display and documentation of the heating control system and current gas consumption in the actual residential building can be consulted to optimise energy-saving efforts.

Benefits

- Energy-efficient heating
- Primary energy savings
- Permanently comfortable heating matched to requirements
- Simple to retrofit
- Continuous monitoring of consumption
- Flexible for further optimisation



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Self-sustainable single family home

Energy management when you're off-grid

The challenge

'Self-sustainable – that's what we ought to be!' is the thought running through the mind of many a householder every time the electricity bill comes in. In view of the energy turnaround and its constantly increasing prices, the trend towards energy self-sustainability could be interesting in the sustainable city as well. In remote areas, some buildings already meet all their power needs with self-generated electricity. The presentation by Smart Building Design GmbH from Switzerland shows how KNX can optimise the interplay of energy generation, storage and use.

The solution

The project shows the KNX installation at 'Finca Los Miticos' on the holiday island of Mallorca. The 450-square metre property includes a resi-

dential house, a guest house and a swimming pool. Electrical energy is generated by a 5.5 kWp photovoltaic plant and a 1.2 kWp wind turbine, and the energy storage unit consists of an 800 Ah/40 V solar battery. If these energy sources are not sufficient, an emergency power generator steps in. Heat for hot water and heating is provided by solar collectors or in an emergency by an oil-fired boiler. The KNX system performs a number of different tasks in order to match the electricity consumption in the building to the availability of electrical energy, and to coordinate the various energy sources with one another.

Practical implementation

The building services have been designed with energy efficiency firmly in mind. For example, the lighting uses

power-saving LED technology, and importance is attached to having the highest Energy Label on the domestic electric appliances. The KNX system controls the lighting, solar control components and room temperatures and incorporates energy-saving automatic equipment such as presence detectors. If the electricity supply nonetheless starts to run low, a load-shedding function switches off certain predefined consumers for a brief period.

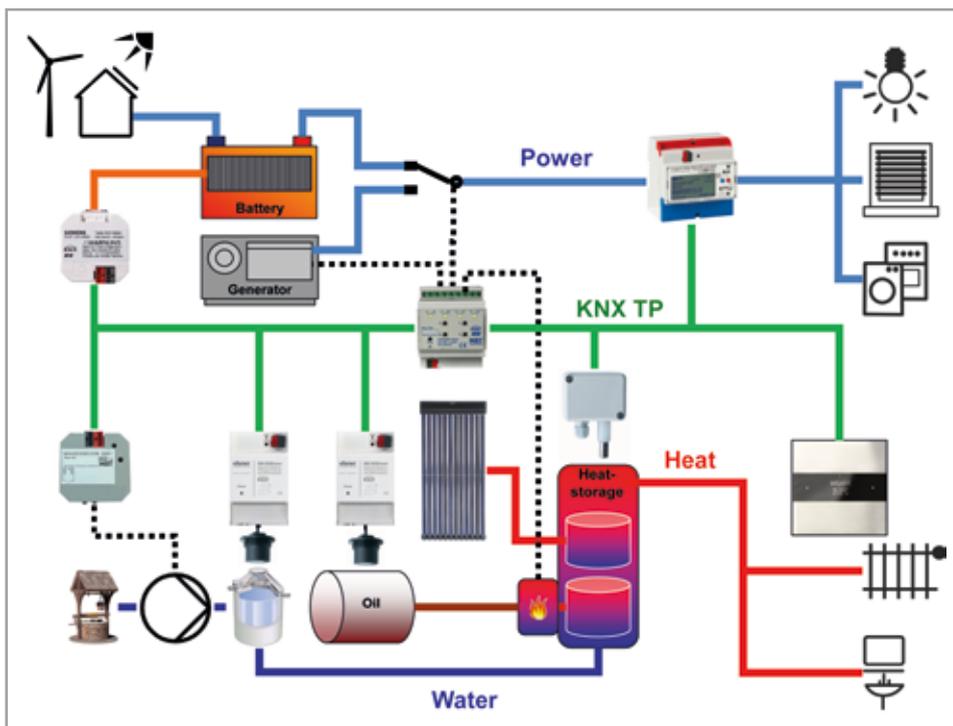
Functions

The system's sophisticated technical features also include battery charge monitoring by a KNX analogue input. If the charge drops to a level below 50 percent, KNX starts the generator and switches over the power supply line. Electricity consumption is measured, analysed and visualised by KNX.

