Greenbuild

Honeywell

THE FUTURE OF HEALTHIER AND MORE SUSTAINABLE BUILDINGS

Decoding The Technologies and Services

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INTRODUCTION

The need for healthier and more sustainable buildings has been a consistent demand from health experts, building industry organizations and governments in recent years. Building owners and facility managers in both the public and private sectors, ranging from commercial real estate groups, to schools and healthcare organizations, are currently working to answer a critical question: "How do we address building health in a more sustainable way?" Healthy building and environmental sustainability conversations are important to have together because efforts to improve one can often impact the other - the same types of projects can have an impact on both objectives. Building owners and facility managers need relevant information to have more productive conversations with vendors and specifying engineers when identifying and selecting the best partners and technologies to achieve an organization's goal to create healthier and more sustainable spaces.

This technical reference guide is designed to help building owners and facility managers:

- Articulate the value of designs that help enhance both the health and sustainability attributes of a building or facility and understand how the two can be complementary – not conflicting;
- Simplify and understand the technology and services that promote healthier and more sustainable buildings; and
- Choose technologies and services that enable a healthier, more sustainable building aligned with the organization's goals.

CONSIDERATIONS AND GOALS

There are many factors to consider before undertaking measures to help enhance a building's environmental sustainability profile or improve the health of its indoor environment. Some of these may include:

- A mandate from organizational leadership to meet sustainability goals for energy and carbon reduction or indoor air quality goals to support employee well-being, or both;
- A desire to improve employee and/or tenant retention with a more attractivem building; and/or
- A need to help reduce costs or enhance productivity.

One of the most important considerations to achieve any of these goals is the thoughtful use of a budget, including justifying any necessary additional financing. Knowing how to appropriately scope a project is critical. A properly scoped solution should convey the value of the proposed improvements.

Many people inherently understand the value of efforts to improve environmental sustainability or the indoor environment of their building, but quantifying those reasons may be elusive. The following summary describes ways to understand and articulate the value of both types of projects.

CRITICAL CONSIDERATIONS FOR HEALTHIER AND MORE SUSTAINABLE BUILDINGS

A HEALTHIER BUILDING MATTERS TO ITS OCCUPANTS

A healthy building is a building with an optimized indoor environment resulting in a positive impact on its occupants' productivity and well-being.[1] The key elements of a healthy building include good air quality and ventilation, a comfortable temperature and humidity levels, natural light and low noise levels.[2]

Globally, workers are concerned about indoor air quality (IAQ), one of the critical components of a healthy building. According to the Honeywell 2023 Building Occupant Survey, nearly three in four respondents (74%) expressed some degree of worry about their workplace's IAQ, while 43% of those surveyed say they are either very or extremely worried about IAQ at work.[3]

A HEALTHIER BUILDING CAN YIELD A VARIETY OF RETURNS

Creating a healthy building can provide multiple benefits, including supporting occupant well-being and helping to improve the value of your building.

For commercial real estate companies, buildings with healthy ratings are often more valuable – rent for certified healthy buildings is 4.4% to 7.7% higher per square foot than for non-certified ones.[4]

Indoor air quality improvements can help support occupant well-being and provide a better building experience. On average, improved ventilation rates can result in up to 35% fewer sick days for employees.[5] Better indoor environment quality (IEQ) may also help improve productivity – one study by Syracuse University found that participants' cognitive function test scores doubled.[6]

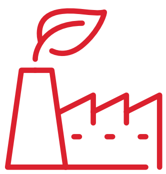
Demonstrating the commitment to create a healthier environment may also help attract and retain talent.[7]

SUSTAINABILITY IS GOOD FOR BUSINESS

Buildings and construction significantly impact the environment, accounting for 37% of energy-and process-related CO_2 emissions and 34% of energy demand globally.[8] Efforts to reduce electrical use and carbon emissions in buildings can have a significant impact.

SUSTAINABILITY DEFINED

Sustainability refers to the ability to maintain or support a process over time. In the context of a business's environmental goals, it typically refers to policies and decisions that seek to prevent the depletion of natural resources and to minimize negative impacts on the environment. One of the things that helps sustainability goals in a building is energy efficiency.



Pursuing sustainability goals can also have a positive business impact, especially when considered within the framework of pursuing a comprehensive Environmental, Social and Governance (ESG) strategy.

