Wireless Energy Management In Hotels

Save Energy & Enhance the Guest Experience

THIS WHITE PAPER WAS DEVELOPED BY:

enocean® alliance
No Wires. No Batteries. No Limits.

Magnum Energy Solutions™

Contents:

Introduction

We recognize the pressure hotel owners are under when it comes to running their properties. Occupancy fluctuations, keeping guest accommodations competitive and increasing energy costs are just some of the concerns facing the hospitality industry. For hotel owners and operators, fears of compromising guest comfort are often the greatest stumbling block when it comes to advancing energy management. The assumption that energy management solutions adversely impact guest comfort is largely unfounded. Advances in sub-metering, wireless technology, data collection and automation systems are made seamless to the guests and contribute to better and smarter hotels.

When it comes to your property's energy costs, unnecessary lighting, cooling and heating for hours can pose a significant drain on your bottom line. Energy management solutions that utilize self-powered, wireless EnOcean based technology allow hotels to monitor, manage and control a hotel's energy consumption. Taking control of, and optimizing operational systems, can result in energy savings of between 20 and 50 percent.

In addition to the energy savings through wireless technology, EnOcean enabled solutions don't require extensive renovations, in fact these solutions can be installed in about the same amount of time a hotel room takes to clean. Wireless, self-powered energy management solutions are both flexible and scalable and can be implemented as either stand-alone, in room applications or as a complete turnkey solution that utilizes a robust and secure software platform.

Hospitality Sector: The Business Case for Wireless

America's 47,000 hotels spend $2,196 per available room each year on energy. This represents about 6 percent of all operating costs . Guest satisfaction remains the number one priority in the hospitality sector and hotel operators are often hesitant to engage in activities that could be perceived as reducing comfort, convenience or the overall brand experience.

However, energy represents the single fastest growing operating cost in the lodging industry. Electricity in hotel rooms is wasted in a number of ways; lighting, standby power losses and electrical devices unnecessarily left on. Hotel owners should consider solutions that can address HVAC, lighting and plug loads in hotel rooms and reduce energy consumption by at least 20 percent .

[1] http://www.energystar.gov/ia/business/challenge/learn_more/Hotel.pdf
[2] EnOcean Alliance

The Market for Low Power, Wireless Solutions

Compared to traditional wired solutions, wireless energy management technology offers far greater flexibility and convenience in hotel automation. There are different options when it comes to commercially available, wireless building solutions. ZigBee, for instance, is an open standard that builds on the IEEE standard 802.15.4, which defines the physical and MAC layers. ZigBee operates on the relatively crowded 2.4 MHz frequency and continues to compete against other technologies in that spectrum, including the latest iteration of Wi-Fi.

Furthermore, ZigBee's functionality depends on the use of batteries. The MGM Hotel and Casino in Las Vegas, for example, has over 70,000 ZigBee radios installed with every sensor and switch requiring a battery. Implementing battery powered wireless solutions results in considerable expense when it comes to proper disposal and replacement of batteries, which require change out at least every two years, not to mention the labor associated with the maintenance of these devices. ON World estimates the labor cost for changing batteries in wireless sensors will be greater than $1 billion over the next several years . These costs for battery replacement are a significant disadvantage to the growth of wireless, battery powered sensor networks, therefore opening the door to EnOcean's energy harvesting, wireless technology.
An alternative to wired systems and wireless solutions that require batteries is energy harvesting wireless. Today, energy-autonomous wireless systems are found in all kinds of buildings in nearly all vertical markets. An energy harvesting wireless module gathers the power it needs to operate from the surrounding environment, including motion, light or changes in temperature. Being self-powered allows EnOcean enabled control systems to operate independent of an external power supply. Even humans can serve as a source of energy, generated by pressure on a button or the heat given off by the body. The ambient energy obtained in this way, given a suitable low power wireless controller, is sufficient to send a wireless signal as a command and control message.

