RESETTING EXPECTATIONS: MAKING SUSTAINABLE ATTAINABLE

An Ultimate Guide to Scaling Sustainability Impacts Across Your Building Portfolio

Honeywell

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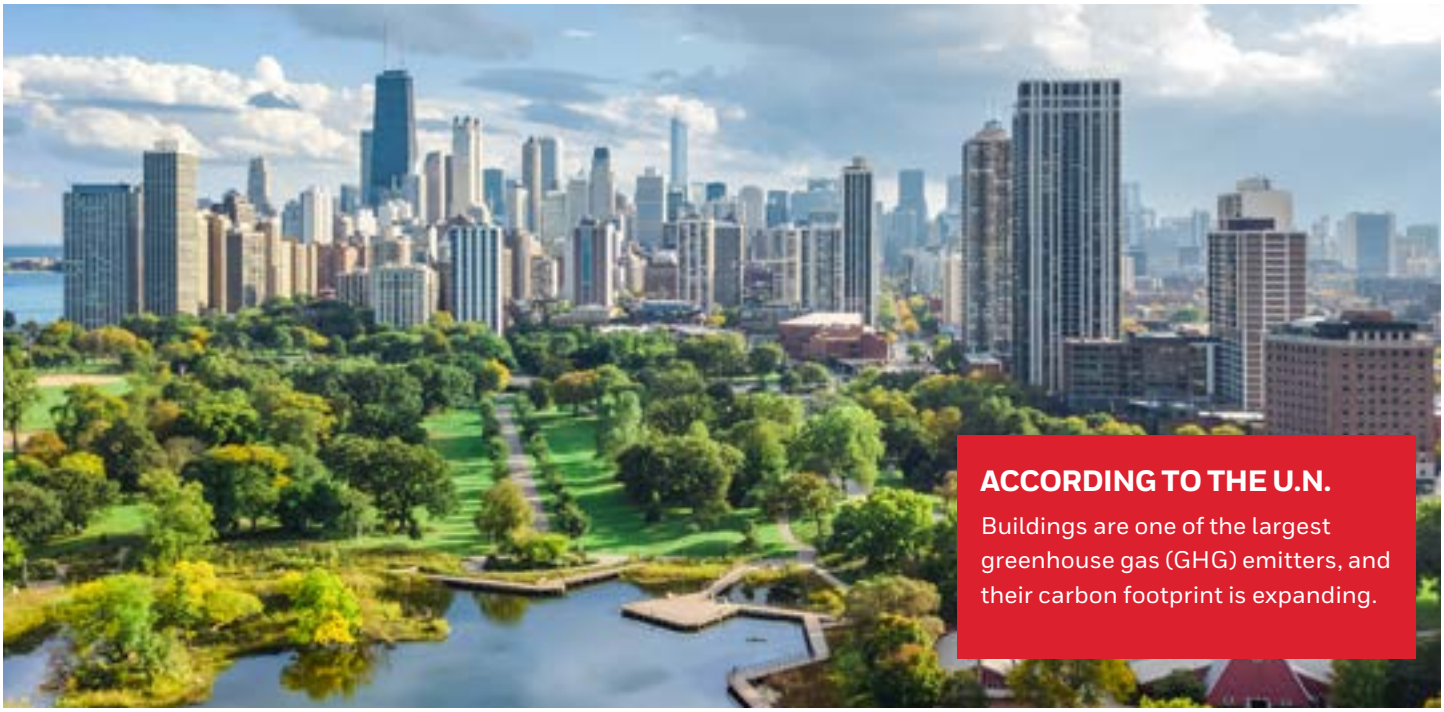
INTRODUCTION

Making buildings more sustainable and resilient has never been more important. Reducing the building sector's carbon footprint is a prerequisite for combating climate change. Additionally, as extreme weather and natural disasters continue to intensify, protecting business continuity against power outages and disruption is essential.



ACCORDING TO THE U.N.

Buildings are one of the largest greenhouse gas (GHG) emitters, and their carbon footprint is expanding.

This e-guide examines how an edge-to-cloud approach can make sustainable more attainable across your enterprise. It also explains how the performance of your assets benefits from a predictive maintenance strategy that compliments your sustainability strategy.

WHAT'S DRIVING THE TRANSITION TO SUSTAINABLE AND RESILIENT BUILDINGS?

