rzero

The Building Intelligence Index

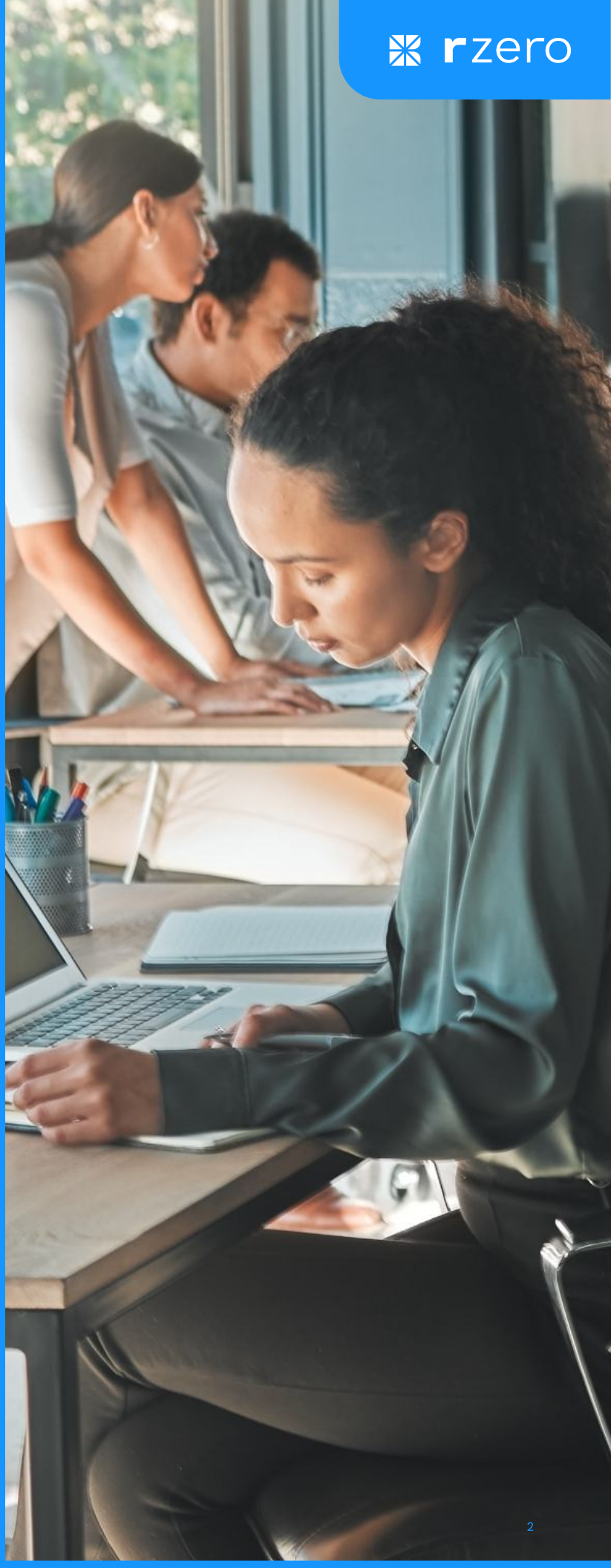
Executive Summary

As the case for net-zero spreads worldwide, commercial real estate is under pressure to meet new climate guidelines for emissions reduction. This includes laws like the SEC's Climate Disclosure Rule, New York's Local Law 97, and California Senate Bills 261 and 253.

Unfortunately, many of our buildings are not on track to meet these standards. Historically, reducing carbon emissions within the built environment has been perceived as costly and laborious, without tangible proof of returns. As a result, many property owners and operators are wary that the pursuit of sustainability, while important, does not always tie back to measurable business outcomes.

The good news is that technology innovation has reset this paradigm. Businesses can now use responsive management systems and performance analytics to drive reductions in energy consumption, without making trade-offs on user experience and health or cost efficiency. Using data, organizations can reap more than reduced emissions and energy savings, they can also unlock a return on investment and competitive advantage in the market.

The Building Intelligence Index explores factors that impact how well building operations optimize for people, energy, and sustainability, and educates on how to measure and adapt the performance of your space across four key pillars: occupancy, indoor air quality, energy use, and indoor health.



Section 1:

The 4 Pillars of Building Intelligence

You should monitor and measure four pillars of building intelligence to truly understand if an indoor space effectively meets the needs of those who use, manage, and invest in it. These pillars are occupancy, indoor air quality, energy use, and indoor health.