EnOcean is a leader in this field with its energy harvesting wireless modules that allow the implementation of fully energy-autonomous applications for hotel automation. The messages sent by this wireless system are brief and repeated several times within a 40-millisecond time frame. By transmitting these data packets at random intervals we can ensure a very low probability of interference. As a result, there is no issue with operating a range of switches and sensors in close proximity to one another. The range of EnOcean wireless sensors is about 900 feet in open spaces and up to 90 feet inside buildings. Repeaters can be used to extend the signals.

EnOcean energy harvesting wireless technology utilizes the less crowded 868 MHz, 315 MHz and 902 MHz frequency bands, making it suitable for use worldwide. This provides a safeguard against other wireless transmitters, while still offering rapid system response and elimination of data collisions.
The EnOcean wireless protocol is standardized internationally as ISO/IEC 14543-3-10, which is optimized for wireless solutions with ultra-low power consumption and energy harvesting. Based on the energy harvesting wireless technology, the EnOcean Alliance, a consortium of companies working to further develop and promote self-powered wireless monitoring and control systems for sustainable buildings, has formalized standardized application profiles. This ensures that sensors from manufacturer "A" are able to communicate with receiver gateways manufactured by vendors "B" within the same ecosystem. Currently there are more than 300 member companies in the EnOcean Alliance who have developed over 1000 interoperable products, most of them for the building automation sector.

[3] http://onworld.com/power/

Efficiency Based Hotel Operations

An example of this functionality and innovation is a solution that utilizes a building's existing IP infrastructure and incorporates easy to use software, enabling hotel owners and facilities staff to control, monitor and configure their property to maximize energy efficiency and enhance the overall guest experience. The outdated method of allowing a thermostat to simply cycle the equipment in a guest room is no longer the preferred method of control. The most optimal method of control is real time monitoring of the internal room environment, including temperature, occupancy and comfort levels. By monitoring the temperature in a guest room, we can cycle the HVAC equipment to prevent overuse.

Furthermore, by installing and integrating an occupancy sensor, and/or a key card switch, the HVAC equipment, lighting system and controlled power strips can be cycled off (or set back) when the room is vacant. For instance, if a hotel has 30 unrented rooms for the night, it can put those rooms into a deep set-back mode without even having to step foot inside the room since controls are implemented remotely. To appreciate the broad utility of wireless sensors, consider that up to 50 percent of the energy used to heat or cool hotel rooms is wasted through open windows or balcony doors while the HVAC is running at full power. In a typical hotel scenario a window/balcony door sensor is used to detect an open window or door. A signal is then sent to the HVAC unit to automatically reduce heating or cooling, or shut it off completely until the window or balcony door is closed. Installing individual room or area temperature monitoring and control can save up to 30 percent in HVAC energy consumption alone.

EnOcean Solution Overview

At the heart of EnOcean's in room energy management solution is the wireless keycard. Upon entering the room, the guest initiates control of the lighting, HVAC system, and television by simply inserting the keycard into the wall mounted keycard reader. Guests use the same key that they are given upon check in. Lighting, TV and temperature control are operated normally while the room is occupied. When guests leave and remove the keycard all room lighting is turned off, the television is powered down and the HVAC system is set back into "eco saving" mode. As a substitute, or in addition to the keycard system, a wireless PIR motion sensor can be utilized.

Incorporating a window/balcony door sensor in properties where windows or patio doors can be opened allows the system the ability to detect open windows or balcony doors and can thereby cycle off the fan coil unit. In addition to controlling heating, cooling and lighting functions in a space, the system can integrate intelligent power strip technology that will power down electrical equipment, such as TVs and stereos, when the space is unoccupied. This eliminates unnecessary plug load losses, including standby losses. This fully wireless solution is easily retrofitted into existing guest rooms and can also be specified into new builds. The wireless sensors and switches inside the guest room can be implemented as a stand-alone system, or can communicate to an access point located in the hallway scattered throughout the hotel. These access points are assembled to a POE cable and tied back to the internal TCP/IP to a front end. The data collected by the access points is directed to a server and is compiled into a standard SQL database. If needed, this system can be tied into an existing BAS or to a property management system.

Below are some of the wireless products typically found in an in room energy management system and included is a brief description of how each component works.