- According to a recent Gallup poll, nearly half of surveyed investors are interested in investment funds that emphasize sustainability.[9]
- Since its inception and through the end of 2022, the S&P 500 ESG Index has performed better than the conventional S&P 500 by a cumulative 9.16%.[10]
- Banks and insurance companies are offering better rates for companies with ESG strategies due to the potential reduction of operational and environmental risks.[11]
- Accountability is preferred – the world's most attractive employers have ESG scores 25% higher than the global average.[12]

THE STANDARDS AND TECHNOLOGIES BEHIND HEALTHIER AND MORE SUSTAINABLE BUILDINGS

Before March 2020, most conversations about a building's environment were focused on occupant comfort and finding ways to manage thermal comfort requests. COVID-19 has significantly changed that dynamic. Now, most building owners and operators are more aware of the importance of indoor air quality (IAQ) in achieving a healthier building.

In addition to air temperature and relative humidity, IAQ can be affected by a variety of factors[13], such as:

- **Carbon dioxide** (CO_2) can increase or decrease based on occupancy rates
- **Total volatile organic compounds** (TVOC) from the off-gassing of materials like carpet and paint
- **Carbon monoxide** (CO) from automotive exhaust or burning gas
- **Particulate matter** (PM), such as dust, dander, pollen, etc.

The criteria for a healthy building and acceptable IAQ ranges may differ from building to building. Several independent organizations, like LEED, International Well Being Institute (the owner of the WELL standard) and RESET, exist to provide science-based standards.

The first step to achieving a healthy building involves understanding the current state of a building and how it compares to suggested standards. The next step is to select a portfolio of technology solutions and services to support defined objectives.

Technologies should be selected based on how they conform to proven industry standards related to performance to support both IAQ and IEQ, based on an organization's goals. If a relevant standard has not yet been established, technologies should be selected based on their demonstrated performance and verified, independent third-party, research-based validation of claims.

TECHNOLOGIES EXPLAINED

The technologies used to help create healthier environments are also often the same that can help reduce energy use in buildings. Strategically using building technologies by leveraging building management systems (BMS) and advanced software controls can help to optimize heating, ventilation and air conditioning systems (HVAC), sensor networks, and lighting systems to meet specific goals – whether it's improving the health of the building or energy efficiency, or both.

SENSORS

Indoor air quality sensors can detect and measure temperature, relative humidity, and indoor air pollutants, such as CO_2, VOCs, and PM. These sensors can provide real-time information on IAQ levels and allow building managers to adjust the temperature, relative humidity, ventilation, and filtration systems as needed. Studies have shown that IAQ sensors can improve occupant comfort and reduce energy consumption by optimizing ventilation rates.[14]

LIGHTING

While this reference guide focuses on improving IAQ through the building management system, another key factor of IEQ is lighting. LED lighting is a more energy-efficient option that can also help improve IEQ. Building designers should consider light levels, glare, and consistency when creating an optimal lighting environment. Proper illumination using natural and artificial lighting can help enhance the well-being and satisfaction of the occupants, while potentially indirectly increasing performance and productivity.[15] Lighting systems can be integrated with IAQ and occupancy sensors and managed through the BMS to help reduce energy use. Building owners and operators should also consider high-efficiency HVAC systems versus conventional systems. These HVAC systems are designed to use less energy while providing the same or better IAQ and thermal comfort.

BUILDING MANAGEMENT SYSTEMS (BMS)

A BMS is often considered the “brains” of a building. It is a centralized system that monitors and controls a building's mechanical and electrical equipment, including HVAC, lighting and even plug loads. It can optimize energy consumption by adjusting the temperature, ventilation and lighting based on occupancy, schedules, and external conditions, such as weather. A study by the National Renewable Energy Laboratory (NREL) found that the installation of a BMS can reduce energy consumption by up to 29% in commercial buildings.[16] A deliberate and purposeful building controls strategy can also help to improve the health of a building.

ADVANCED SOFTWARE CONTROL

Maximizing your BMS with a deliberate strategy to do even more by coupling a BMS with advanced controls software that can help you achieve the goals you set for your building. This provides a tool to reduce energy consumption and Scope 1 & 2 carbon emissions, while managing energy costs without impacting occupant comfort.

ENERGY GENERATION AND STORAGE

On-site energy generation and storage (commonly referred to as microgrid) are behind the meter solutions that enable a building or campus to produce and store their own energy. This can help ensure business continuity of operations during power outages. With AI/ML algorithms, demand and time of use energy charges can be optimized by coordination of on-site microgrid use and building demand reduction. On-site energy generation and storage can include solar PV, combined heat and power, fuel generation, as well as newer technologies such as thermal energy or battery energy storage solution.

