



## Wireless Sensor Networks – for a Green World

Our factories, refineries, warehouses and offices all waste energy. However, by using the next generation of ZigBee based wireless sensor networks, not only can we greatly reduce wasted energy, we can also reduce the amount of energy required to actually operate these networks. Until now, wires and cables for power and connectivity have limited the widespread adoption of sensor networks by making them difficult and expensive to install and maintain. Battery powered wireless networks can simplify installation and reduce cost. But their high power consumption and the corresponding need for regular battery replacement has made wireless networks difficult and costly to maintain. Nobody wants to replace hundreds or thousands of window sensor batteries in a large building on a regular basis.

The promise of wireless sensor networks can only be fully realized when the wiring for both the data communication and the power supply is eliminated. Doing so requires a true battery-free wireless solution, one that can utilize energy harvested directly from the environment. This includes energy harvesting devices that can generate power from solar, from kinetic energy and vibration, from temperature differentials, etc.

To facilitate the widespread deployment of wireless sensor networks, GreenPeak has developed an ultra-low-power ZigBee-based communication technology that can utilize environmental energy sources such as light, motion and vibration. This technology, employing on-board power management circuits and software to monitor energy harvesters and optimize the use of harvested energy, enables sensors to operate reliably in a battery-free environment.

Eliminating the need for batteries does more than just cut cost and maintenance requirements. It also minimizes exposure to the toxic substances within batteries and eliminates the waste and headaches associated with disposing of and recycling batteries. Ultimately, battery-free operation is a key step in paving the way for truly green systems that do not adversely impact the environment. This environmentally-friendly approach can also extend the reach of sensing technology to distant and inhospitable climates and regions.

For example, consider a network of sensors for leak detection in a remote oil pipeline. Retrofitting a cable to accommodate thousands of standard wired sensors spread out over hundreds of miles of pipeline is very financially challenging even given the enormous environmental risk associated with oil leaks. However, a wireless sensor network equipped with energy harvesters is fairly inexpensive and straightforward to install. No batteries, no power lines, no network cables.

To enhance the network's reliability and ease of use, GreenPeak has developed a mesh technology that enables each wireless sensor and actuator device, utilizing integrated mesh software, to act as a repeater for other wireless devices in the network. The sensor nodes form a mesh network by sending messages through intermediate nodes from source to destination. This approach enables the network to span larger distances (even when individual nodes can only see a local area of the network), allowing site-wide wireless coverage throughout a facility without the need for dedicated base stations or routers.





To streamline installation and day-to-day operation, GreenPeak has created a self-organizing network that is self-forming and self-healing. Once a sensor node is powered, it automatically links to the wireless network. This 'plug and play' approach enables every technician to install a system without the need for the sophisticated training and real world experience often required to set up wireless networks utilizing routers and base stations. The self-healing nature of this technology also makes it easier to adapt the network to changing office layouts and designs, enabling nodes to automatically find alternative communication routes when the signal quality decreases or building infrastructure changes.

By combining these two emerging technologies – wireless sensor networks with energy harvesting, we are approaching a "greener" world where energy is conserved, where people don't need to maintain remote sensors and change batteries, and where the power we need is harvested from the very environment around us.

[cees.links@greenpeak.com](mailto:cees.links@greenpeak.com)

► [www.greenpeak.com](http://www.greenpeak.com)

► [info@greenpeak.com](mailto:info@greenpeak.com)

**GreenPeak Technologies**

T +31 30 262 1157 ► Utrecht - Netherlands

**GreenPeak Technologies Belgium**

T +32 52 45 87 20 ► Zele - Belgium

**GreenPeak Technologies Japan**

T +81 3 3783 0377 ► Japan

**GreenPeak Technologies USA**

T +1 512 464 1188 ► USA