# Leveraging IoT Sensors & Analytics To Optimize Energy Efficiency

From Iota Communications

Chances are good you're already familiar with the Internet of Things (IoT), and how its array of sensors and gateways make it possible to "track" in real time just about anything inside your facility. That data forms the foundation of the IoT's value proposition, which is essentially this: *Intelligent data acquisition* that makes your company more profitable. In the case of commercial buildings, that often translates to saving money by becoming more energy efficient.

But if we're talking about *intelligent* data acquisition, then monitoring your facility's "things" is only half the equation. The other half is analyzing the data you collect to make sense of it.

And there are more than one or two data streams to contend with. **Your building's intricate operations depend on multiple parallel processes happening both inside *and* outside your building, all of which must be examined in relation to one another before significant insights can be gleaned.** Just knowing where, when, and how energy is being consumed can allow facility managers to adjust schedules and adopt load shedding schedules to reduce energy demand. Those insights are the ones that lead to actionable intelligence and, ultimately, to savings.

## An ocean of actionable intelligence exists within your building environment. Proper data analysis can uncover its invisible ecosystems, allowing you to optimize energy use.

This whitepaper discusses some of the parameters the IoT monitors and analyzes to uncover energy efficiency solutions, and describes two of the most impactful strategies organizations are implementing today—demand response and demand control ventilation.

# The IoT: How It Optimizes Decision-Making

The energy consumption of a commercial building is continuously changing based on a number of dynamic conditions—there is no static model of energy use. Better energy management, then, relies on having the right data at the right time, which allows building managers to be flexible and agile in their approach to energy reduction.

The IoT is not only capable of monitoring and measuring various aspects of your building, but also of bringing in various other data inputs to extrapolate anomalies, making correlations, and helping end users gain knowledge to make smart operational decisions that will affect the bottom line. Depending on your goals and the specific strategies being used, some of the data inputs that may be used to gain insights include:

- **Total energy consumption of systems and equipment connected to the electrical network.** Some of your systems are always operational; other pieces of equipment and machinery may be connected only occasionally. Either way, it's crucial to understand both the total daily electrical consumption of your building and the role individual devices play in your overall energy use.

- **Occupants' behavior.** Activity levels, behavior patterns, and comfort preferences of occupants may not be a consideration for all energy efficiency measures (or for all types of buildings), but they are a factor for certain types of buildings and saving strategies.

- **Building environmental conditions.** If you can "sense it" you can connect to "it" using IoT sensors. Many types of sensors exist today, making it possible to measure things about your building like CO2 level, air temperature, humidity, luminosity, water temperature and conductivity, and more. This data often plays a critical role in using energy more efficiently.

- **Energy usage patterns.** Knowing when and how your building uses energy—and attempting to reshape those patterns to your advantage—are key components of some cost-reduction strategies (see demand response below).

- **Utility time of use charges.** Shifting your energy use away from high-priced time periods set by utility companies is a common way to generate savings. IoT systems can help identify periods where energy costs are the most expensive.

- **Cyclical or seasonal factors.** Over time, your building's energy consumption may follow predictable change patterns that an IoT analytics platform can take into consideration when generating proposed solutions.

- **Weather data.** Weather conditions can have a direct impact on energy use, specifically as it relates to HVAC systems. Collecting, compiling, and analyzing weather data in connection with other building information gives you a way to be proactive about energy use on especially hot or cold days.

With the right data variables—collected, correlated, and analyzed by the IoT—it's possible to design your building's optimal approach to energy management for guaranteed cost savings.

Two energy efficiency strategies that are being implemented today at commercial buildings are **demand response** and **demand control ventilation**; we take a look at both approaches below.