BUILDING VENTILATION

Building ventilation systems provide fresh air to indoor spaces and remove stale air. Studies have shown that improved ventilation can reduce the concentration of contaminants of concern.[17]

FILTRATION

High-efficiency particulate air (HEPA) filters are commonly used in buildings to remove particulate matter, including allergens and fine particles. Studies have shown that air filtration can significantly reduce indoor air pollution and improve occupant well-being.[18]

PRESSURIZATION

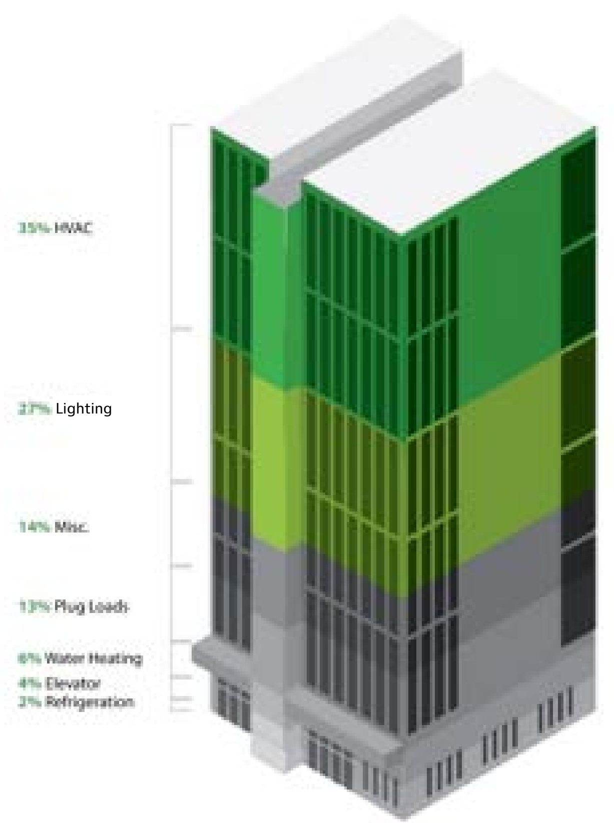
Pressurization controls air flow direction between zones in a building by maintaining an advantageous differential pressure between different zones; for example - keeping a restroom at a lower pressure than surrounding areas ensures air flows into the restroom instead of the other way. Studies found that negative pressure rooms with high ventilation rates can reduce the risk of transmission of infectious diseases.[19] Studies have also found that positive pressure ventilation can be an effective method of reducing the risk of airborne infections in the building, which can help improve indoor air quality.[20]

THE RELATIONSHIP BETWEEN BUILDING HEALTH AND SUSTAINABILITY IMPROVEMENTS

Projects that target key aspects of improving sustainability via a reduction in energy consumption can also impact healthy buildings objectives.

This guide addresses conducting assessments to identify the changes required to make a healthier or more sustainable building. It's important to understand the building owner's sustainability goals, how those goals can impact other goals, the available budget and how to document success. From a sustainability standpoint, starting with understanding and reducing energy use is often critical for many building owners and operators. There are obvious places where energy can be reduced in a building, such as HVAC and lighting systems. These two systems typically account for more than 60% of a typical building's total energy consumption and often have an outsized impact on a building's overall carbon footprint.[21]

While it's well-established that IAQ, thermal comfort and lighting are key aspects of a healthy indoor environment, more than half of the action areas for a Well Performance Rating are directly tied to a building's HVAC and lighting performance.[22] This is why it's critical to establish clear, measurable goals, understand potential opportunities for system improvements, and develop a comprehensive building controls strategy to accomplish them. The building management system and advanced controls software are critical to helping achieve these goals and balance desired outcomes.



UNDERSTANDING SCOPE 1, 2 AND 3 EMISSIONS

Scope 1 Emissions
Greenhouse gas (GHG) emissions that come directly from sources owned or controlled by the organization, such as fuel combustion in vehicles, boilers or furnaces.[23]

Scope 2 Emissions
Indirect GHG emissions are related to the purchase of cooling, heat, electricity or steam used to power a facility. Even though these emissions physically occur in the facility where they are produced, they are accounted for in the GHG inventory of an organization because they result from the energy use of the organization.[23]

Scope 3 Emissions
Produced from activities of assets the organization does not own or control, but its value chain is indirectly impacted by them. These emissions include all sources outside an organization's scope 1 and 2 boundaries. Scope 1 and 2 emissions from one organization may comprise the Scope 3 emissions of another organization.[24]

Many of the advances in technologies discussed throughout the guide are focused on increasing energy efficiency and lowering overall energy consumption. An equipment upgrade may be the best way forward versus replacing an entire system, taking the equipment's age and the total life cycle into account to have less environmental impact.

UNDERSTANDING AND APPLYING THE SOLUTIONS

There are several technologies that can help create a healthier and more sustainable building environment.