Wireless Keycard Reader - When the guest enters the room, they insert their keycard into the access switch, giving them full control of the HVAC, thermostat and lights. When the keycard is removed, all lights, TV's power are terminated and HVAC levels return to a level preset by hotel management. This device has no batteries.

Thermostat - When this thermostat receives an "occupied" signal from a wireless switch or sensor, the user immediately gains full control of the HVAC settings. When an "unoccupied" signal is received, it sets the room back to the present unoccupied temperature. This thermostat can also communicate sophisticated messages, alarms and even alerts to occupants and has the ability to receive and transmit data back for analysis.

Intelligent Power Strip - The power strip contains four outlets that are controlled by occupancy and two outlets that are always on. This device turns plug load devices on and off based on occupancy.

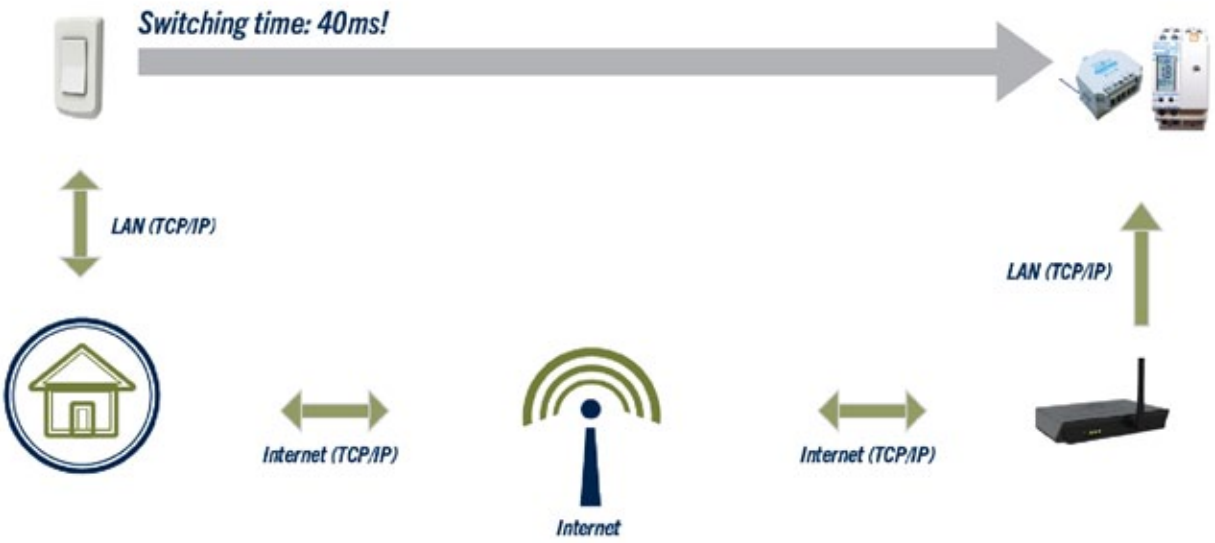
2 - Channel Relay - The two-channel relay can control two devices. One channel has timing on/off delays. This wireless. This wireless relay communicates to window/door sensors, key cards and motion sensors.

Wireless Door Sensor - The door sensor is controlling the HVAC by terminating power when balcony doors or windows are opened. This device has no batteries.

EnOcean Over IP

The inclusion of a software based platform ties the entire system architecture together by integrating data from multiple access points into a centralized aggregate for the management and control of lighting, heating, cooling and security systems. This unique solution reduces energy consumption, costs and optimizes the operation of facilities. This innovative solution features the ability to monitor actual power, water and gas consumption, includes pricing information and has the ability to attach functions, macros and conditions to actual consumption, meter reading and pricing data.

The system utilizes LAN (TCP/IP) access points, which extend and amplify the existing range of EnOcean radio signals. The JAVA enabled software backbone functions as a complete building automation system and can be paired with a variety of EnOcean enabled, wireless energy harvesting devices, including switches, window sensors, occupancy sensors, key cards, thermostats and meters to create a fully functioning, in building and in room energy management solution.