In this section, we'll share more about each and how they determine if your space is being maximized for its intended purpose and where there are opportunities for improvement.

Occupancy

Indoor Air Quality

Energy Use

Indoor Health

Occupancy

Understanding occupancy analytics throughout your space gets you the highest level of effectiveness and performance from each square foot. With an accurate capture of where people are, where they're not, and how often different spaces are at peak occupancy or sit vacant, you can improve space planning and management to cut down costs by reducing underused space, delaying expensive expansion, and ultimately, optimizing energy usage over time.

What are the benefits of understanding usage patterns across different building spaces and layouts?

Take, for example, an office space with many desks that haven't been used since the company switched to a hybrid work model. From Monday through Friday, employees are flowing in and out of the office at different times and for different reasons — to join a team brainstorm, take an important call with management, or meet in-person with a client. In these circumstances, a room full of desks might not suit the ways in which employees need to use these spaces any longer.

Also consider energy use. Should HVAC and lighting use the same amount of energy for 100 people on Friday as would be used for 500 people on Tuesday? Or if conference and meeting rooms are sitting empty?

With access to real-time occupancy analytics—like peaks, lows, passive presence, and vacancies—you can analyze usage trends to understand the alternating workflows of your building from one day to the next.

With these insights in hand, you can make smarter and more effective decisions around how to reorient your spaces for the highest performance while also adapting and automating HVAC cycles, lighting, and cleaning schedules to intelligently match the ebbs and flows of people throughout your spaces.

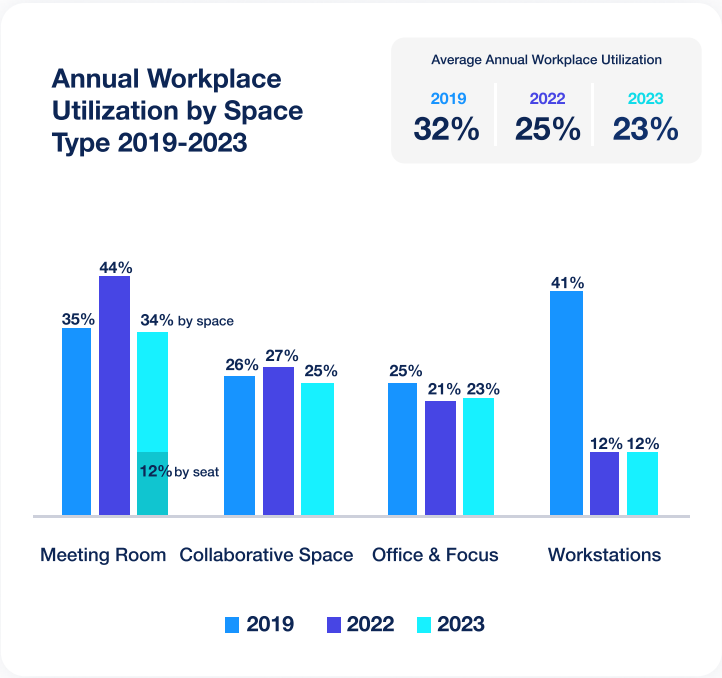
Different levels of occupancy sensing: Which one's for you?

Are you interested in measuring presence at the desk level, counting the number of people in a room, or knowing how many people are entering a floor or building overall?

One type of sensor does not always fit all use cases — do you need a sensor to count people in a space or one that simply detects presence at a fixed location? As you plan your approach, consider the number of spaces you have to measure and the outcomes you are striving for. Sensor technologies vary across the level of data richness they can provide.

Passive infrared	Simple detection of presence: Is someone here or not?
Thermal imaging with AI	Counts the number of people in a space by detecting and interpreting heat signatures of bodies. AI interprets the data and reduces inaccuracies from other sources of heat, like a sunny window or a laptop.
RGB imaging with AI	If you need to go beyond people counting. Track objects that people leave behind, making rooms look occupied even when they're empty, RGB imaging with AI can identify laptops, backpacks, or other inanimate objects, which can help you detect when somebody has left an item in a conference room or on a desk, but are not there, so you can free that space up for others.

Workplace Utilization Trends[1]



Average Utilization is Holding Steady

A pre- and post-pandemic snapshot across annual workplace utilization paints a picture of what space types are creating the most value for employees in the office.

