The Ecosystem of the EnOcean Alliance

Energy Harvesting Wireless Standard for Energy-efficient, Comfortable, and Flexible Buildings

The EnOcean Alliance is an open consortium of companies worldwide, which develop and promote wireless building automation solutions. The organization's main objective is to make the most effective use of intelligent control-based and sustainable technology to improve a building's carbon footprint while increasing comfort and safety at the same time.

"We cannot consume the world's resources without regard to the effect."

What is the EnOcean Alliance?

The EnOcean Alliance was initiated in 2008 by leading companies from the building sector. It is an open, non-profit organization, which aims to make buildings more energy-efficient, more flexible, and more cost effective by using intelligent wireless automation solutions. The Alliance's core technology is the EnOcean energy harvesting wireless standard. Currently, nearly 400 members belong to the EnOcean Alliance, which offer more than 1,500 interoperable products (status July 2015). The Alliance is headquartered in San Ramon, California.

The Alliance's major objectives include:

- establish energy harvesting wireless technology as the wireless standard for sustainable buildings
- help further the use of wireless monitoring and controlling products in buildings and further internationalize the technology
- continuously improve the specifications for the interoperability of EnOcean-based products

What are the Alliance's main tasks?

A major task of the EnOcean Alliance is to establish energy harvesting wireless technology as the leading wireless standard for sustainable buildings and to enable interoperable wireless monitoring and controlling products in and around residential, commercial and industrial buildings. For this, the Alliance ensures the interoperability of EnOcean-based devices and solutions by defining standardized application profiles (EnOcean Equipment Profiles, EEPs) based on the international wireless standard ISO/IEC 14543-3-1X. This enables products from different Alliance members to seamlessly work together in a system.

In addition, the organization offers its members a platform of vital exchange and partnership. Today, the EnOcean Alliance is one of the fastest growing technological alliances and has the largest installation base of ultra-low power wireless devices in commercial buildings worldwide.

What is the EnOcean Standard?

The EnOcean standard is based on the international wireless standard ISO/IEC 14543-3-1X, which is optimized for ultra-low power wireless applications and energy harvesting. The standard can be downloaded at www.iso.org. The EnOcean radio protocol is specifically designed to support devices, which are powered by the energy of their

surrounding environment. This energy harvesting principle enables wireless applications to work without wires and batteries.

Products that use the energy harvesting wireless standard are normally labeled with the EnOcean Alliance Ingredient Logo:

The EnOcean technology's three major energy sources are motion (harvested by electro-mechanical converter), light (harvested by miniaturized solar cells) and temperature differences (harvested by thermo generator and DC/DC converter). EnOcean GmbH, the founding company of the basic technology and a Promoter of the EnOcean Alliance, markets its comprehensive energy harvesting platform of energy converters, wireless modules, energy management, and ultra-low power radio to OEM customers worldwide.

What are the specifics of the EnOcean Standard?

The EnOcean standard is ideally suited for reliable wireless communication in building and home automation. For optimal RF effectiveness, the radio protocol uses sub 1 GHz frequency bands, which offer high penetration through walls, furniture and other barriers in a building. At the same time, the electromagnetic fields emitted by the wireless devices are extremely low, which minimizes electric smog. RF reliability is assured because wireless signals are less than one millisecond in duration and are transmitted at a data rate of 125 kilobits per second. The short telegram is randomly repeated twice in the space of about 40 milliseconds to prevent transmission errors. The range is up to 100 feet/30 meters in buildings and 1,000 feet/300 meters in the free field.

The EnOcean standard optimally uses different frequency bands in different countries, including 868 MHz in Europe, Africa, South America, Middle East and China; 902 MHz in North America) and 928 MHz in Japan; and 315 MHz in Asia and other countries. This allows for the technology to be suitable for worldwide use.

Why do buildings need the EnOcean standard?

Governments around the world have set ambitious goals to significantly reduce energy consumption over the next couple of years. Buildings play a key role as they consume 40 % of the primary energy. Existing buildings take the highest share, which demands the integration of innovative technologies that can be installed easily, especially retrofit projects, with a fast return on investment (ROI) whilst providing significant energy savings.