Hotels In the Cloud

In addition to a robust, software enabled, IP based hotel energy management solution we have also introduced the advent of energy management-as-a-service. Hotel operators and facilities staff can monitor important inventory, equipment, assets and energy related information from anywhere at anytime, via the cloud. Critical hotel building related data is automatically pushed to the cloud, freeing owners and managers from the often-challenging coordination and expense of hosting onsite servers.

Hosting energy management data in the cloud clearly has its benefits, including 99.8% uptime, unlimited client access, automatic backups of the database and enhanced security since onsite servers can be hacked and are vulnerable to natural disasters and other unexpected events. One of the major advantages of a cloud-based solution is that the energy management system arrives to the hotel completely pre-commissioned from the manufacturer and ongoing device commissioning is expertly done on behalf of the client and pushed out from the cloud. The client is granted unlimited access to their remote, dedicated virtual server with their own IP address, accessible from a desktop or smart phone.

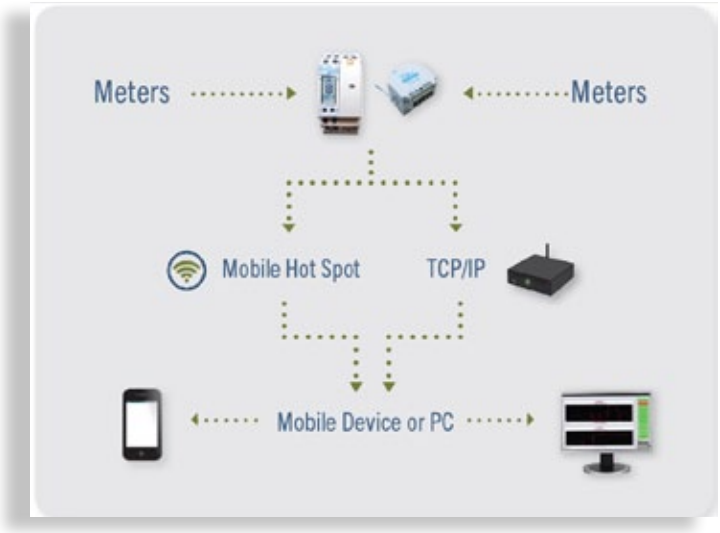
Hotel owners have already made the transition to the cloud and are realizing the benefits of having unlimited access to building related data in real time. Those in the EnOcean community expect cloud based energy management to be the future of how hotels, and other buildings, operate. But the ability to utilize the cloud isn't the only advantage of EnOcean enabled technology, there are a variety of unique features and benefits that set it apart.

Unique System Features and Benefits

EnOcean enabled sensors have built in "heart beats" that send out a signal every 1,000 seconds. If the software doesn't receive a signal, an email notification is sent to a central monitoring system or directly to maintenance personnel notifying them there is an issue. For instance, if a guest in a hotel room is attempting to lower the temperature/set point in their room, yet the set point continues to rise, the system will send a notification to maintenance staff. This timely notification alerts the facilities team to an issue even before a guest has initiated a complaint.

An intelligent thermostat utilized in hotel applications can also broadcast a variety of alarms, including information about CO2 levels, humidity as well as temperature and even assist with egress and emergency notifications.

Another unique system feature is the ability to remotely maintain and commission system components. Traditionally, EnOcean enabled devices have to be manually paired so that they can "learn" each other within a system. Each device is enabled with a unique 32-bit ID so that the device only communicates with the devices that it is paired with. If devices become inoperable, instead of having to manually pair the devices back into the system, the software allows for automatic commissioning through a simple "drag and drop" process. The new device is then immediately integrated and ready to be installed into the room. In the unlikely event that there is a server failure, the hotel maintains full local control of the thermostat and lighting. The sensor data is stored within the access points until the server is operational again. Because the access points add a time stamp to the sensor data, no data is lost. Basic control capabilities also remain operational by each individual access point.



An important feature of an EnOcean enabled hospitality solution is the inclusion of metering. A metering package that includes pulse output energy meters, fitting CT's and a wireless EnOcean based transmitting KWH meter provides complete visibility into a hotel's energy consumption profile. The data gathered through the wireless meters are forwarded via the same TCP/IP infrastructure as the building management system and stored in the SQL database, or in the cloud. This critical data can be displayed at any location, including an onsite dashboard, and even via a mobile device.