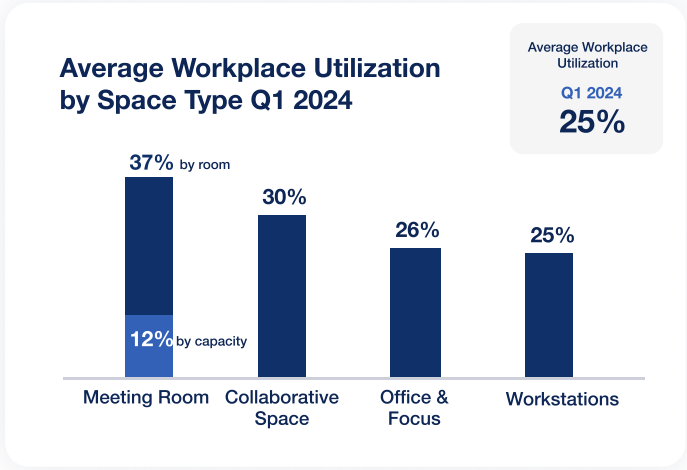
Workers remain consistent in their use of two types of spaces — collaborative spaces and enclosed or private focus spaces. Usage of conference and meeting rooms, which surged in 2022, is down to its pre-pandemic level of one-third of all space utilization.

This quarter, we also tracked the difference between seat utilization, or capacity, and room utilization. Note the gap between 34% room utilization and only 12% seat utilization in 2023.

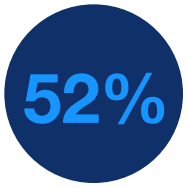
Another notable data gap is the drop in workstation use, which began to rise again at the start of the year. This is likely due to the shifting ratio to more personal and collaborative spaces.

Q1 Utilization Averages Trend Upward

Average utilization in Q1 shows a small increase across nearly all space types compared to Q4 2023, with the most significant gain in workstation activity, while office and focus space saw a dip in utilization. These changes are likely attributed to new, more productive layouts and more in-person collaboration, whereas in 2023, the common complaint was that people came to the office only to collaborate over video, in an office, or in a phone room. This data suggests a highly positive and anticipated transition.



Average Seat Vacancy Rate Q1 2024



Seat Vacancies Indicate Daily Show-Up Rate

A 52% average vacancy rate implies that despite utilization increasing, only 48% of the seats provided to support work in-office are used on a daily basis. Considering that workers who genuinely spend time in the office (not those who coffee-badge) are likely to use 2+ seats daily, we can start to see a trend in daily show-up rates of half (or 26%) which is in line with the average 25% utilization figure.

1 These insights represent an analysis of workplace utilization data collected across R-Zero's global portfolio of building intelligence sensors from January 2023-March 2024. The data was aggregated across whole buildings or campuses and coverage may vary based on location.

Indoor Air Quality

Indoor air quality is another way to measure the effectiveness of our spaces. After all, clean air helps us live and function most effectively.

Understanding and improving indoor air quality by tracking if there is adequate ventilation is important because it not only helps keep the people in your spaces comfortable, productive, and healthy; it also helps reduce unnecessary energy costs from racking up.

Unfortunately, many of the commercial spaces and buildings that we occupy have not evolved as quickly as our needs on this front.

The biggest issue with existing building ventilation standards is that they focus more on physical comfort rather than keeping indoor air clean and well-circulated, two key components in preventing carbon dioxide build-up, exposure to high formaldehyde levels, or the spread of airborne illnesses like Coronavirus, Influenza, and Norovirus.

Following the impact that poor indoor air quality had throughout the pandemic, the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) introduced updated ASHRAE standards in 2023, based on occupancy and room purpose, to guide building managers in designing ventilation systems that better prioritize clean and contaminate-free air. However, very few commercial buildings recognize the new standard as it has not yet been adopted into building codes. Safe to say that there's still a lot of work to do to create healthy indoors.

Standard Ways to Measure IAQ

IAQ Standard Measurement	Benefit
Temperature	Comfort
Humidity	Comfort & Mold Prevention
Carbon Dioxide	Higher Performance & Productivity
Particulate Matter (PM2.5)	Safety & Health
Total Volatile Organic Compounds (TVOC)	Safety & Health
Formaldehyde (CH20)	Safety & Health

These measurements are typically referenced in indoor air quality and high-performance building standards like LEED.

In addition to the standard air quality measurements, there are a few other environmental markers that contribute to creating a more productive and comfortable indoor environment, such as light intensity and noise levels.