SENSORS

Monitoring the effectiveness of IAQ solutions requires continuous measurement. What gets measured gets managed. Sensors can record, report and allow a user or automation system to take action on values.

For instance:

- Temperature and humidity measurements are required if the HVAC system is to maintain comfort parameters
- The addition of CO_2, PM2.5 and TVOC measurements can provide a more complete picture of IAQ
- CO sensors should be installed in areas where combustion takes place, like parking garages, kitchen, etc.
- Radon detectors should also be installed as appropriate for continuous monitoring

When connected to a building control system, sensors provide the context for a DCV or smart ventilation system to act and make HVAC system adjustments to maintain IAQ. Users should consult with a vendor who can determine the right sensor strategy for a particular application that can be readily integrated into the building's systems for results.

ADVANCED SOFTWARE CONTROL

A powerful way to do even more with a building management system is through advanced software.

Carbon and energy management: A BMS, when coupled with electrical submetering, can help monitor discrete energy use and, with the help of software, can help translate that into a holistic view of how energy is being used within a building and how that translates into a carbon footprint. Such a system can use dynamic control software that optimizes energy consumption across occupant use patterns, utility price changes, weather changes, and the availability of on-site energy storage and generation for the benefit of both lowered operating costs and reduced carbon footprint.

Healthy building parameters can be optimized using a smart ventilation control system that factors IAQ and outdoor air quality (OAQ) parameters and occupancy sensors along with scheduling information to help inform when ventilation should be minimized or maximized. A smart ventilation system can learn how the system operates using artificial intelligence algorithms and machine learning. This allows the system to continuously adjust ventilation rates to ensure the lowest possible energy use to maintain IAQ parameters within the specified limitations.

Continuous monitoring is the critical next step once improvements are made to make a building healthier and more sustainable. It's important to leverage advanced controls software to identify that the investments in technology are delivering the intended benefit. Cloud-based dashboards that connect to the BMS and sensors on equipment can aggregate information to give a system-wide view of building performance – and can even provide insights across an entire building portfolio.

Types of Information that can be monitored:

- Healthy Building Score
    - o IAQ parameters, such as CO_2, PM2.5, TVOC
    - o Effectiveness of combined ventilation, filtration and air cleaning efforts
    - o Occupancy data

- Energy and carbon use data
    - o Energy use levels relative to historical levels at the asset or system level
    - o Carbon emissions data at the asset or system level

In addition to providing robust data, effective monitoring tools should:

- Identify IAQ, energy issues or waste outside of ideal parameters, historical use or benchmarks and make recommendations for resolutions
- Alert system maintenance issues so concerns can be addressed before they become problematic
- Provide carbon footprint information including energy use information for Scope 1 and Scope 2 emissions
- Communicate efforts to make a healthier or more sustainable building to key stakeholders, including building owners, tenants and occupants
- Generate reports on the building's performance for inclusion into corporate ESG reports or to gain or maintain certifications, including data like healthy building statistics, energy use and carbon footprint

Local indicators and controller-level indicators are helpful but may not provide a complete picture of how an entire building system is performing.

ELECTRICAL LOAD MONITORING AND MANAGEMENT

Just as it's important to monitor and maintain key IAQ parameters, it's the same for energy use to understand the areas of current or potential energy waste. By monitoring, visualizing and understanding energy use over time, it's possible to actively manage use to help reach energy savings and carbon reduction goals.

Installing **electrical submeters** can help identify energy use at a device level to help enhance the details of understanding use and the impact of potential energy efficiency improvements.[25] An electrical submeter is an energy measurement device located downstream from a building's utility revenue meter. It can be a digital meter or integrated into an electronic trip unit of a circuit breaker.