Hundreds of hotels around the world have realized considerable benefits and energy savings by using EnOcean technology. The advanced solution described in this whitepaper has also been deployed in a number of hotels in the U.S. including both Wyndham and Starwood Hotels, which have both selected this solution and its provider for this in room energy management technology. Below are just a few hotels that have benefitted from EnOcean's wireless, battery-free solutions.

Case Study: Aloha Surf Hotel, Honolulu Hawaii

The Aloha Surf Hotel in Waikiki is part of Hawaii's first boutique hotel chain, Aqua Hotels & Resorts, offering a collection of 15 boutique and budget friendly hotels in Honolulu and 6 Hawaiian resorts on Maui, Kauai, Molokai and Lanai. Part of their recent green initiative included the installation of Green Key Switches, also referred to as "key cards", in all 204 guestrooms at the Aqua Aloha Surf in Waikiki. The team was able to complete about 15 rooms per day, which meant little to no disruption to daily hotel operations, which was an important factor for the hotel's management and facilities team.

The installed energy management solution utilizes a key card switch to automatically control both the HVAC and the lighting in the guest's room. When the guest enters their room, they place their key card into the key card switch located inside the entry way, thereby activating the thermostat control unit, bringing it into "occupied" mode. When the guest leaves the room, they remove their key card from the key card switch and both the thermostat and the lights return to energy saving mode. Most rooms also have a battery free, wireless balcony door sensor. When the balcony door is opened, a signal is sent to the in room HVAC unit, which switches off, until the balcony door is closed.

The key card based energy management system has been in place since January 2012 and the savings are significant. With respect to lighting, the system has resulted in an average of 45 percent energy savings. The energy savings for the HVAC system, which is where the larger load exists, is about 50 percent. The estimated modeling criteria allocated approximately 70 percent of the consumption to the guest rooms and 30 percent to the common areas. The combined KWh savings conservatively amount to an estimated $ 44,043.00 annually. These results show an ROI without rebate incentives of 15.2 months. When you factor in an additional rebate of $125 per room, for a total of $25,500, from Hawaii Energy, the recalculated ROI is 8 months.

Aloha Surf Hotel Energy Savings Calculator

Aqua Aloha Surf SPA Savings Estimator

Property Information		Venergy Control System	
# Rooms	204	Cost per room(components)average	$273
Average Energy Cost per room per year	$617	Total System Cost	$55,692
Estimated Annual Savings per Room	$215.95		
Annual Savings Total Property	$44,053.80	ROI Timeframe (months)	15.2

Cash Flow Analysis

Year	Annual Savings	Accumulated Cash Flow
1	$44,053.80	-$11,638.20
2	$44,053.80	$32,415.60
3	$44,053.80	$76,469.40
4	$44,053.80	$120,523.20
5	$44,053.80	$164,577.00
Total	**$220,269.00**	**$164,577.00**

Notes / Assumptions

1. Data based on a recent customer installation and actual internal cost justification analysis
2. Annual Energy costs per room for the property $617 annual Based on 15,000 per month utility.
3. The Venergy Control System cost per room is customer actual cost from preliminary proposal
4. Costs do not assume any rebate from local energy company

VENERGY™
intelligent energy use

Case Study: Marriott, Spring Hill Suites, Texas

When the Springhill Suites by Marriott opened its doors in January 2012 in Richardson, Texas, it was the first in a new generation of Marriott properties. The new format features contemporary décor and innovative amenities designed to appeal to younger business travelers. The Richardson hotel also features guest rooms with keycard switches, thermostats and electrical load controllers. The keycard switch provides occupancy-based control of lights, outlets and the HVAC system in the room. When the access card is placed into the keycard switch, the room is enabled, thus activating the room's HVAC unit, as well as the lights. When the occupant leaves the room and the access card is removed, the room is then deactivated and the HVAC unit, lights and other electrical devices will turn off or go into set back mode immediately, preventing the room's temperature from moving outside of an economical range.