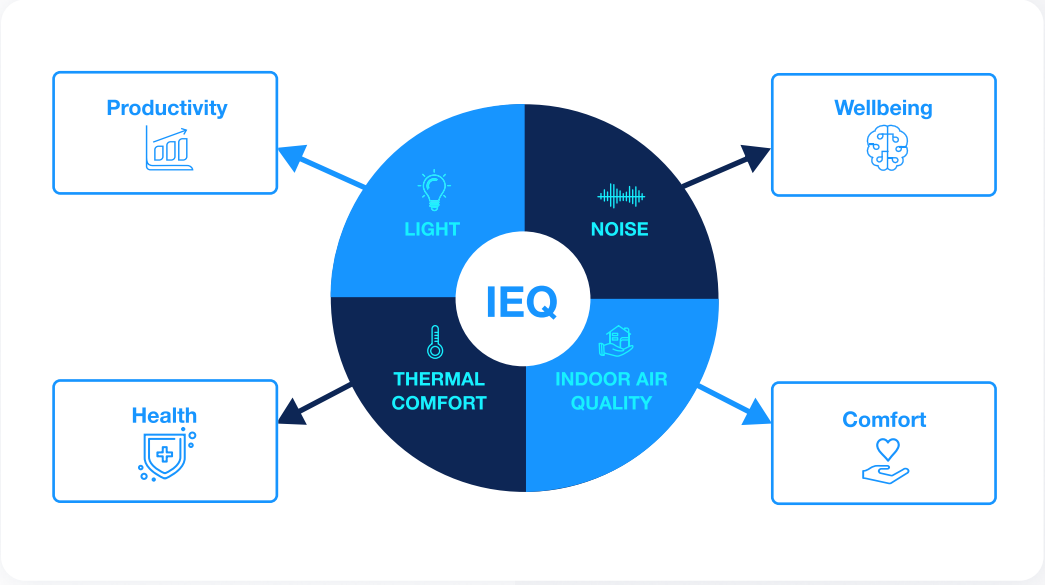
Just like temperature, humidity, and carbon dioxide levels, noise, and light can play a crucial role in determining the comfort and popularity of a space.

For example, understanding noise levels can help identify if a space is too distracting or not meeting its desired objective, like when architectural features that were meant to create ambience actually end up creating a nuisance.

Similarly, measuring light intensity allows individuals to search for spaces that align with their preferences, whether that's a brightly lit or dimly lit room.

Measuring noise and light can also be useful in understanding whether a space is doing what it's expected to do. Further, these measurements can be integrated into room booking systems to enable employees to find spaces that suit their needs and add value to their overall work experience.