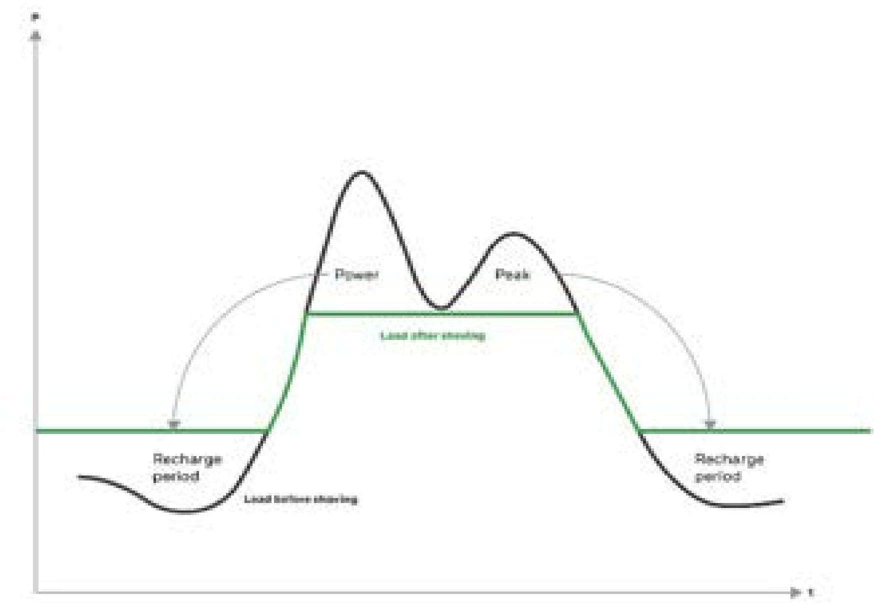
The device, and its associated data acquisition, communications, and software components, can measure and record real-time electrical parameters, such as current, voltage, real power (kW), reactive power (kVAR), apparent power (kVA), power factor, energy use (kWh) and harmonics for the circuit in which the electrical submeter is installed. An electrical submetering system can be designed to measure the electrical energy consumption associated with an entire switchboard or panelboard, each individual branch circuit, each individual outlet, and anywhere in between. This means the user has the exact amount of use visibility required down to a specific device, zone or system.

Once a measurement is installed, energy use can be monitored either for the purpose of validating improvements, identifying waste or prioritizing areas for future improvement. Electrical submetering is becoming recommended in certain standards, buildings and regions; refer to ASHRAE 90.1-2013, California Energy Code (2016, Title 24, Chapter 8), and the 2021 International Energy Conservation Code.

Demand response is the act of modifying electrical consumption during peak power demand on the larger electrical grid and is one way to actively monitor and reduce overall demand in

a building. An effective demand response system can allow building owners and operators to gain better insight into utility costs during peak and off-peak hours, manage power demand and create greater resilience by leveraging renewable energy and battery energy storage systems (BESS). Following is high-level detail about the technologies, and we will have future guides to address these technologies in more detail.

- Energy use software to understand and visualize forecast times of peak grid demand and costs based on information supplied by the utility provider.
- Leveraging software, in conjunction with the BMS to help manage power demand during peak through actions, such as automated adjustments of HVAC settings, deferring EV charging to a different time or drawing down on BESS.
- Grid-interactive Efficient Buildings (GEBs) integrate energy efficiency responses, energy storage, and generation (solar or similar) into one system that is actively managed for the benefit of the building owners, building occupants and the grid. This requires a dynamic management system that optimizes energy consumption across occupant use patterns, utility price changes, weather and the availability of on-site energy storage and generation.[26]



ELECTRIFICATION

Electrification is one of the most important strategies for reducing carbon emissions. Governments are providing taxes, incentives, and rebates to accelerate this energy transition. Electrification trends include:

- **Heat Pumps**: Heat pumps are a cleaner alternative to conventional heating, such as boilers. Heat pumps offer an energy-efficient alternative to furnaces and air conditioners for all climates. Like your refrigerator, heat pumps use electricity to transfer heat from a cool space to a warm space, making the cool space cooler and the warm space warmer.