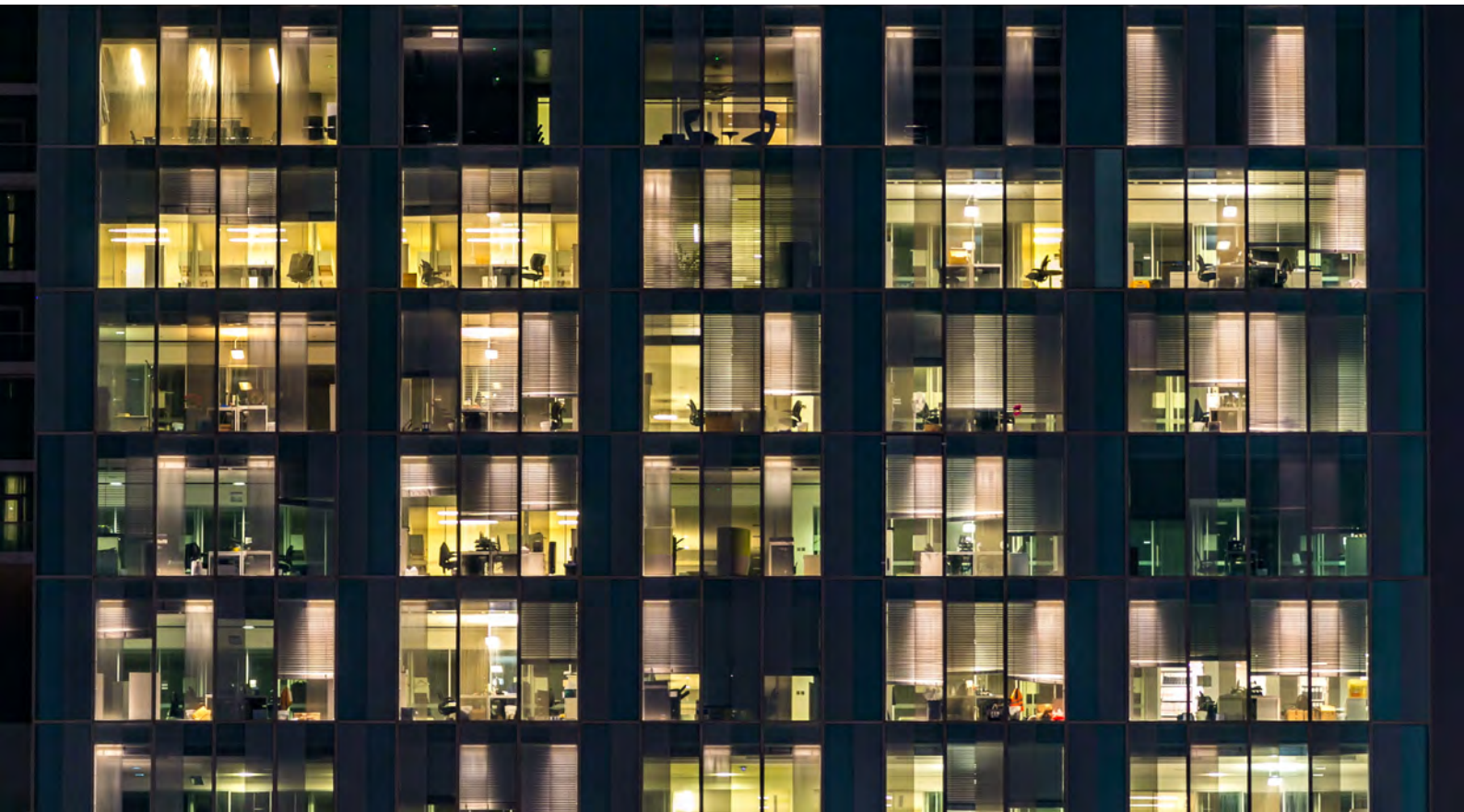
# Demand Response

## What is demand response and how much can it save?

In a nutshell, demand response is a programmatic approach to energy curtailment during a utility's "peak hours"—hours when the cost of energy is traditionally much higher than off-peak hours. Peak charges are a supply and demand strategy that helps utilities balance power production with consumer demand. Some examples of demand response strategies might include:

- **Scheduling the reduction of HVAC supply air and ventilation during peak times.**
- **Dimming lights between the hours of 7–9 a.m. and 5–7 p.m., when occupancy is low.**
- **Scheduling production during off-peak hours.**
- **Eliminating the use of parking garage fans during peak hours.**

**Companies that adopt demand response measures can reduce their energy costs by as much as 20% to 40%.**



# Demand Response & The IoT

Traditionally, demand response programs required considerable effort from facilities staff to be successful. Peak load shedding events were fairly large and infrequent, so opportunities to save were few and far between. And often, staff members had to manually turn off or change settings for various pieces of equipment.

Today, the IoT makes it easier for organizations to identify and take advantage of opportunities for shedding and shifting loads to avoid peak rates. Here's how it works:

- The first step in implementing a strategic demand response is to **understand what your energy consumption looks like within the building environment**. IoT sensors provide detailed tracking of energy, mechanical, and indoor air quality, showing you your "energy footprint." This information serves as a baseline of your typical consumption pattern.

- The data is then measured and cataloged. **Sensors assign it a real-world, physical value so it can be interpreted and used for analysis.** The IoT further provides some degree of context by aligning the data points and actual measurement values in a statistical or analytical model. Cataloging the data provides a framework to better understand the relationship of variables by organizing the data in a quantifiable format.

- Many IoT platforms have **an advanced analytical component that helps you unlock real business value from your data by providing context and perspective**. In the case of demand response, it brings together a number of different data points to identify opportunities for demand response measures, including several of those mentioned above.

- The IoT platform **maps building activities to utility charges and other data to determine areas of impact and energy reduction** that will help you beat the peak charges. This blending of consumption data, environmental data, and external data via an IoT analytics platform makes it easy to identify energy efficiency opportunities, and take action regarding the elements you can control.

## A Demand Response Example

If all your AC compressors turn on at the same time—say, when the air temperature hits 80 degrees—that creates a big power draw and causes a spike in your peak demand. Rather than continue to incur hefty demand charges, you can devise an alternate strategy, one where your building automatically staggers the times AC compressors turn on. Or, you might decide to restrict the use of a particular piece of machinery that consumes a lot of energy to certain hours. Actions like these would be difficult to perform without the historical benchmarks and real-time data provided by an IoT analytics platform.

**Reducing your demand charge by just 3% to 5% can result in significant savings—without having any impact on the comfort level of the building.**

# Demand Control Ventilation

## What is demand control ventilation and how much can it save?

Demand control ventilation modifies the amount of outside air supplied to a building based on actual occupancy levels. Most buildings aren't usually fully occupied, and some spaces are used more frequently than others. As a result, ventilation systems often bring in more outside air than necessary, which has to be conditioned (heated or cooled) before being introduced into the environment. That means your air handling units—motors and fans—are working harder than they have to adjust the outside air temperature.

By implementing a more deliberate strategy of bringing outside air in, it's possible to increase your building's operating efficiency and significantly reduce electricity costs at the same time.

**You could see anywhere from 15% to 20% savings on your energy bill as a result.**

# Demand Control Ventilation & The IoT

Carbon dioxide ($CO_2$) is often used as a surrogate for air quality and building occupancy level. That's because the more occupants there are in a room or building, the more $CO_2$ is released into the air. To prevent $CO_2$ levels from rising too high, which can have a negative impact on occupants, outside air must be deliberately brought into the building through a ventilation system.

An innovative approach to improving energy efficiency while monitoring air quality is to modulate outside air intake according to CO2 levels in the building. That's exactly what the demand control ventilation process does—and it's endorsed by the U.S. Department of Energy's Federal Energy Management Program and the EPA.

Here's how the IoT enables demand control ventilation:

- **IoT sensors continuously monitor CO2 levels within all areas of the building in real time.** The higher the level, the more people in the space.