RISING GREENHOUSE GAS EMISSIONS

Environment Programme, buildings worldwide are responsible for more than **34%** of global energy demand and around **37%** of CO2 emissions. The 2022 Global Status Report for Buildings and Construction found that:

- **Investment in energy efficiency** increased by 16% in 2021 but was offset by an unprecedented expansion in floor space
- **CO_2 emissions** rose by **2%** from pre-pandemic levels
- **Operational energy demand** for heating, cooling, lighting, and equipment grew by **3%** from **2019**

Reducing the carbon impact of the building sector is critical to achieving the climate goals set by the Paris Agreement.

SUSTAINABILITY POLICY AND LEGISLATION

Governments and public and private organizations are taking it upon themselves to help reduce the built environment's carbon footprint and support sustainability efforts. Policy and legislation are among the primary drivers behind growing investment in energy performance-enhancing measures in buildings.

Notable examples include:

- The U.S. Army's commitment to halving GHG emissions from all its installations by 2030 and reaching net zero by 2050
- The E.U.'s Carbon Border Adjustment Mechanism, a pricing system aimed at carbon-intensive goods entering the European Union, and the Emissions Trading System, the world's first and largest "carbon market"
- Canada's carbon pollution pricing system
- Boston's Green New Deal, which focuses on investing in clean energy industries and achieving carbon neutrality city-wide by 2050
- California's goal to run entirely on renewable energy by 2045. The state's building energy efficiency standards have been updated to incentivize clean energy in commercial buildings
- The U.S. Government's Federal Building Performance Standard, which requires federal agencies to cut energy use and electrify equipment

Multiple public and private organizations have also set internal sustainability goals, which include improving energy efficiency, reducing carbon emissions, and committing to Science Based Targets. In some regions making this information publicly available is a legal requirement. For example, the E.U.'s Corporate Sustainability Reporting Directive mandates large companies and listed small-to-medium enterprises that operate in the E.U. disclose their social and environmental performance.

ENERGY RESILIENCY

Energy resilience is another top priority for governments and organizations. The U.S. Department of Energy defines energy resilience as "the ability to operate building energy services, such as heating, cooling, ventilation, critical plug loads, and shelter, during and in response to a major disruption." Resilience is essential at a time of climate change and extreme weather, particularly for critical infrastructure like healthcare or military installations. In some communities, municipal buildings and schools operate as public emergency shelters, furthering the need for those buildings to improve their resiliency.

The focus on energy resilience is enabling a transition from highly centralized power grids to more decentralized and distributed energy infrastructure known as microgrids. Microgrids are a localized power grid that can operate independently of the traditional grid and typically combine electrical generation sources, battery energy storage systems, and complex controls to ensure operational continuity during outages.

Grid-interactive efficient buildings (GEBs) are another alternative to traditional power grids that can help strengthen resilience. GEBs combine energy efficiency and demand flexibility with smart technologies and communications to enhance energy performance.

RISING ENERGY COSTS

Rising energy prices are another critical factor compelling organizations to invest in energy efficiency and conservation measures. Many regions experienced a spike in energy costs in 2022, with average wholesale electricity prices more than doubling in Europe , and U.S. wholesale natural gas prices increasing by nearly 65%.

ENERGY MANAGEMENT IN BUILDINGS: WHAT ARE THE CHALLENGES? FACTS ABOUT THE ENERGY DEMAND OF BUILDINGS

Buildings are among the largest energy consumers, particularly in the E.U. and the United States, accounting for around 40% of the total demand. Most existing building portfolios are a smattering of old and new, analog and digital, manual and automated, and the size, vintage, geographic region, and principal activity of a building are among the key determinants that influence its energy use. In addition:

- Buildings operated by businesses, federal, state, and local governments in the United States consume more energy than the entire country of Canada
- Commercial buildings in the United States waste, on average, 30% of the energy they use
- Three quarters of buildings in the E.U. are energy inefficient
- In other regions of the world, sustainability has long been a focus, with 90% of the existing building stock in Australia and Singapore having a sustainability rating, while in Tokyo the figure stands at 70%

THE IMPACT OF ELECTRIFICATION

The trend toward electrification is increasing energy demand from buildings. According to McKinsey research, electricity demand could triple by 2050. Electrified HVAC systems like heat pumps are becoming the future for buildings. Depending on the electricity source, heat pumps can be a key enabler for decarbonization. Today's heat pumps are 2.2 to 4.5 times more efficient than gas furnaces. If adopted worldwide, global CO2 emissions could be reduced by 3 gigatons per year. Not only can heat pumps reduce carbon emissions, but they can also reduce equivalent energy consumption.