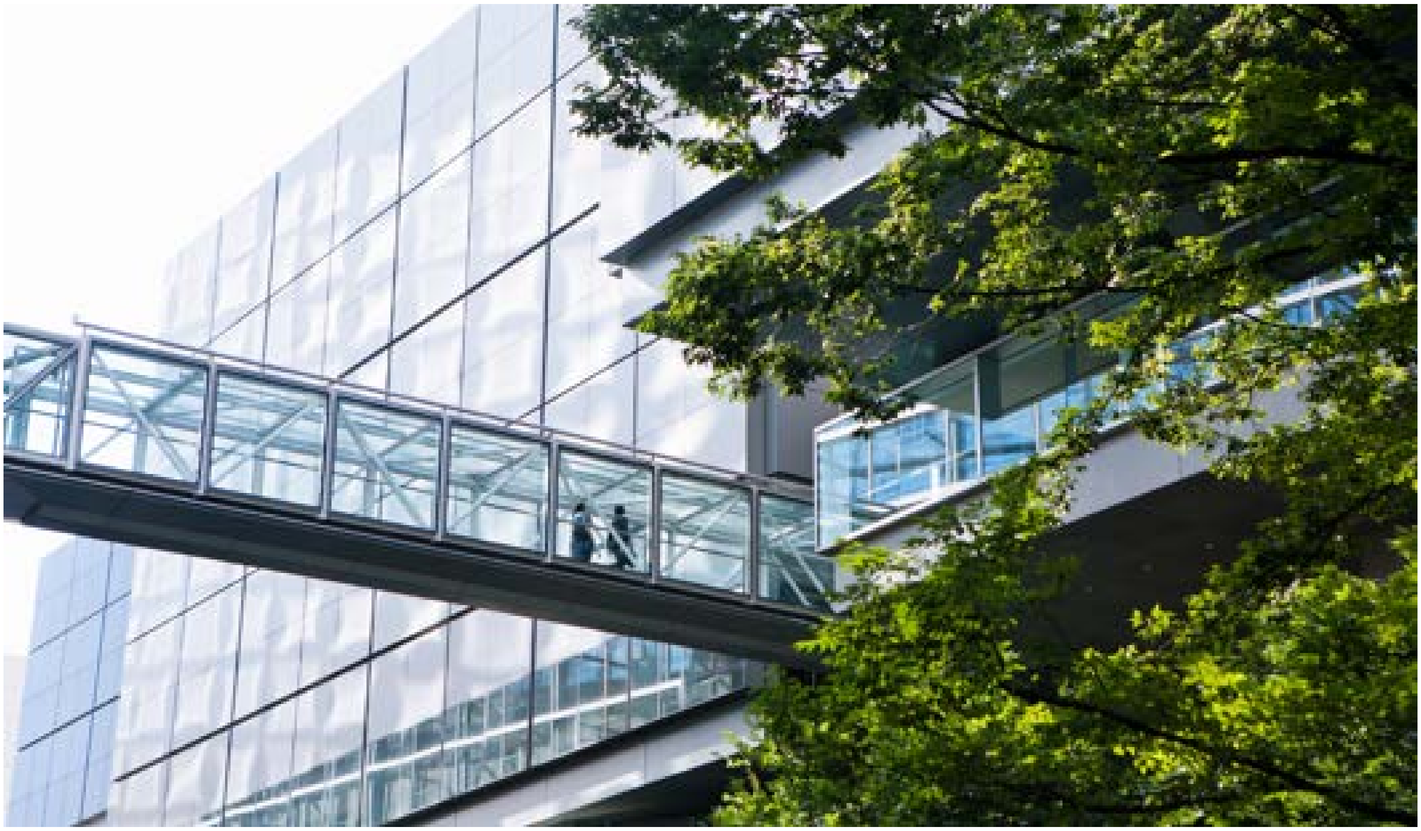
- **EV Charging Infrastructure**: As EV adoption increases, buildings need to add EV charging infrastructure to charge fleet and employee's EV. This can increase the electrical power needed for the building. Load management techniques can be used to reduce the charging rate, stagger the charging of vehicles, or offset other building loads.

Electrification has the unintended effect of increasing building energy consumption, increasing the utility loads and electrical infrastructure needs, and significantly increasing costs for the building site and the utility. This is why Grid-Interactive Energy Efficient Buildings and implementation of on-site energy generation and storage solutions are paramount.

On-site Energy Storage and Generation is the production of energy at the point of use, specifically, the site where it will be consumed. It is a form of decentralized energy, enabling a business to make and use its own energy at a particular location, rather than buying that energy through the grid.

Components of on-site energy storage and generation can include:

- **Solar PV Photovoltaic (PV):** Materials and devices that convert sunlight into electrical energy.
- **Battery Energy Storage System (BESS)**: Energy storage can reduce the cost to provide frequency regulation and spinning reserve services and offset the costs to consumers by storing low-cost energy and using it later, during peak periods at higher electricity rates.
- **Thermal Energy Storage**: One method to manage peak in district heating and district cooling is to store hot or cold water in insulated tanks when utility rates are low and discharge when utility rates are high.
- **Combined Heat Power**: The concurrent production of electricity or mechanical power and useful thermal energy (heating and/or cooling) from a single energy source.



- **Traditional Generation**: Diesel or natural gas generation are commonly used for backup power, but often emit significant levels of carbon emissions. Traditional generation can be offset with renewable power options. In the future, hydrogen blending can also help reduce carbon emissions.

BUILDING VENTILATION

The standard for improving and maintaining good IAQ is providing adequate ventilation by intentionally introducing outdoor air into a space via fans, natural air movement, or both. In a healthy building, the primary purpose of building ventilation is to improve IAQ by diluting and displacing pollutants and potential pathogens in indoor air. If this is done without consideration for energy use and consumption, it can be like operating the air conditioning with the windows and doors open. This is one key example of why a deliberate building controls strategy is vital so that both healthier and more sustainable outcomes are achieved.

