

## EnOcean CleanTech – Enabling Intelligent Green Buildings

**Architects, contractors, and property owners are constantly faced with new challenges. These include increasing demands for greater convenience, as well as stringent political directives such as the “EU Building Directive” in Europe or the “Cal Title 24” in America. Whether undertaking new construction or remodelling, it is advisable to consider a combined “Intelligent Green Building” concept. EnOcean technology provides the essential basis for meeting these requirements.**

*Dipl.-Ing. Armin Anders, Co-Founder of EnOcean and VP Product Marketing*

### EnOcean is the key to the Intelligent Green Building

An ‘Intelligent Green Building’ is defined as one that optimizes personal productivity and comfort, cost efficiency, environmental awareness and energy-conservation. “Intelligent”, here, defines buildings that accommodate mobile working environments, that adapt to changes of use (flexible, mobile, modular), that enable integrated office workstations (furniture), and that facilitate central building monitoring and control (management systems). “Green” refers to the call for conservation of materials and space, reutilization of open-plan rooms and energy efficiency, but also to ecological requirements relating to building materials and installation (sustainability, electrosmog).



B/S/H company headquarters in Munich:  
Feng Shui and EnOcean-Funk under one roof

If these requirements are to be satisfied, buildings need an ever increasing number of devices to serve as the sense organs of intelligence. These sensor networks must be installed with a minimum of wiring to ensure mobility and flexibility – i.e. wireless radio technology. The EnOcean standard lays the technological foundation for systems in compliance with the principles of building biology and is thus the central key to intelligent green buildings. EnOcean defines the industry standard for

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“battery-less radio sensors”. Unlike all other radio technologies, these radio sensors do not require batteries for operation. EnOcean makes this possible by collecting energy from the environment, e.g. from the press of a finger, indoor lights, slight temperature differences, or vibrations and by using highly efficient energy converters called “energy harvesters”. Due to the unique combination of miniaturised energy converters with reliable radio technology, these wireless sensor networks operate for decades without maintenance, are flexible, and ensure cost reductions and energy savings in buildings and industrial installations:

- Building automation optimizes energy savings and reduces operating costs lowering total cost of ownership. Furthermore, it enhances security, protection and convenience.
- Wireless radio technology is essential to the success of building automation. It permits the required number, functionality and flexibility of the necessary sensors. Radio technology minimizes installation times and reduces system costs.
- No battery requirement is mandatory for larger installations. The cost to monitor, replace and recycle batteries increases with the number of installed nodes. Battery-less EnOcean radio solutions are eco-friendly, comply with the principles of building biology, and save key resources.

### EnOcean: Convincing building biology solutions

Many people these days are concerned that their health may be affected by the absorption of electromagnetic energy, referred to as electrosmog. Manufacturers worry about potential future claims for damages due to adverse health effects of their products. But the demand for wireless devices continues to increase. For this reasons, EnOcean commissioned ECOLOG, the institute for socio-ecological research and education, to measure the typical emission field effect of EnOcean radio switches under real conditions of use. The results were surprising:

- The EnOcean radio switches emit 100 times less intensive high-frequency fields than conventional, wired light switches (the high-frequency fields of the latter being caused by the characteristic spark formation when being switched).
- EnOcean products generally do not contribute at all to low-frequency electromagnetic emissions (due to the avoidance of cables to and from the switches).
- Using EnOcean radio switches eliminates constant electrosmog (only active when operated).

EnOcean technology is used in hospitals and nurseries, and even feng shui enthusiasts concerned about nature and health use our technology in their self-designed buildings. EnOcean reduces electrosmog and helps creating a consumer-friendly and harmless environment!

### EnOcean: Saves resources

The market share of radio solutions in building automation currently ranges from 25% for roller shutters and security alarms, 60% for awnings, 80% for heat cost allocators, and 100% for garage doors. In 2006, around 5 million radio transmitters were sold for building automation in Europe, almost all with batteries. This figure is expected to double each year, a huge potential for the eco-friendly use of resources!

EnOcean dispenses with batteries: it is well known that batteries contain harmful chemicals, however, disposable batteries are rarely recycled properly. The batteries in the 5 million radio transmitters sold for building control in 2006 will die over the next few years. The number of transmitters sold annually

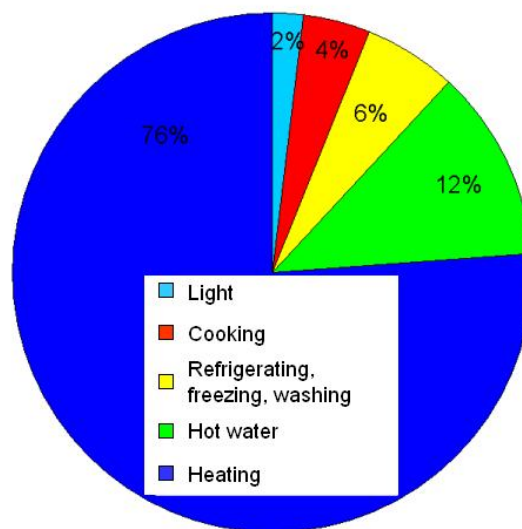
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is expected to double. Over the next five years EnOcean may eliminate 100 million batteries for new radio devices in addition to the enormous replacement requirements.