Electric vehicle charging stations in buildings can also be a significant factor. The IEA estimates that nearly 9 in 10 charging stations are "located in places where access is the most convenient, such as at home or office buildings."

A 2021 study published in Advances in Applied Energy found that charging stations could increase a large grocery store's monthly peak power demand by more than 250% and the annual electricity bill by up to 88%. (23) Adopting smart charging technologies like vehicle-to-buildings (V2B) will be critical to reducing a building's total cost of ownership.

PUBLIC BUILDINGS: OLD INFRASTRUCTURE, NEW CHALLENGES

Public buildings come in all shapes and sizes, ranging from military installations to government facilities, schools, universities, and hospitals. Each organization has different energy management needs, but also similar challenges.

Honeywell's experience with customers across the public sector suggests common challenges include issues like:

- Managing aging infrastructure
- Reducing high operating costs and overcoming budget constraints
- Justifying the use of taxpayer money
- Improving operational efficiency and ROI
- Making progress toward sustainability goals

ENERGY CHALLENGES IN THE PRIVATE SECTOR

Private commercial and industrial buildings make up a large proportion of the built environment. Everything from warehouses and offices to retail stores and manufacturing plants falls within this category. Energy needs can vary significantly from one building to another depending on industry type, location, environmental factors, and more.

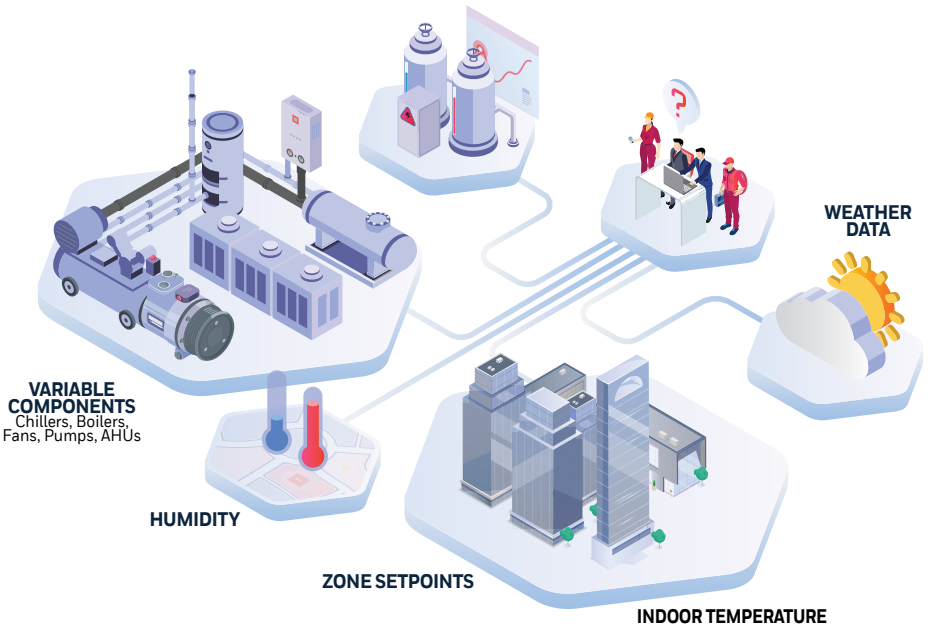
Yet many private organizations share similar challenges, including:

- Meeting carbon reduction objectives as part of broader environmental, social, and corporate governance (ESG) goals
- Maximizing profitability and return on investment (ROI)
- Minimizing capital expenditures (CapEx)
- Scaling improvements across diversified building portfolios
- Sustaining the performance of buildings and energy intensive assets over time

THREE STEPS TO MORE SUSTAINABLE AND RESILIENT BUILDINGS

Different Buildings, Different Needs Vs Enterprise Scale

The Complexity of Energy Optimization in Commercial Real Estate



Buildings—even those owned or leased by one organization—can be vastly different due to their function, size, occupancy levels, location, and more. The technology running most buildings has likely evolved over time, with a mixture of providers and systems of varying ages. When adopting an approach to scale sustainability related outcomes across a portfolio, one cannot overlook all the inputs required. It's important to ensure that each building's energy needs are taken in context of building use, location, and other variables for optimal outcomes for operators, occupants, and owners:

Here are the three fundamental steps to sustainability success:

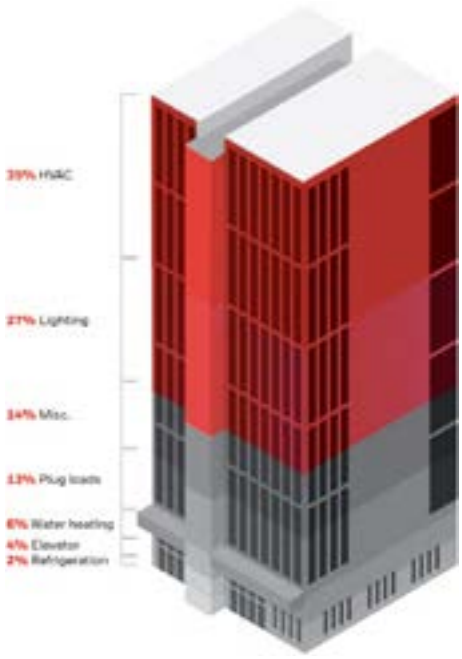
1. Assess the building needs and track performance
2. Think holistically edge-to-cloud
3. Sustain performance with a smart preventative maintenance approach

These improvements can then be scaled across a portfolio. Table 1 lists common services delivered for each step

STEP 1: ASSESSING THE BUILDING NEEDS AND TRACKING PERFORMANCE

Understanding how a building consumes energy is central to the assessment phase. Depending upon the age of a facility submetering may be common practice, providing granular insight into energy consumptions. For those facilities without existing submetering, smart meters offer granular level data that can transform the way we understand and manage energy consumption. These meters collect building-specific energy data, even at the asset level. They can capture data from various sources such as rooftop HVAC units, central plants, and lighting systems, providing a comprehensive view that allows you to establish sustainability baselines, pinpoint energy waste, monitor performance, and better comprehend the economic and environmental costs of equipment ownership.

Once you understand your energy consumption and which assets are most energy intensive, you can start making prioritized decisions regarding upgrading or replacing existing systems to improve energy efficiency and conservation for the biggest impact.



Energy Use in Commercial Buildings by Source

Provides a breakdown of the main sources of energy demand in a typical commercial building.

However, energy efficiency should not be at the expense of other needs, and consideration should be given to:

- **Resilience:** What's the building's ability to withstand power outages and other types of disruption caused by natural disasters?
- **Occupant experience:** How is the well-being of occupants affected by the indoor environment (e.g., temperature, indoor air quality, etc.)?
- **Operational efficiency:** How are resources and productivity managed?
- **Sustainability:** How are assets in a building or building portfolio being monitored, controlled, and optimized to meet KPIs such as energy use intensity or carbon reduction?
- **Compliance:** How is data gathered and analyzed to track progress toward ESG goals?
- **Data:** Beyond having access to the data, being empowered to use that data in a meaningful way across your portfolio of buildings is important.
- **Reports:** Smart, simplified reports reduce the need for manual data input and collection. They also save significant time and decrease the risk of manual error.
- **Dashboards:** Smart dashboards that visualize key-performance-indicators—such as energy usage intensity, disaggregated energy consumption, or avoided carbon emissions—help to inform action across your portfolio.
- **Automated Utility Breakdown**
  Deciphering your utility spend across your portfolio can be a daunting task. However, an automated utility breakdown that helps you understand demand charges and peak rates can empower you to make more informed decisions regarding diversifying
- **Power sources and operational costs.**

STEP 2: THINKING HOLISTICALLY FROM EDGE TO CLOUD

Once you have the data and insights to prioritize action, start thinking about your technology stack, from edge-to-cloud, for an accretive approach to energy efficiency.

In recent years, the processing power of edge devices has shifted intelligence and computing power to the edge, with smart edge devices capable of prescriptive analysis and even taking self-corrective actions. When considering energy intensity, connected plug sockets are an example of a smart edge device that can reduce wasted energy consumption while also increasing health and safety within high-occupant areas.

Supervisory platform capabilities, which typically vary across building portfolios, play an important role for the local facility manager to oversee the day-to-day. With actionable data in hand facility managers can control equipment set points, evolve schedules, and triage alarms and alerts to better prevent energy deterioration from escalating.

