The ‘Internet of Things’ or IoT is a term that has rapidly taken center stage in business and consumer technology circles, with tremendous amounts of hype in both. It refers to networks of connected devices that promise to transform all aspects of our business and personal lives. Enabled by the explosion of inexpensive sensors embedded in a variety of devices, pervasive wireless networking and low-cost computational power, the IoT is here, with growing ramifications for decision-makers.

Don’t be distracted if some of the hypothetical consumer examples of the IoT seem far-fetched and far from mission-critical. The trend has serious implications for businesses, which need to understand how to leverage this wave of innovation for maximum strategic benefit. Some of the questions organizations are currently wrestling with include:

- What are the opportunities?
- What are the infrastructure requirements?
- How are businesses justifying these investments?
- What are the results?

Due to the growing awareness of the role the IoT will play on near-to-mid-term competitiveness, the IoT for businesses (aka the Internet of Business Things) is, for good reason, the subject of heightened industry conversation. This whitepaper takes a look at some of the opportunities afforded by the Internet of Business Things (IoBT) and how large numbers of early adopters are leveraging energy efficiency investments within the built environment (warehouses, retail establishments, office buildings) to implement IoBT strategies.

The IoT is Here. What are the Opportunities?

People talk about the IoT as a Jetsons-style future state, but the Internet of Business Things (IoBT) is already delivering real-world value to a wide range of commercial, retail and industrial businesses. Retailers, for example, are using beacon technologies that communicate with customers’ smartphones to provide location-specific offers and promotions, enhancing the effectiveness of these programs and delivering a new source of data-driven intelligence on consumer behaviors, while fleet operators are using sensor data to track delivery vehicles and improve the overall efficiency of logistical operations.

Yet as interesting as some of these applications are, the larger potential for the IoBT is to deliver wholly new classes of applications, based on increased operational visibility, intelligence and value. Within the built environment, for example, today’s generation of IoBT applications are enabling facilities to:

- Improve space utilization
- Optimize inventory placement
- Shorten workplace transit times for personnel and/or equipment
- Identify operational anomalies
- Optimize equipment utilization, scheduling and maintenance
- Enhance capital investment decision-making
- Identify energy efficiency opportunities
- Improve workplace safety, comfort and convenience

The key to successfully implementing a high-value, high rate of return IoBT strategy is data. Specifically, the ability to gather, analyze and apply data for the purpose of increasing the efficiency of business operations.
IoBT Infrastructure Upgrades: What are the Requirements?

Historically, collecting and managing large volumes of operational data has posed significant challenges for businesses, from both a logistical and financial perspective. This is because, at a minimum, gathering copious amounts of highly granular data requires:

- A large number of sensors and meters to monitor physical systems (e.g., machinery, HVAC components, lighting) and building occupancy patterns;
- A network backbone (wired or wireless) to capture and transmit the sensor-generated data;
- A centralized storage and processing server to analyze the data for patterns, anomalies and inefficiencies;
- Analytics application(s) to transform the data into information that can be used to improve operations.

Not surprisingly, the biggest hurdle most organizations face is finding an economically justifiable means of investing in the sensor network necessary to gather essential data — a hurdle that is further compounded by the need to build out the analytics side of the equation — making it an uphill climb for most organizations.

IoBT in the Built Environment: How Are Businesses Justifying These Investments?

At the same time that businesses are struggling with how to cost-effectively implement IoBT strategies, a rapidly growing source of intelligent, connected, sensor-laden devices within the built environment is delivering massive energy savings to businesses. Namely, intelligent LED lighting. As one of the most densely distributed elements within the built environment, lighting and, in particular, intelligent LED lighting, provides the ideal platform for gathering essential data about what is happening in the workplace and across the enterprise.

So while it is well known that simple LEDs reduce energy consumption and emit far superior light compared to fluorescent and other legacy technologies, fueling a massive migration to LEDs, the real transformation in lighting technology isn't limited to the illumination source. Instead, it is in intelligence-driven IoBT applications where the richest value resides.

This is because intelligent lighting networks provide the most natural vehicle for backhauling information within the built environment — whether the office, retail floor, sporting facility, conference center, factory floor, warehouse or parking structure. These powerful networks reveal detailed patterns of employee concentrations across a facility, shopper traffic, space usage and equipment utilization, among others — taking a central role as a platform for large-scale business and energy intelligence.