KNX sensors (Lingg & Janke) measure the supply and return temperatures and also the temperature in the heat storage unit of the solar and heating system. If the heat hits a minimum level, the oil burner is started. KNX also controls the well pump as a function of the cistern level, and monitors the heating oil tank and the protective circuit breakers.

Benefits

- More economical energy use
- Reliable electricity supply
- Solar, photovoltaic and cistern systems all integrated
- Heating and ventilation performance optimised by KNX
- Visual displays for operation, monitoring and analysis
- High energy efficiency




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Distributed facilities

A quick check on what's going on at the office

The challenge

Is there anyone still in the office? Has anyone remembered to put the alarm on? Employers in particular will appreciate the way that KNX makes it possible to check up on your business premises, turn down the air conditioning or switch the lights on or off, all without leaving your own home. Elektro Wagner GmbH in Wehrheim, Germany, has tackled the issue of networking two sites to permit the operation and monitoring of one building from the other. The project additionally shows how several sites can be incorporated into a single, centralised energy management system, in line with the 'sustainable city' concept.

The solution

The sample project is portrayed with the help of two examples, one representing the typical functions of a residential building, the other showing examples of the technology that might be found

in a commercial building. All of the functions of the two buildings, for example lighting control, the shading system, home communication, media control and malfunction messages are integrated into a single, completely homogeneous operating concept. The internet is the network used to link the two 'buildings'.

Practical implementation

Both of these two building installations are based on KNX technology. They are joined by KNX IP via VPN (Gira, with ABB KNX IP routers). The VPN Tunnel ensures that communication between the buildings is adequately protected against unauthorised access.

In the residential building there are local operating keys for light, room temperature control, music and voice (Merten, Jung, Elsner, Arcus-EDS), a video entry phone system (Gira), and a Multiroom system (Trivum). All functions

can be viewed on a single visual display (Homeserver), and monitored, controlled and preset via a touchscreen (Gira). This is where all alerts and video footage from the house system are displayed. The 'commercial building' demonstrates, for example, how a VdS-certified burglar alarm system can communicate with a KNX installation. The integrated KNX interface links the systems in a completely transparent way, allowing status information to be requested and control room equipment to be operated all via KNX.