When introducing cloud services your enterprise benefits from simplicity and scale, reducing the need for manual intervention or localized skilled labor. Optimizing also means leveraging the latest technologies, including artificial intelligence (AI), machine learning (ML), and the Internet of Things (IoT), to add to the capabilities of your building management systems (BMS). Using advanced software controls with your BMS can enable adjustments before energy use escalates, as well as provide clearer analysis of energy and carbon emissions through smart meters, sensors, and utility data. As Figure 2 illustrates, buildings gain the ability to make autonomous data-driven decisions near real time, including:

- Predicting heating and cooling demand based on occupancy levels and weather forecasts
- Monitoring energy usage and identifying inefficiencies, enabling targeted measures to improve performance
- Integrating smart edge with AI to create a game-changing combo

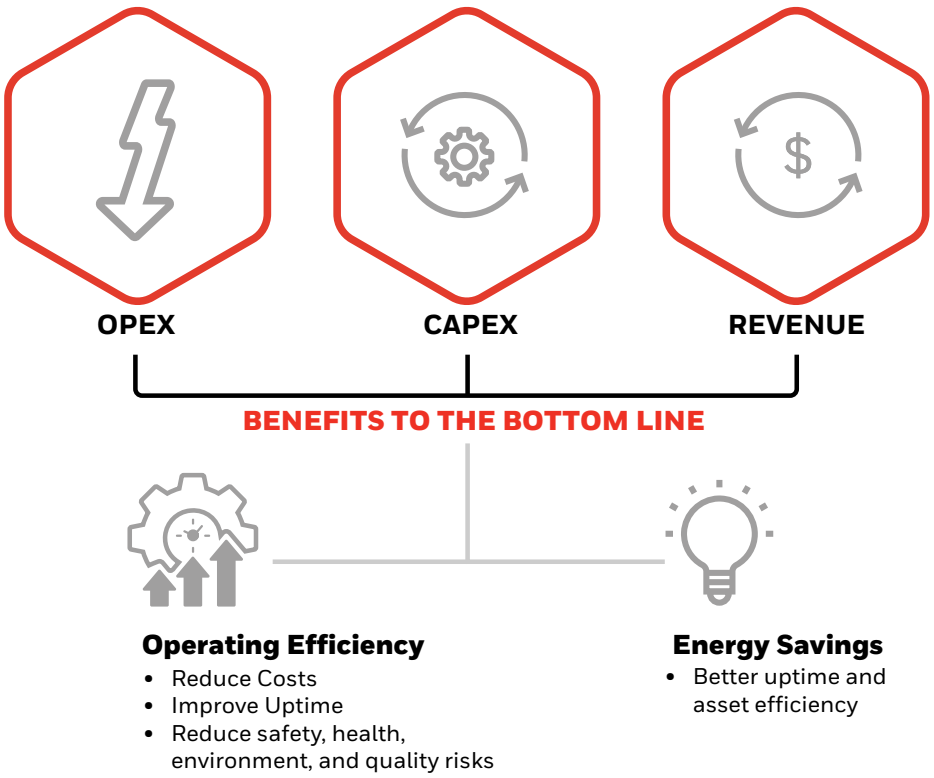
This accretive approach, from edge-to-cloud, offers a better way to manage energy consumption across your building portfolio so you can scale your sustainability outcomes.

STEP 3: SUSTAIN PERFORMANCE WITH SMART PREVENTATIVE MAINTENANCE

According to the U.S. Department of Energy, maintenance techniques targeting energy efficiency can result in an annual savings of up to 20%. Revisiting Figure 1, maintaining critical assets, especially those energy intensive HVAC mechanical assets for example, directly influences the sustainability impact and environmental footprint. Assets must be properly maintained to meet the sustainability levels expected from their original design. The more efficient a building operates, the less energy and waste is accumulated. Reducing an operation's negative environmental impact conserves energy and enables a safer, more dependable space for employees and their communities.

For enterprise portfolios expanding the edge-to-cloud approach for energy efficiency to interoperate with your predictive maintenance strategy offers a single source of truth, as well as a unified approach to optimizing building performance. With AI-based alerts and recommendations replacing inefficient manual processes, detecting faults earlier and guiding technicians to problems faster can help to reduce energy consumption. Cloud-based KPI visibility across your enterprise—encompassing comfort, asset availability, and service-case performance—can unlock sustained energy reduction, productivity, and efficiency.

Maintenance practices not only influence sustainability outcomes but also impact a range of business operations and cost sectors. From asset lifespan (CapEx) to maintenance services and utilities savings (OpEx) to occupant experience and brand reputation, investing in modernized maintenance practices can enhance business continuity and deliver end-to-end value across an organization.



To scale your sustainability strategy across your enterprise and achieve optimal impact, partner with a technology services provider equipped with edge-to-cloud capabilities and a lifecycle approach to sustainability.

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