There are regional standards to determine proper ventilation rates, such as ASHRAE Standards 62.1 and 62.2 - Ventilation and Acceptable Indoor Air Quality and the United Kingdom Building Regulations Part F.

From a healthy building perspective, the effectiveness of a ventilation system can be quantified by measuring the change in concentration of CO_2, TVOC, CO and PM levels based on ventilation. Maintaining these parameters within recommended limits is essential to maintaining good IAQ.[27]

Changes to the mechanical (fan-driven) ventilation system can be as simple as adjusting an existing fresh air damper on a system, or as complicated as completely redesigning the system to incorporate more outside air during operation.

Any change to a mechanical system should be performed by a professional with experience in balancing ventilation systems so as not to induce other unintended consequences. Changes to the mechanical system should be done carefully because increasing outdoor air can also drastically increase the energy spent to condition that air. Any changes to ventilation should follow national and local recommendations and be appropriate to local conditions.

Rather than using a single, fixed rate of ventilation based on estimated average occupancy, energy-efficient buildings can modulate the amount of ventilation as a function of demand by using either demand control ventilation (DCV) or a smart ventilation scheme. A DCV uses a CO_2 sensor to monitor the occupancy levels and control the amount of ventilation. CO_2 levels rise in an interior space based on the number of occupants, so the room's air exchange rate increases, to keep the IAQ parameters under the thresholds recommended by standards body. When a space is unoccupied, CO_2 levels drop and the system adjusts to minimize ventilation levels and help save energy. Smart ventilation factors in additional IAQ parameters, OAQ parameters, incorporating occupancy sensors and scheduling information to help communicate when ventilation should be turned minimized or maximized. Artificial intelligence (AI) algorithms can also be incorporated within a smart ventilation scheme to learn how the ventilation system operates and continuously adjusts ventilation rates to use the lowest possible energy to maintain IAQ parameters.

DCV and smart ventilation upgrades can deliver improved IAQ in conjunction with energy savings; however, they can also become highly complex projects that require the installation of new sensors, new ventilation equipment and new integrations with the HVAC control scheme.

FILTRATION

Air filtration devices address one of the primary monitored constituents of IAQ – particulate matter – by removing as much of it as possible from the air. This guide will discuss two different types of air filtration: mechanical air filters and electronic air cleaners (EAC).

Mechanical air filters are typically constructed with a pleated filter media housed inside a frame and come in various effectiveness levels to suit many applications. Filters are generally classified by their ability to remove particulates from the air often by using either Minimum Efficiency Reporting Value (MERV) or Dispersed oil particulate (DOP) ratings.

- **Minimum efficiency reporting value (MERV)** measures a filter's ability to capture particles between 0.3 and 10 microns in size as defined within ASHRAE Standard 52.2. A higher MERV rating indicates it is better at trapping specific particle types.[28]
- **Dispersed oil particulate (DOP)** is a method for verifying filter effectiveness by measuring the filter's ability to capture an aerosol with a consistent particle size of 0.3 microns per a standard. HEPA ratings are established using this type of testing. A HEPA filter can filter 99.97% of particles in the 0.3-micron range.[29]

In general, ASHRAE recommends using a filter with a MERV 13 or higher in HVAC applications, but the filter choice can significantly impact the overall HVAC system. Typically, more efficient filters can have a higher pressure drop leading to both decreased air flow and increased energy use.[30] Upgrades in filter efficiency should be completed in consultation with an expert who understands and can help balance these trade-offs.

Electronic Air Cleaners (EACs) typically remove particles from the atmosphere by charging particles and then collecting them onto oppositely charged plates.[31] The efficacy of EACs is measured using the test method described in ASHRAE Standard 52.2.[32] As more particles accumulate on the EAC's filters, the filtration becomes less effective. This technology requires regular manual maintenance to wipe the collecting plates clean.

In-room or portable air cleaners can be used when adequate ventilation is difficult to achieve or a higher level of filtration is required, such as in an area with very high traffic or for occupants susceptible to respiratory impairment. The system should be designed so airflow is not obstructed and doesn't blow directly on the occupants. For an air cleaner to be effective in reducing pathogens from the air, it must be able to remove small airborne particles (size range of 0.1-1 microns). Manufacturers report this in multiple ways. In some cases, they may indicate efficiency for particle removal using specific particle sizes (e.g., "removes 99.97% of particles as small as 0.3 micrometers"). Manufacturers may also use the clean air delivery rate (CADR) rating system to indicate air cleaner performance. Others indicate they use HEPA filters.