Indoor Environmental Quality

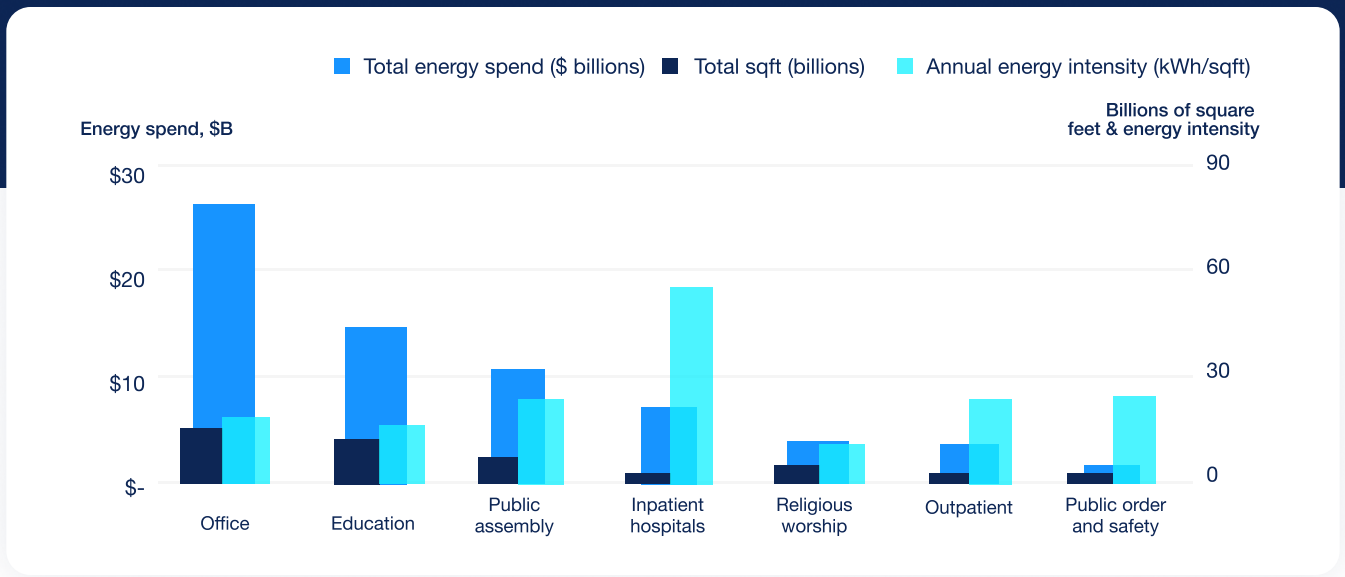


Energy Use

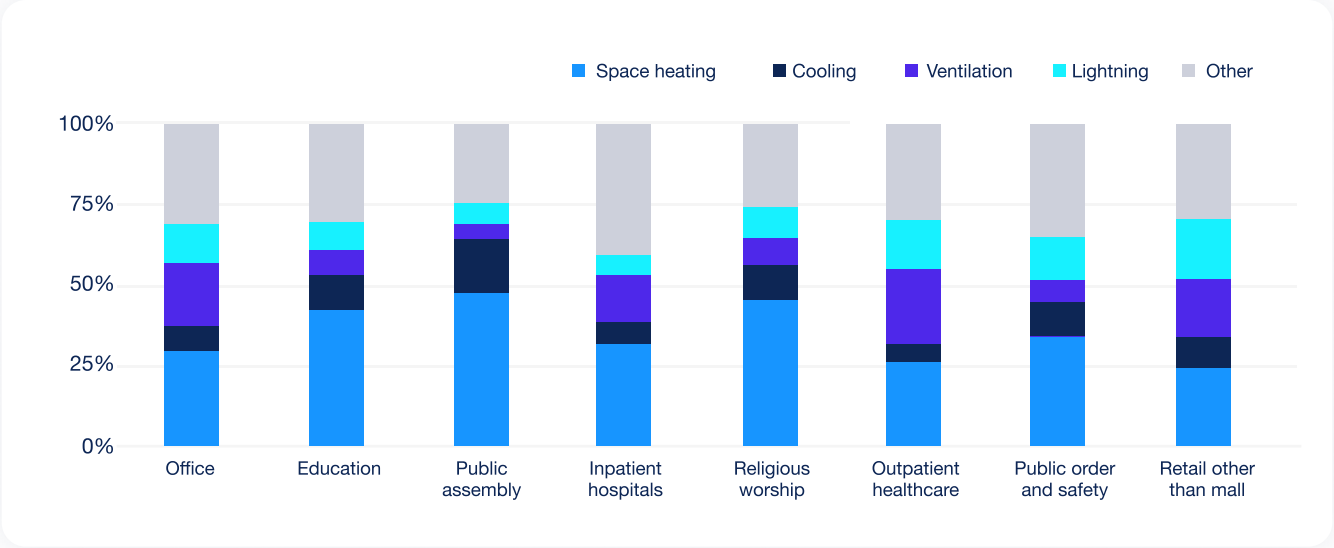
Understanding energy usage and spend across your building, especially as it relates to heating, cooling, ventilation, and lighting, is one of the most important measures for identifying the performance of your building. Why? Because it's the costliest.

Nationwide, office buildings tend to spend the most at more than $27 billion in energy consumption every year; education, public assembly, and hospital buildings aren't too far behind either.

Energy Spend in Select Commercial Buildings



Commercial buildings consume a lot of energy. Interestingly, in hospitals energy spend is three times higher than in offices when comparing spend by square footage. Outpatient and public safety buildings also tend to rank high on energy intensity by comparison.



In most commercial spaces, HVAC and lighting consume 60-75% of energy spend.

Indoor Health: Modeling Risk

In any indoor space, there are various levels of risk. In fact, studies estimate

70-90%

of airborne illnesses are spread indoors.

Spaces that are densely packed and occupied for longer periods tend to have a higher risk. More social interactions or physical exertion that increase breathing also increase the potential for the spread of germs. On the other hand, more sparsely populated spaces with shorter dwell times, and quieter environments where individuals tend to be still, such as private offices, are lower at risk. But the method for measuring risk in both space types is based on very general guidelines and requires refinement.