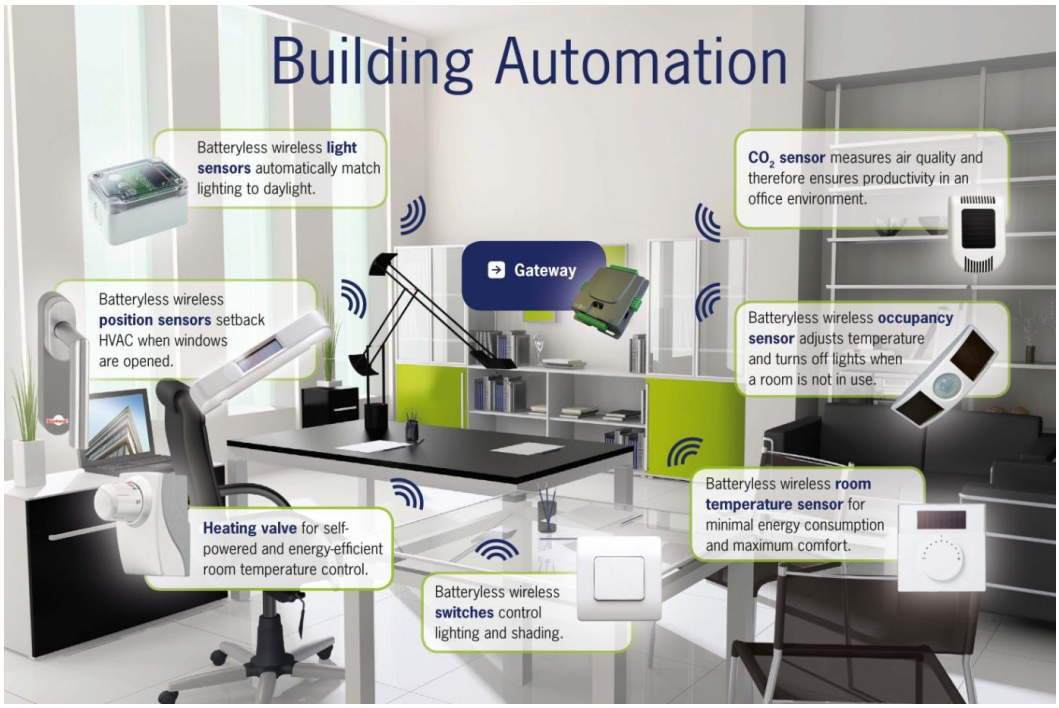
Energy harvesting wireless devices are the ideal solution to meet this demand. They bridge the last leg to provide all the data needed for intelligent central control in commercial buildings and smart homes. With no wires to pull, and no need for access to replace batteries, it yields devices that are highly flexible and easy to position, remove, and relocate. It eliminates the cost and effort associated with installing wiring and conduits, and it enables maintenance-free and long lifespan systems, resulting in the most cost effective wireless building control systems.

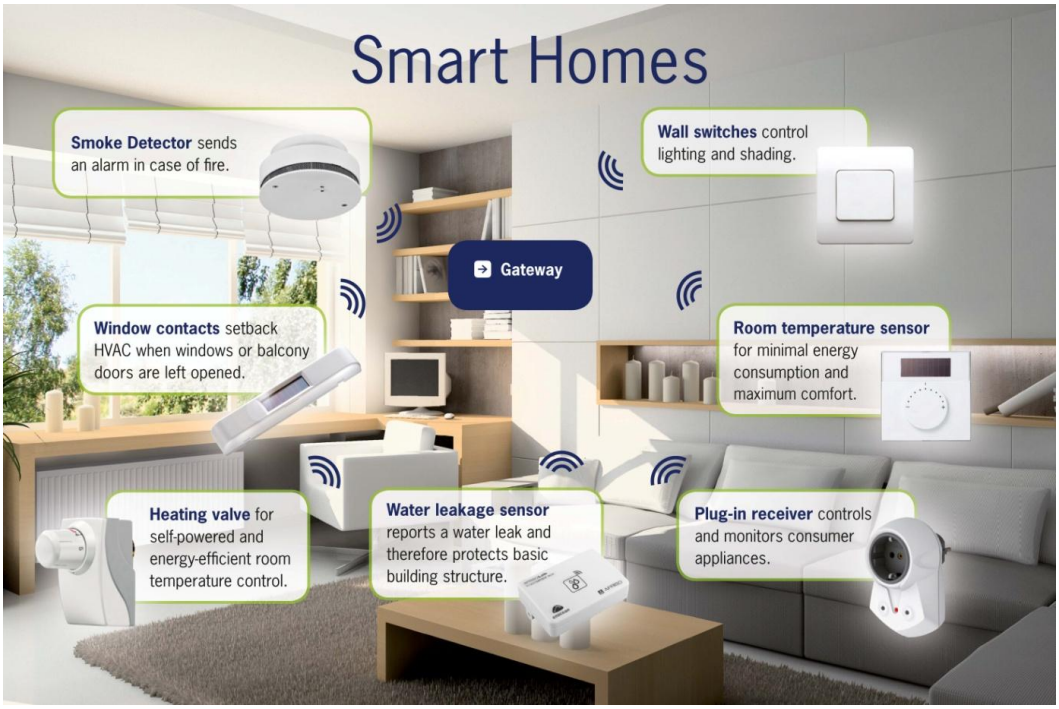
Employing energy harvesting wireless solutions, installers and system integrators can utilize the energy saving potential of a building quicker and with less effort. In addition, the freely placed components fit into flexible office and living concepts, in which partitions and room divisions should fit into the heterogeneous requirements of different users. In the case of a change in the room structure, the switches and sensors relocate easily.