As a platform for IoBT, intelligent LED systems offer several distinct advantages over standalone sensor networks, including:

- The ever-present nature of lighting, which reaches into every corner of a facility where people, systems and machinery reside, turning lighting into an intelligence-gathering solution for facility-wide energy and operational efficiency.
- Integrated sensors in every fixture, which generate copious amounts of data for evaluating both lighting and non-lighting-related events, such as energy loads and occupancy patterns.
- Integrated wireless networking in every fixture, which transports critical data from any type of sensor (occupancy, load monitoring, temperature and so on) in the system, without requiring a new hardwired network.
- Integrated control capabilities, as well as reporting and analysis tools, which provide facility managers and enterprise executives with a single, uniform and, importantly, familiar way of evaluating performance metrics, by system, facility or multi-facility rollups.
- Compelling business cases created by the dramatic energy efficiency savings, which typically drive a two-year payback — or better. In effect, energy efficiency savings from intelligent LEDs economically justify deployment of this intelligent network, and make these other value-added applications virtually ‘free’.

Intelligent Lighting Data = Business Intelligence

Today, the range of big data available to facilities includes occupancy events, which show personnel and customer traffic patterns, energy trends and comprehensive energy statistics for any system, circuit or piece of equipment connected to the system, as well as any operational anomalies. With rapid paybacks, intelligent LEDs offer value far beyond simple illumination. For example, leading facilities worldwide are currently using this data to:

- Consolidate merchandise placement in high-traffic spaces based on data about actual movement of customers, personnel and equipment over time.
- Identify opportunities to save energy through load balancing or the scheduling of energy-intensive activities during lower kWh-cost periods.
- Optimize production and maintenance schedules by tracking machinery utilization rates through lighting and occupancy data.
THE INTERNET OF THINGS

• Identify operational anomalies, such as energy spikes or unusual occupancy events over time, enabling corrective measures.
• Identify where inventory should be placed to improve access, reduce transit times and improve workplace safety.
• Decide whether or not to invest in more capital equipment based on usage data.

With actual facility-generated data, there is no guesswork required to fine-tune operations or answer key energy-related questions, as the data can be applied to inform decisions that range from:

• Where is energy usage the highest?
• When does it peak?
• How does energy use change over time?
• Where does staff congregate and for how long?
• What paths through a facility are most frequently used?
• Are there patterns to inventory picking and storage?
• Do we need additional machinery or capital equipment?
• Why is energy use dramatically different for similar facilities?
• How quickly are people and equipment moving through a facility?

The answers to these questions can be used to direct everything from optimal system settings to peak versus non-peak power management, driving operational excellence, savings opportunities and enhancing bottom-line profitability.

Big Data & the Enterprise

One of the most compelling aspects of fully networked lighting and energy management systems that generate significant amounts of data is the ability to gather and compare metrics across multiple facilities. This enterprise-wide view is a valuable business intelligence asset that provides comprehensive visibility into key performance indicators across an entire portfolio. This includes energy usage per square foot, operating hours or degree-days, among other relevant data points.

The keys to an enterprise-wide view are the ability to access, aggregate and normalize the data. Without the ability to gather and consolidate data, operational blindness occurs, resulting in missed opportunities. Furthermore, even when data is available, it is necessary to normalize the data. Normalized data provides a standardized method for analyzing metrics and highlighting how operations can be improved across a range of building types, locations and sizes, while still providing drill-down visibility into facility-specific operational data.

For example, if one warehousing facility is three times bigger than another, normalized data enables managers to look at apples-to-apples comparisons on how energy is being used across the various sites in relation to other key performance indicators (KPIs). In this way, per-square-foot data on energy usage within similar areas of multiple facilities, such as storage spaces, maintenance areas or racked aisles, provides useful metrics for comparative analysis and improvement. Similarly, normalization of climate-related differences or discrete operating hours makes comparative analysis not only possible, but an easily leveraged tool that delivers actionable insights in complex operating environments of all types.

IoBT, Big Data and Your Operations: Unprecedented Opportunities

With surprising swiftness, the Internet of Things and Big Data have arrived, offering unparalleled opportunities for organizations to gain new insights into operational and energy efficiency. In much the same way that ISO, Six Sigma and TQM revolutionized business processes, its disruptive potential is massive, as industry-leading organizations leverage the intelligence gained to slash energy use, wring inefficiencies out of operational activities and secure significant competitive advantages.

It requires, however, that businesses take a strategic approach towards these developments and understand the implications these new intelligent networks will have on business competitiveness in the near future. Accordingly, for facility managers, IT managers, finance managers and all others responsible for operations, technology and strategic investments, it is imperative to analyze all infrastructure investments to understand:
• How they integrate with your other networking, business intelligence, and/or energy management infrastructure;
• What strategic opportunities IoBT-enabled technologies offer your operations — now and in the future;
• The implications of implementing solutions that are not IoBT enabled and what the lost opportunities may be.

With these questions applied to every investment, organizations can extract new value from their infrastructure, while gathering essential data to document progress toward sustainable business practices.

Figure 2: Normalized data allows facility-to-facility comparisons across the enterprise.