To accurately assess the risk of any space, factors such as room dimensions, the HVAC system in place, safety protocols, and observed behaviors within a specific space need to be considered. Real-time monitoring of occupancy and indoor air quality, as well as cleaning practices, contribute to active risk management.

Furthermore, by using sensors that measure temperature, humidity, and indoor air quality, maximum comfort can be guaranteed for the people within a space. Replacing infrequent traditional chemical cleaning with cleaner methods during periods of high occupancy can contribute to the improvement of indoor health.

By considering these factors over time, understanding the unique risks associated with a particular space, and implementing the appropriate measures, risk can be effectively managed, promoting a healthier environment for everyone.

Section 2:

Adapt Your Buildings for Energy Savings

Now that you've been introduced to the four pillars of building intelligence, you can start using these measurements as a method to save on energy consumption and costs while also creating a more optimized environment for your building user.

You might ask how this is possible, given the tremendous price tag that comes with retrofitting buildings with energy-efficient upgrades. Add to that the rising cost of energy and the growing demand for better indoor air quality and you've got yourself a list of expenditures that would overwhelm any reasonable building owner or facility manager.

But there's another solution. One that's more cost-effective, accessible, and easier to implement. A strategy that uses integrated building analytics to identify and create energy-saving opportunities tailored to the specific needs and utilization patterns of your spaces.

For example, here are a few tried-and-tested strategies some of our customers deploy based on building intelligence data they collect regularly:

- Adapting HVAC controls and dimming lighting during off hours and in unoccupied areas
- Increasing HVAC recirculation when IAQ standards are met
- Using more energy-efficient cleaning methods like UV-C when indoor risk levels are elevated
- Reducing lighting where daylight is sufficient

> "The secret to success for building owners or operators that want to implement energy-efficient practices in their buildings now, is not expensive retrofits. It's investing in software solutions that provide an actionable and holistic understanding of how a building system performs in real-time, and over time, across various quantitative and qualitative measures. With access to this layer of data visibility, building owners and operators can inform more intelligent decision making across space planning, portfolio management, systems and equipment performance, operational workflows, and building maintenance; which in turn can drive significant energy savings."
>
> **– Jennifer Nuckels, Chairperson & CEO, R-Zero**

Spotlight on: Occupant-Count Demand Control Ventilation

One innovation on the rise is the use of occupancy analytics to monitor, measure, and exact control over building HVAC systems. While not a novel concept, accomplishing occupant-count demand control ventilation (DCV) at scale is not without its challenges. Getting it right requires measuring occupancy precisely, via a holistic view of building intelligence data, not standalone measures like CO2 level. The reason for this is that CO2 concentration is a delayed indicator of increased occupancy and can be easily impacted by sensor placement and efficacy.

When occupancy can be measured precisely, organizations can proactively adapt their HVAC controls for optimized energy performance and occupant comfort.

This is a huge win, as historically, achieving a balance between occupant well-being and experience typically resulted in increased energy use and cost; presenting a significant trade-off for building owners and operators aiming for efficiency and sustainability.

Occupant-count DCV allows you to identify opportunities for optimizing ventilation across crowded and underutilized spaces, while maintaining indoor air quality and environmental comfort at optimal levels.

By implementing occupant-count DCV, organizations can create a healthy and comfortable building environment while avoiding unnecessary energy waste. This not only contributes to cost savings, but also aligns with sustainable building outcomes and user well-being.

Closing Thoughts

And that's a wrap. Now that you've read through **The Building Intelligence Index**, you should have a better understanding of why it's valuable to track building intelligence data in any commercial space, as well as how monitoring and measuring metrics like occupancy, indoor air quality, energy use, and indoor health will inform on how to transform our buildings into spaces that are more intentional, comfortable, productive, operationally effective, and energy-efficient for the people they serve.

By embracing the principles of building intelligence, we can unlock the full potential of our built environment and pave the way for a more prosperous and sustainable future.

Start Planning for Energy-Efficient Outcomes with R-Zero

At R-Zero our goal is to create healthier and more responsive buildings by using intelligent solutions that optimize spaces for the benefit of people, energy, and sustainability. For a complete assessment of how our solutions can help you drive reductions in energy costs and GHG emissions, contact us at gtm@rzerosystems.com.