

# Attention Customers: Energy Reduced Now on Aisle 6

Commercial businesses see value in taking action to improve sustainability for the planet and their businesses.

Wireless sensor networks enable energy management systems to meet both goals.

*Supermarkets and other retailers deftly shift demand from one product to another by manipulating prices, packaging, and promotions. Then, there is always the classic call to action “on aisle six,” and sure enough, customers are immediately drawn to a great deal “while supplies last.” But even a good deal isn’t enough; the supermarket equips its customers with a shopping cart so that they may respond on impulse while completing the family grocery list. In many ways, demand response is about conditioning electricity customers to respond to a similar call to action: to reduce electricity load, perhaps only for a few minutes, but just enough for the utility to avoid costly generation or spot market supply costs. What the utility industry needs to realize is that the potential for demand response to provide savings is the equivalent of the shopping cart to enable customers to conveniently respond on impulse.*

### Costs Squeezing Most Businesses

Increasing energy needs and rising supply costs are putting great strain on utility companies and consumers across all sectors. The commercial sector is feeling the squeeze between slackening revenues and margins (as customers and suppliers spend more on energy) and rising operating costs. Yet, while businesses are constantly looking for cost-effective ways to conserve energy and reduce costs, the Commercial Buildings Energy Consumption Survey (CBECS), published by the Energy Information Administration (EIA [www.eia.doe.gov](http://www.eia.doe.gov)), suggests that there is enormous opportunity for improvement.

The CBECS shows that only about 30% of the commercial sector electricity demand in the US is under the oversight and control of an energy management system. Energy management systems (EMS), generally speaking, serve to indicate the technical capability – the essential “shopping cart” – of businesses to better understand energy consumption, reduce waste, shift demand, and align energy costs with operational necessity. Without such a capability, a business wouldn’t know a deal “on aisle six” if it saw one and it wouldn’t be able to take advantage of it either way.

The CBECS further reveals that EMS technologies exist in only 50% of large buildings (over 100,000 square feet) while no EMS capability is present in 83% of buildings under 100,000 square feet (representing about 55% of US electricity consumption). So, by and large, the commercial sector energy consumption is out of control. EMS deployments to date have been primarily driven by new construction and renovation, as the expense to install such technology limits the

extent and breadth of deployments in existing buildings. Without broader commercial deployment of energy management systems, including in small and existing buildings, enormous amount of energy and money are constantly being wasted while misalignments in electric demand and supply drive costs ever higher. Increasing energy prices will surely motivate a greater investment in EMS, but can we continue to wait for new construction or renovation?



**The potential of Demand Response is the equivalent of the shopping cart to enable consumers to conveniently respond to impulse.**

### The Future Can be Now

The vision of Automated Meter Infrastructure (AMI) is to leverage communication technologies to gain broad-based real-time monitoring and control of energy and engage consumers in active demand response programs. Within this infrastructure, wireless mesh sensor networks offer a means to achieve broad deployment of real-time energy monitoring and control in residential, commercial, and industrial environments. Businesses need an affordable solution that can be easily installed in operating facilities with minimal disruption of business operation. Wireless technology is the perfect solution. However, it is what lies beyond the installation that is fundamentally important – this should drive the technology choice for commercial wireless sensor network solutions. The success of AMI in delivering expected energy reductions and aligning supply and demand depends on having an infrastructure that serves business in the long run – the equivalent of the “shopping cart” in the commercial customer market.

These needs are being met today in numerous establishments to improve energy consumption. For example, an international retail chain chose to deploy a wireless energy management system in more than 300 stores in multiple countries. Its goal was to determine and eliminate energy waste in order to better respond to peak energy demand. It looked to reduce CO<sub>2</sub> emissions by 25% in the next five years. Another major retail chain, one operating hundreds of supermarkets, was motivated to quickly deploy a similar system.

In comparison to residential (Home Area Network) requirements, businesses seek:

Greater Scalability	Hundreds of wireless sensors (10+ hops) with sub-second dynamic network reformation.
Higher Performance	Low-latency and bi-directional response to monitor and control robustness.
Better Reliability	Proven industrial-class self-forming and self-healing network.
More Robustness	Communication integrity and network monitoring to ensure no data loss.

Prior to having an energy management system, such companies relied solely on monthly consumption data to analyze energy consumption, severely limiting their ability for in-depth analysis. These companies installed a system based on Millennial Net’s Energy Management Solutions ([www.millennialnet.com/energy](http://www.millennialnet.com/energy)) to closely monitor, analyze, and control energy use within each site.

### The Problem is at its Peak

The most common problem businesses face today in conserving energy and reducing peak demand is a lack of simple and unified ways to continuously monitor energy usage. It is critical to be able to measure and analyze energy at the points at which it is being generated (local wind or solar), supplied (grid), and consumed. Without such visibility, it is impossible to obtain tangible results in optimizing local consumption and managing electric demand in response to energy supply conditions during critical time frames. To satisfy such conditions, the energy management solution must be flexible enough to monitor a wide array of sensors while unifying different types of data to one location without large overhead or invasive installations. Energy consumption profile data must be reliable and continuously captured throughout each day to support real-time decisions. Additional sensor data (e.g. temperatures) enhance the meaning of the consumption profile. A robust sensor network ensures the data integrity required for the enterprise-wide data historian, enabling analytical comparisons of different locations and equipment to each other over time.

Millennial Net Energy Management Solutions provide businesses with advances monitoring and control capabilities via a wireless network. Millennial Net works with partners such as Geneva-based LEM to develop and market numerous sensing devices based on Millennial Net’s MeshScope wireless mesh sensor networking system. LEM is a market leader in providing innovative and high-quality solutions for measuring electrical parameters ([www.lem.com](http://www.lem.com)). It offers an advanced electrical sub-meter for breaker-level monitoring, called Wi-LEM, which works with other MeshScope devices. The host of MeshScope devices includes thermostats as well as temperature, pulse

metering, electrical sub-metering, and other types of sensors and output devices.