What does a battery-less wireless automation system look like?

An automated building or smart home using battery-less wireless components can be realized flexibly with different system architectures according to individual requirements. When choosing a system, in particular for retrofit projects, it is important to consider the on-site conditions as well as the goals of automation.

The following illustrative graphics show an installation example in a commercial building and a smart home:





What saving rates can be achieved?

Based on battery-less wireless technology, intelligent HVAC system and sophisticated lighting control can be realized using self-powered automated thermostats, window contacts, key cards, humidity sensors, occupancy and light level sensors, switches and CO_2 sensors. These are just a few examples of the self-powered products in place, to regulate climate and lighting control automatically. As battery-less devices use standardized communication and application profiles, system integrators can flexibly combine solutions from different vendors.

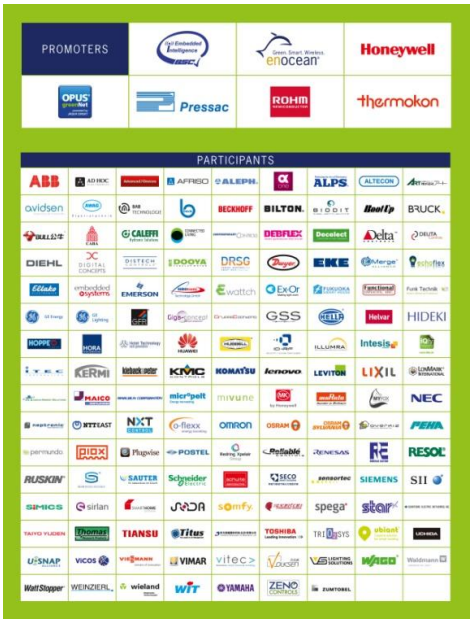
Occupancy-based HVAC and lighting control, as well as monitoring systems integrated with energy harvesting wireless technology, can dramatically reduce installation costs by more than 30% in new construction and up to 70% in retrofits. Additionally, these integrated wireless, battery-less systems significantly help reduce energy consumption by 20% to 40% in commercial buildings, generating generous savings with a payoff ROI between one to five years. All of these green building effects can be realized by eco-friendly, resource-saving technology.

How do other building standards come into play?

The EnOcean Alliance has always constituted an excellent platform for cooperation between various standards. This also includes solutions that combine the energy harvesting wireless standard with other established building and communication protocols to enable optimized and customized automation solutions. Via gateway controllers, the battery-less devices can be integrated with other communication protocols such as WiFi, TCP/IP, KNX, BACnet, Modbus, DALI, LON, ZigBee, and Thread. In addition, the EnOcean Alliance actively supports the definition of open interfaces, so that benefits of different established standards can grow together to realize an integrated system achieving optimized results in energy savings, comfort, and usability. Additionally, the EnOcean Alliance collaborates with other organizations such as LonMark International, OSGi Alliance, EEBus Initiative, and AllSeen Alliance to progressively participate in the coming Internet of Things (IoT) and the future of device connectivity.

Who is involved in the EnOcean Alliance?

The EnOcean Alliance is a consortium of members with diverse purpose for technology but the same commitment to it and its advancement. Today, the Alliance is represented by nearly 400 member companies in 42 countries worldwide, from product manufacturers and distributors to building professionals and research institutions. An overview of all Alliance members can be found at:
www.enocean-alliance.org/our_members



The Alliance has three membership classes:

- **Promoters:** innovative key players who lead, define, and drive the Alliance
- **Participants:** companies and suppliers providing products and services using the EnOcean technology and standard
- **Associates:** building professionals, academics, smaller distribution partners, and others interested in the technology, advancements, examples, or training.

The Technical Working Group (TWG) of the EnOcean Alliance further develops the interoperability of energy harvesting wireless devices and technically defines new application profiles as well as specifications and interfaces. This ensures a seamless communication

within the ecosystem, a smooth networking to other systems and the standard's sustainability for future requirements. In addition, the TWG developed a Certification Program designed for self-certification by the device manufacturer and defined a Remote Commissioning Specification for EnOcean-based networks.