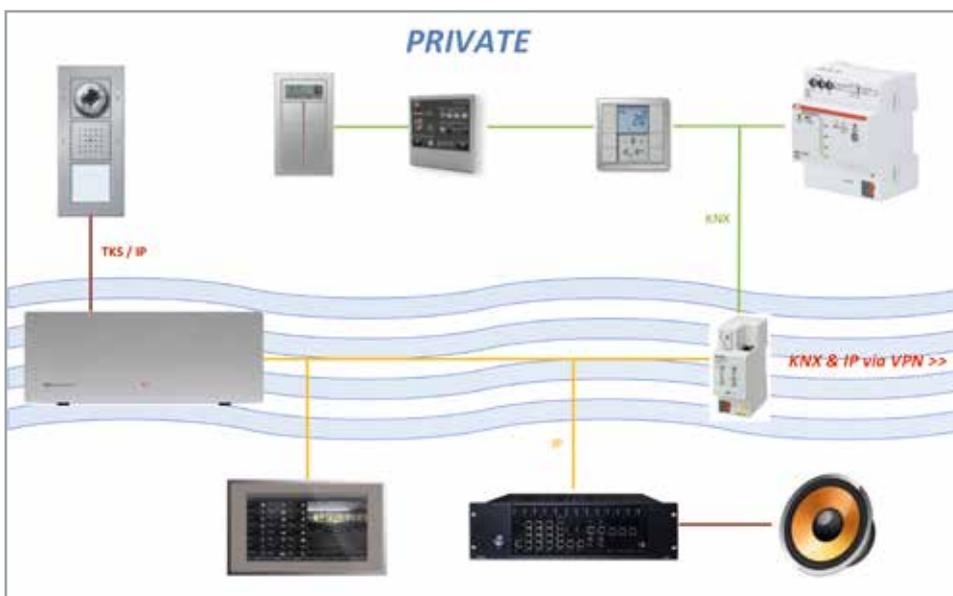
Functions

KNX does not only allow the functions of the commercial building to be monitored and controlled from the residential building; conversely, it is also possible to determine from the office whether someone is ringing the doorbell, the heating system is faulty, or the CCTV has been triggered back at home. The

convenient 'talking' room controllers (Enertex) will be a very popular attraction among visitors to the fair. Not only can they be used to control lighting scenes, multimedia and setpoint temperatures by voice, but they can even answer users' spoken questions about the statuses of these functions.

Benefits

- Easy monitoring of the building technology in separate buildings from a single location
- Consistent, ergonomic operating concept means two buildings can be operated just as easily as one
- Easy to quickly check operating statuses and remedy faults
- Better monitoring of energy use saves energy and money
- System is easy to modify or add to thanks to KNX technology



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Overall energy management in buildings

Central control increases hospital efficiency

The challenge

Everything in hospitals in the sustainable city is focused on the treatment and recovery of the patients. This requires the building services to function faultlessly. The sample project by ib company GmbH, Pforzheim, is based on a project that has already been implemented. The task was to network several buildings in an existing hospital complex to permit modern, efficient building control with central energy management. A central control station is required to monitor and operate the technical systems, receive error messages and process energy data. Additional tasks: the room functions also needed to be automated to increase comfort, convenience, safety and security in the wards, and as energy-saving measures.

The solution

The electrical installations in the hospital buildings were fitted with KNX a few years ago. An ideal solution to the task therefore presented itself. The existing KNX-based building services could simply be combined into a single unit using a KNX/IP router (Hager). The central control station for building management now allows visualisation of all the functions in the buildings. The sample project shows in particular the field bus level for regulating the individual room control, lighting control and blind control plus various operating options.

Practical implementation

If KNX is already integrated in the building, then functions can often simply be retrofitted. The KNX individual room control (Gira) was implemented using wireless window handles (EnOcean) and

an appropriate KNX Gateway (Wago), without having to lay any cables. This measure helped to avoid heat loss e.g. through open windows. Automatic functions were also integrated for the lighting and solar control. The extensive parameterisation work in the actual project was facilitated by the KNX configurator with automatically generated Group Addresses.

Functions

In addition to wall-mounted push buttons with room temperature control, the tablet attached to the hospital bed allows barrier-free operation of the room functions.

Patients have control of the lighting, blinds and room temperature at their fingertips. They can also switch on and select programmes on consumer audio and video devices. In addition the tablet allows communication with the nursing staff via the integrated patient call system. The central functions of the control centre include alarm management. Fault messages are relayed to the relevant service department depending on their type and priority. Centrally compiled energy data including those generated on site are used for monitoring and optimising measures for efficient energy use.