This innovative system enables the hotel to save energy without sacrificing the comfort of their guests. "Our guests are primarily young business people who tend to be very comfortable with technology," said Gail Jackson, Regional Director of Operations for Lowen Hospitality Management. "They are also very concerned about the environment and appreciate the fact that we are making efforts to save energy and reduce our footprint." Ms. Jackson went on to say, "From a management perspective, products like the keycard switch allow us to introduce innovation into our properties and ensure that we stay in sync with the green initiatives that are an important part of the Springhill Suites brand."

Hotel Energy Study: Aqua Bamboo, Waikiki Hawaii

The intent of this study was to determine the effectiveness of an EnOcean based wireless, self powered energy management solution implemented in the Aqua Bamboo Hotel in Hawaii to reduce KW usage in guest rooms. The test period was from June 15th 2012 to July 30th 2012, for a total duration of 45 days. The test was conducted in four rooms all having the same AC unit and with the same condition exposures. The in room energy management and control system was installed in two of the four guest rooms to provide the necessary comparison between the two non- controlled rooms.

This 45-day evaluation demonstrated that the energy management solution reduced KW an average of 31 percent. The average occupancy of this property is 90 percent with a KW savings of 23 percent and 43 percent per guest room. The ROI is anticipated to be 10 months.

	Room 905: No Controls	Room 206: With Controls	Room 804: No Controls	Room 607: With Controls
KWH	3712	2133	5341	4136
KWH Differential	43 percent		23 percent	
				Average Savings = 31 percent

For the energy study conducted at the Aqua Bamboo, the data loggers were programmed to record actual amp draw every 5 minutes for 45 days. The average amp draw for each room was converted to KW using the formula KW = Amps * Power Factor (.88) * Volts (120)/ 1000. Calculated energy use for the rooms with the control system enabled vs. non-controlled rooms shows an average reduction between 23 percent and 43 percent less KW used per room.

Extrapolating the measured data and applying the average KW to 80 guest rooms with an average occupancy of 90 percent means projected estimate energy savings annually per guest room of 1116 KWh. The estimated total savings to the property would be 89280 KWh. This will mean an estimated ROI of about 9 months.

Based on the successful test of the system, the Aqua Bamboo is implementing a solution very similar to the one deployed in the Aloha Surf and installation will begin in early 2013.

Aqua Bamboo Waikiki Energy Savings Estimator

Property Information			**Venergy Control System**	
# Rooms	80		Cost per room(components)average	$262
Average Energy Cost per room per year	$1,116		Total System Cost	$20,958
Estimated Annual Savings per Room	$334.80		Estimated annual savings (Typical average)*	30%
Annual Savings Total Property	$26,784.00		ROI Timeframe (months)	9.4

Cash Flow Analysis

Year	Annual Savings	Accumulated Cash Flow
1	$26,784.00	$5,826.40
2	$26,784.00	$32,610.40
3	$26,784.00	$59,394.40
4	$26,784.00	$86,178.40
5	$26,784.00	$112,962.40
Total	**$133,920.00**	**$112,962.40**

Notes / Assumptions

1. Data based on a recent customer installation and actual internal cost justification analysis
2. Annual Energy costs per room for the property $1,116 annual
3. Venergy Control System cost per room is customer actual cost from preliminary proposal
4. Costs do not assume any rebate from local energy company
5. Leasing options available that deliver net positive cash flow month 1

VENERGY™
intelligent energy use

Conclusion

Incorporating wireless, batteryless energy management solutions into hotels can be accomplished without the costs and burden of expensive, disruptive installations. Wireless systems can be deployed in hotel rooms without needing to take rooms out of commission during installation. All rooms can be pre-configured and fully programmed so that they are ready for easy installation. In most instances, a knowledgeable facilities team can complete the installation.

The main driver for the implementation of wireless energy management technology is economic. Hotel owners are looking for additional ways to save money and reducing energy consumption can positively impact the bottom line. Hotels that incorporate lighting and HVAC control can expect energy savings of between 20 and 50 percent, which typically represents simple paybacks of less than 3 years. Hotel owners should also check out available incentives/rebates through their states energy office or their respective utility provider. There are both prescriptive and custom incentives available that can make a substantial difference when it comes to finding money to pay for energy efficient retrofits.