EnOcean reduces the use of copper: switches and sensors linked through radio technology save around 30% of the installation cables required, or approx. 1km of cables across 450sqm of floor space. Assuming an average of around 40kg of copper per km of cable and approx. 100 mill. square metres of floor space in new and renovated buildings, the saving potential in Germany alone would amount to around 10,000 tons of copper per year!

**Energy saving potentials in buildings**

The following demonstrates how EnOcean can save energy in buildings. Buildings need energy predominantly in the form of thermal heat and hot water (approx. 25–33% of the entire German primary energy budget) and electrical energy, a part thereof for lighting purposes (approx. 2% of the entire German primary energy consumption).



Energy requirement of a household (Quelle: Wikipedia.de)

**20-30% energy savings with single-room temperature control**

Intelligent sensors are required to balance the contrasting demands for occupant comfort with energy conservation. It is well known that simply lowering the average room temperature will reduce energy consumption significantly. For example, corridors and hallways as well as side rooms and bedrooms can be heated to a mere 15°C (59°F) without feeling uncomfortable. For offices and living rooms, 20-22°C (68-72°F) is sufficient. The energy consumption can be greatly reduced if the system lowers the heating temperature when an occupant leaves the room for longer periods of time. Here, “central single-room controllers” are an interesting option. These control systems monitor the environment for time of day, occupancy and personal settings and adjust air temperature in different rooms from a central point.

The savings using central single-room temperature controllers are estimated at 20-30% (source: Bremer Energieinstitut). Cost-effective, easily commissionable wireless sensors enable solutions that only a few years ago were found exclusively in the upper price segment.

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Similar observations are made in regard to air-conditioning systems. Each degree of increased room temperature results in more than 4% less energy requirement for cooling (source: LfU). The use of controls regulated by time, location and use based on effectively placed sensors (temperature, humidity, presence) is a trendsetting approach to ensuring energy savings and the protection of the environment.



Uniqa company head offices in Vienna:  
500 EnOcean radio-based room sensors on 22 floors

### Reduction of energy requirement by up to 40% through wireless window contacts

Due to their frost protection system simple thermostat valves open in case of cold falling air. Permanently tilted windows above radiators should thus be avoided, especially in winter. To air a room, windows should only be opened for short periods. According to a study carried out by the IFE Krefeld, the daily energy requirement for heating can be reduced by 40% through the use of window contacts. When a window is opened, a battery-less, contact switch transmits a radio signal to set back the heating in the room. This calculation is based on the assumption that the room is aired for a total of one hour with an inside and outside temperature difference of 10 degrees.

The same applies to air-conditioning systems: when opening a window, the air-conditioning should simply be switched off. Window contacts are a reliable means to ensure this.

Window contacts show enormous energy saving potential. Fitting a building with such contacts previously proved quite complex and expensive due to the cabling required. Small radio sensors now help unlock this savings potential as an inexpensive alternative, even through retrofitting. Battery-less radio sensors are essential especially for a large number of windows, since they do not require maintenance.

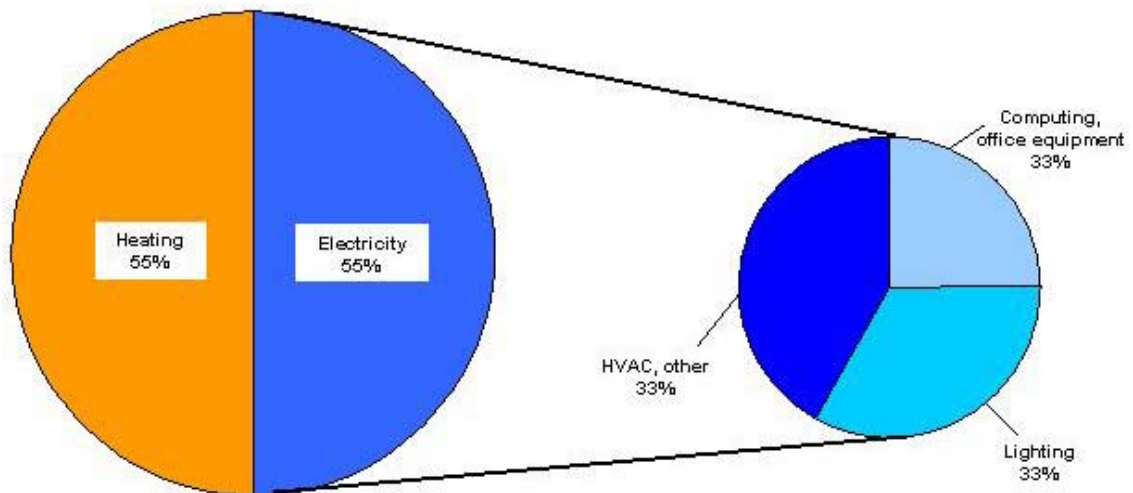
### Up to 70% reduced energy requirement for office lighting through need-based light control