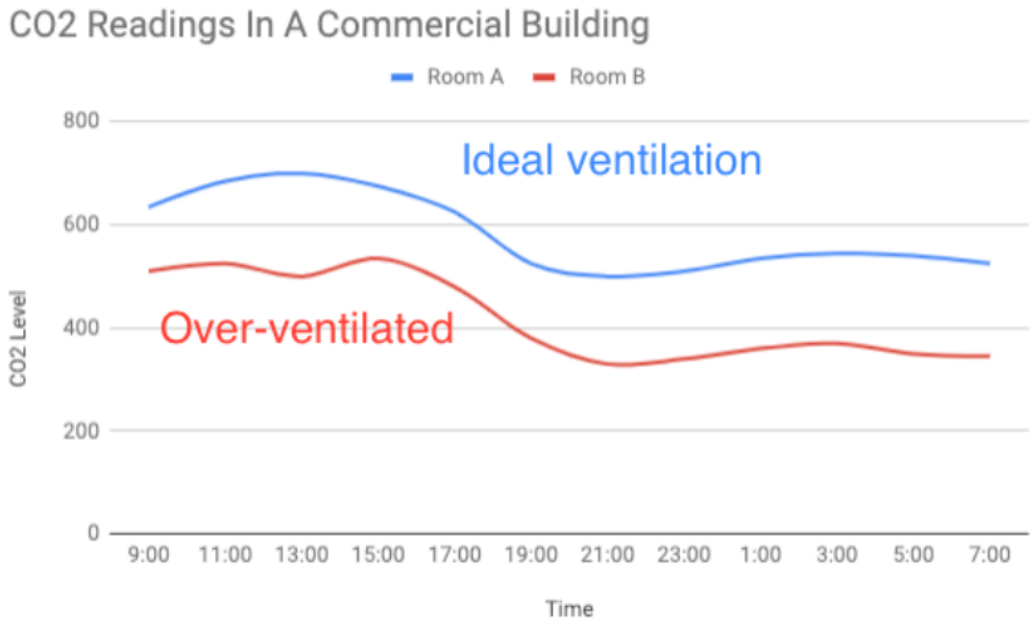
- **The IoT platform measures CO2 data in parts per million** and translates that into cubic feet per minute airflow per person. For commercial buildings, the EPA recommends CO2 levels below 1,100 parts per million. Another guideline provided by ASHRAE calculates that 20 CFM of outdoor air per person corresponds to CO2 levels of over 900 parts per million.

- **The demand control system continuously reads the sensor data and, based on CO2 levels, automatically directs the air handling units to adjust the outside air intake.**

    a. If CO2 levels are adequate, it reduces the outside air intake.

    b. If CO2 levels are approaching the limit, it brings in additional outside air.

The chart below compares two rooms in a commercial building, one with ideal ventilation and the other being over-ventilated. The outside air being brought into Room B keeps CO2 levels in the 400 range, which means the ventilation system is being overworked all day long. Room A's ventilation system keeps CO2 levels well under 900 PPM, so that high-quality air is maintained *without* overworking the system.




**Research has shown that demand control ventilation has the potential to reduce aggregate HVAC energy consumption by 24%, translating to approximately $39,000 in annual savings for a 100,000-square-foot office facility.**

# Take the first step toward becoming more energy efficient.

Getting started with the IoT doesn't have to be hard, as long as you have the right partner.

At Iota, we make intelligent data collection and analysis easy—and we also help you make the smart decisions that lead to savings.

- Our line of IoT sensors enables us to remotely monitor your energy and environmental conditions, and provide visual insight into your operations and conditions.
- Our demand response program blends traditional consumption and mechanical information with environmental data to identify opportunities to achieve significant savings.
- Our demand control ventilation solution responds to actual occupancy and weather conditions to help you improve energy usage and maintain a healthier building environment.

To learn more about our offerings—and see how much you could save by implementing IoT solutions—get in touch with us today.

**Talk To Us**