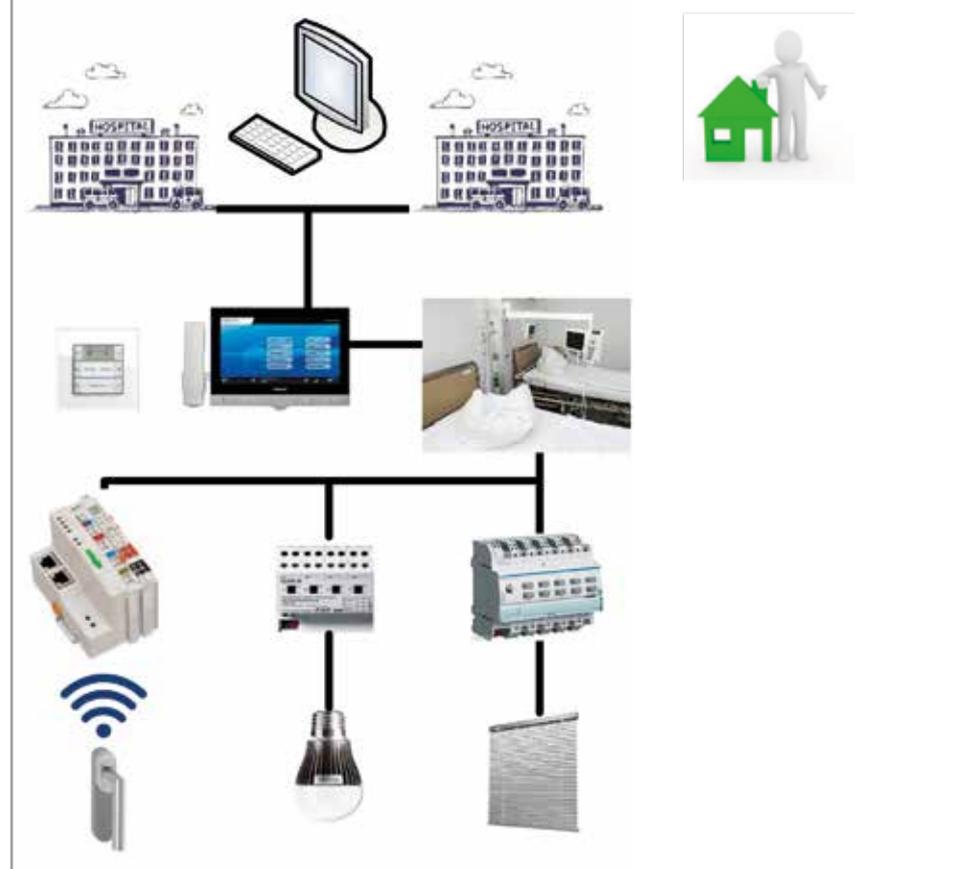
Benefits

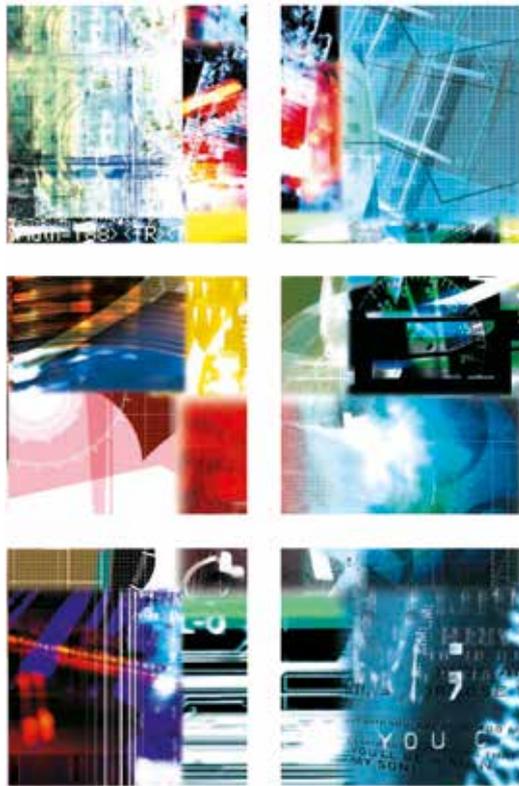
- Technical management for efficient building use
- Central energy management
- Fast response to fault messages
- Retrofittable energy-saving measures
- Barrier-free operation from hospital bed
- Comfort, convenience, safety and security for patients

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Control technology for distributed properties in hospitals





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