These utility devices monitor and control energy use, benefitting both utility companies and commercial customers by:

- Providing each customer with tools to better respond to peak demand
- Implementing and enforcing an energy management policy internally to optimize consumption and reduce waste

All MeshScape sensors are equipped with wireless radio frequency modules for data exchange, eliminating the wires and cables used in conventional systems. Devices automatically form a wireless mesh network and constantly communicate data between each other and with a host server application via a gateway. MeshScape's Persistent Dynamic Routing mechanism ensures reliable data transmission by determining the best delivery route for every data packet; using devices on the network as data repeaters, data packets are sent through multiple hops to form a mesh network. Persistent Dynamic Routing uniquely ensures reliable bi-directional data communication, allows low-power consumption, and provides scalability that cannot be matched by other wireless systems.

The ability to continuously monitor sensors and control the environment opens new opportunities in energy management for the commercial sector. Devices are not only able to send data to the hosted software application, but they can also communicate with other devices on the network and adjust their own operations to optimize energy consumption.

### **Business Changes to Improve Operations**

The retail chain operating hundreds of stores looked to save millions of dollars every year by retrofitting stores with a wireless energy management system. It deployed systems consisting of fifty to eighty devices in a matter of a few days each. The initial focus of the installations was energy metering. Each installation included Millennial Net's Wi-Pulse and dozens of Wi-Lem devices to measure key electric circuits. The Wi-Pulse was installed in each store to capture and transmit pulse outputs at certain intervals (e.g. 15

minutes). The Wi-LEM electric sub-meters were installed inside circuit breaker boxes and wherever else was necessary to measure the consumption of major circuits (e.g. lighting, HVAC, and refrigeration).

The retailer chose to install Wi-LEM devices because they are particularly well-suited for retrofit installations and are easy to deploy. The Wi-LEM is a complete sub-meter device that greatly simplifies installations compared to solutions that require multiple components. It is equipped with split core current transformers that snap over existing wires without disrupting service. The Wi-LEM is compactly designed to operate in an electrical box and communicate wirelessly to the network. This provides substantial time and installation savings while eliminating many of the complications and sources of error typically found in wired installations. Each Wi-LEM has a unique identification, facilitating commissioning, and can readily communicate a rich set of information, simplifying the mostly automated software configuration. Within minutes after installing the devices, the sub-meter can be found online measuring and transmitting electric consumption data and associated characteristics. Other devices in the energy management solution are designed for ease of retrofit similar to that of the Wi-LEM. The Wi-Pulse, for example, simply plugs into the pulse out-port of most utility meters.

Individual stores see the immediate benefits of receiving current and historical energy consumption information in detail, aggregate, and comparison:

- Status of each separate zone for any time
- Historical trending looks back on particular periods (e.g. minutes, hours, days, several days, weeks, or months)
- Comparisons of consumption profiles reveal differences in operation loads and anomalies

A store manager can see all energy-consuming zones to easily identify consumption patterns that are not in line with the energy policy or typical pattern. One can see if certain equipment is being turned on or run for long periods of time, even when it is not needed. In one instance, for example, the consumption profile presented information that prompted administrators to make a simple change in operations that resulted in

\$20,000 of annual savings. As monitoring comes online and is trended over time, users frequently realize that they waste an exorbitant amount of energy on cooling and heating unoccupied space from leaving lights on after hours and operating non-essential equipment. Monitoring helps companies better comply with their energy policies and identify areas for improvement. Stores can identify excess energy consumption during off days and holidays. Cases have shown that even locations with energy policies struggle to enforce them because non-essential equipment is not always turned off when scheduled. Equipment left on for extended periods of time while stores are closed waste significant amounts of energy. Historical analysis can immediately show noncompliant zones and allows companies to adjust operations and create performance metrics to save thousands of dollars in multiple stores.

Continuous energy monitoring allows companies to measure the real benefits of capital and operations improvements. When the effects of changes are recorded, real energy consumption savings are visible and more easily quantifiable. For example, a store can see the direct result of raising a temperature set point by a few degrees during the cooling season. Such measured results encourage conservation and help to better direct future investments.

Retailers are no longer operating blindly in their efforts to adjust energy consumption to reduce peak demand. Actual information about how much energy each piece of equipment consumes over time equips stores with the data necessary to actively and intelligently manage their energy demand during peak hours. For example, supermarket stores are able to identify the equipment that consumes the most energy during peak times and adjust their operations accordingly. The stores can also track the energy consumed by non-essential equipment to ensure that the energy consumption of these devices is not defeating their energy consumption efforts.

### **Green is Good for the Bottom Line**

The bottom line in the commercial sector is the “Bottom Line.” Businesses must focus their efforts on doing whatever it takes to get their customers to make

the deal “on aisle six,” for this transaction is primarily what drives commercial energy consumption. They need to consume energy in order to do business, yet most business hours are during peak demand periods. There is growing recognition that general wastefulness and operating a non-essential load during peak periods is bad for business, bad for utility operations and quality of service, bad for the general economy, and bad for the environment. Commercial businesses see value in taking action to improve sustainability for both the planet and their businesses; therefore, energy savings are good for business. However, to realize this goal, businesses depend on technology that can be easily deployed and rapidly absorbed into their business. An affordable and non-invasive wireless sensor network is an attractive solution, but it must be able to perform to the commercial sector’s demand response needs for monitoring and control while at the same time being scalable, robust, and reliable to satisfy the commercial customer.

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