The Marketing Working Group (MWG) actively promotes the EnOcean standard and the members' solutions worldwide via several marketing and lead generation activities such as trade shows, trainings for installers and system integrators, roadshows, videos, newsletters, and public relations.

How are decisions made?

Decisions on strategy and membership applications, as well as final approvals of specifications and Group documents, are made by the Board of Directors. Membership to the Board is reserved for Promoter members. Each Promoter and Participant member has the possibility of being involved in the Alliance's Marketing and the Technical Working Groups, according to their individually desired level of involvement. Therefore, they can participate in all provided marketing activities and bring in new applications or technical content to be included in the next release of the EEPs and other specifications.

How can companies or organizations join the EnOcean Alliance?

Anybody, including product manufacturers and suppliers to the ecosystem, can join the standard-based, open EnOcean Alliance as a Promoter or Participant member. The Associate class is geared only towards building professionals, academics, users, and retail organizations. Interested companies can find all details on the membership application process and compare involvement levels by visiting www.enocean-alliance.org/joinus. All new membership applications require Board approval before officially becoming a member of the EnOcean Alliance.

What benefits does the EnOcean Alliance offer to its members?

80% of all members' fees are invested in marketing and demand creation activities that target architects, contractors, specifying engineers, and system integrators. 125,000 people visit the Alliance website annually, with over 50% looking for Alliance member products and solutions. Perpetuum Magazine and the quarterly EnOcean Alliance Newsletter reach over 20,000 industry professionals. Thousands of industry professionals annually learn about energy harvesting and wireless by visiting EnOcean Alliance trade show booths.

The Alliance's marketing benefits are numerous and include the free use of all collateral and video materials, involvement in newsletters and press releases that promote products and solutions or the inclusion in thought leadership and market pull activities. Furthermore, the Alliance organizes sponsored trade shows worldwide and invites its members to participate. The target is to position the member companies as leading players in innovative energy and resource saving green technology and to educate the market on the benefits of the EnOcean standard.

From the technical side, only EnOcean Alliance Promoter and Participant members have access to all approved Alliance specifications such as EEPs or Remote Commissioning and can participate in beta programs for new developments. In addition, they are authorized to propose features to add to the standard. This enables the Alliance to be a strong networking platform for knowledge exchange and support in technology and market positioning. Details on the Promoter, Participant, and Associate Member benefits are available to review at www.enocean-alliance.org/member_benefits.

Which trends does the EnOcean Alliance see for the building automation market?

The requirements of building automation are continuously growing. The control of areas such as heating, ventilation, lighting, and security were originally developed independently from each other, establishing different optimized standards and technologies for each field. Today, the target is a seamless collaboration of building areas and standards to unlock the full potential of intelligent control. This calls for open, standard-based solutions and a deep connectivity, which drives significant interest in the IoT.

None of the standards can cover all IoT applications, which range from a simple light switch to video streaming and data processing in the cloud. This goes hand in hand with a seamless plug & play operation of having devices properly work and simply work together, which is the primary requirement from a user's perspective.

Monitoring and control capabilities, such as temperature sensors, occupancy detection, or light level and window status sensing, require low data rate transmission via sensors and switches that are highly flexible to install. This level will be dominated by the EnOcean energy harvesting wireless standard, which enables small devices to be powered by their surrounding environment. The technology has already been already proven with successful deployment in several hundred thousand buildings worldwide. With potentially more than a hundred of such devices in a smart home and several thousands of them in commercial buildings, it becomes immediately apparent that battery- or wire-powered devices are not an option for this communication level. The highly flexible and sustainable EnOcean energy harvesting wireless standard is the perfect fit to provide the needed data from thousands of measurement points to a supervising system.

However, a building also needs high data rates. This can be video streaming, security cameras, or data processing in the cloud via WiFi and TCP/IP, for example. In the future, all of these communication levels will work together seamlessly. With the boundaries between products, standards, and disciplines dissolving into one solution, the user doesn't need to realize the crossover of different standards anymore; instead, the user beneficially experiences only the underlying results of increased energy efficiency, comfort, and security.

About EnOcean Alliance

Leading companies worldwide from the building sector collected to form the EnOcean Alliance and establish innovative automation solutions for sustainable building projects – and so to make buildings more energy-efficient, more flexible and lower in cost. The core technology of the Alliance is energy harvesting wireless technology for flexibly positioned and service-free sensor solutions. The EnOcean Alliance aims to further internationalize the energy harvesting wireless technology, and is dedicated to creating interoperability between the products of OEM partners. Basis for this is the international standard ISO/IEC 14543-3-1X, which is optimized for wireless solutions with ultra-low power consumption and energy harvesting. The headquarters of the non-profit organization is located in San Ramon, California. **www.enocean-alliance.org**