In office buildings, an average of one third of the energy is used for lighting. Typically the lights are turned on first thing in the morning and shutoff when the last person leaves in the evening. In many corridors and staircases, light is on permanently, even outside the working hours. In banks and insurance companies, the average energy consumption per employee tops 5,000kWh. This is more than in most households. Key saving potentials include:

- 500kWh per year and employee, where the light has previously been left on throughout the day

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- 350kWh per year in a 10m corridor with windows, where light is switched on only as and when required (traffic routes and side rooms take up 30% of the space in office buildings).
- 250kWh per year in toilets, if the light is switched on only when needed.



Energy consumption in office buildings (source: [www.energieeffizienz.de](http://www.energieeffizienz.de))

By using appropriate lamps and an intelligent lighting control system, it is possible to ensure not only a considerable improvement in personal comfort, but also a drastic reduction of the energy consumption. Halogen lamps of the same wattage produce twice as much light as conventional light bulbs. Fluorescent and energy saving lamps require a mere 20% of the energy of a conventional light bulb, their cost of production and price, however, are higher. Therefore, energy saving lamps should only be used where light needs to be on for sufficiently long periods of time. But then there are further, quite significant saving potentials: When using fluorescent lamps to light a room, motion and brightness sensors in conjunction with electronic (dimmable) ballasts can save up to 70% compared with conventional ballasts (source: Wikipedia, "Energy savings").

EnOcean allows the effective positioning of maintenance-free, wireless switches, motion detectors and photo sensors in places that provide maximum benefit, e.g. on flexible room dividers, furniture and other fittings, and on concrete ceilings and walls, also during structural alterations.

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### Outside shutters and awnings reduce inside heating

Inside blinds reduce glare. Contrary to outside shutters and blinds, however, they are not as effective in preventing the room from heating up in summer. Outside shutters and awnings thus reduce the energy requirement for air-conditioning systems, but also require flexible operation directly at the workplace or from the living room couch. Radio controls, therefore, win more and more recognition. Currently, a total of 25% of all electric roller blinds and 60% of all awnings in Europe are already operated by radio control (source: IO Homecontrol).



Siemens Munich: light and blind control in eleven office buildings using EnOcean radio sensors.

### Radio-controlled heat cost allocators ensure energy-conscious consumption

In buildings with shared heating systems, 'heat allocators' monitor the energy consumed by calculating the transfer of heat from a radiator to the room. Used already in millions of buildings, these ensure an energy-conscious and economical consumption. Today, around 20% of all heat cost allocators in Germany are based on radio control, 80% are currently being installed as radio devices. Thanks to radio-controlled heat cost allocators, there is no need for meter readers to access the flats. Tenants no longer have to wait for meter readings. Landlords appreciate radio systems because they reduce administrative expenses and save costs: no alternative arrangements for meter readers, no intermediate reading on site, no reading errors, less hassle with tenants.

An enormous market: the number of heat cost allocators in Germany totals 31 million devices (classic evaporators and radio devices, 2006). 6.2 million of them are currently radio-controlled heat cost allocators (previous year: 5.1 million, source: Techem). Today EnOcean is working on thermogenerators which, in future, will replace several millions of batteries.

### Radio sensors reduce hot water requirement

In second place in terms of energy consumption in a home is water heating. The most significant hot water consumption in a home relates to personal hygiene (baths and showers). A shower requires approx. 60-120 l of hot water, a bath roughly three times as much. Intelligent EnOcean radio sensors with appropriate temperature and nozzle control make showering more comfortable and help to reduce the amount of hot water used for a shower.

### Intelligent Green Buildings become a reality through EnOcean Alliance

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To make “CleanTech” information available to investors, specifying engineers and housing companies is important, as carrying out research is time-consuming and in daily life for house owners and specifying engineers often impossible. This hindrance leads to a lack of tenders for innovative technologies for new buildings and renovations, in consequence only conventional technology is used and the energy saving potential not fully tapped.

EnOcean based radio devices are used worldwide by well-known product manufacturers in their system solutions for intelligent, energy-efficient buildings. The EnOcean Alliance is a consortium of independent system integrators and leading manufacturers in the area of building automation. A strong, international alliance allows energy saving potentials and cost advantages to be widely and effectively communicated. The “intelligent green building” becomes a reality.



**EnOcean stands for Intelligent Green Buildings**