Select an effective air cleaner by choosing either:

- A unit that is appropriately sized for your space (typically indicated by the manufacturer in square feet); or
- A unit with a high CADR for smoke (versus pollen or dust) that is designated a HEPA unit, or one which specifically indicates that it filters particles in the 0.1-1 micrometer size range.

Air cleaners that purposefully generate ozone in occupied spaces or that are not compliant with state regulations or industry standards for ozone generation should not be used.[33]

PRESSURIZATION

The most commonly used airflow control device is the terminal box or variable air volume (VAV) box. While these devices can do a great job of providing temperature-controlled air into a space for comfort control, they can fall short when trying to maintain directional airflow or proper pressurization, such as in an isolation room. Venturi valves are designed to use directional airflow and pressurization to control airflow. This helps to limit the spread of airborne pathogens, improve indoor air quality (IAQ), and increase room-state flexibility.

SERVICES

Implementing technology upgrades are essential to improving healthy building and sustainability parameters and achieving the anticipated associated benefits. Defining the required upgrades needed for a building and then maintaining those improvements requires services to support the solutions.

CREATING A BASELINE PERFORMANCE ASSESSMENT

Whether the goal is creating a healthier building, reducing energy use, or both, the place to start is a thorough assessment of your building's performance to establish a baseline for improvement. This means conducting a comprehensive review of all building systems to identify opportunities for improvement, areas of strength and the most optimal ways to use the budget to make necessary changes.

Working with a building technologies partner, building owners and operators can either conduct the assessment directly with them or engage a third-party organization. It's essential to choose a partner that can communicate the process, describe the insights the assessment provides and produce a comprehensive report that can serve as a blueprint for projects to make a healthier and more sustainable building.

A Healthy buildings audit should include a detailed test program to measure the building baseline indoor environmental quality – inclusive of air, water, light, and acoustics – along with a summary report comparing these parameters to acceptable standards (RESET, WELL, etc).

A comprehensive energy audit may seem optional, but in several cities like New York City, Atlanta, and Los Angeles, regular energy audits are required in large commercial buildings.[34]

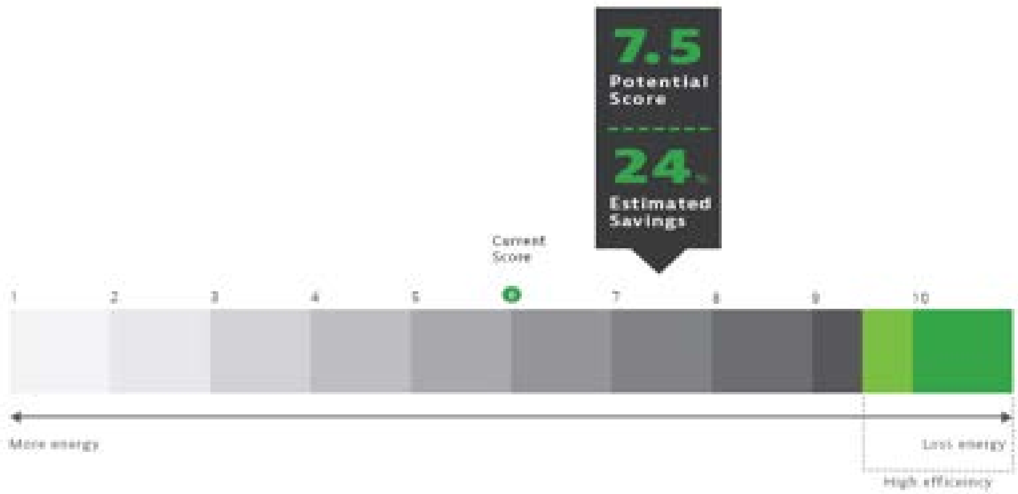
A few of the key things to evaluate in an assessment:

- Identify baseline IAQ parameters
- Review system settings
- Identify areas of energy waste

An effective third-party energy audit may leverage an established practice for conducting and results reporting, such as ASHRAE Standard 211, Standard for Commercial Building Energy Audits and the ASHRAE publication, Procedures for Commercial Building Energy Audits. Per ASHRAE procedures, an energy audit can be conducted at one of three levels, each with more intense level of detail:

- Level 1 - A walk-through survey
- Level 2 - Energy survey and analysis
- Level 3 - Detailed analysis of capital-intensive modifications

Depending on the level of detail in the audit, recommendations in an energy audit report can range from procedural modifications that can be made immediately to reduce energy use, to recommendations on potential equipment upgrades.



Another tool to measure building energy efficiency is the U.S. Department of Energy's Building Energy Asset Score[35], a free tool that analyzes aspects of the building and generates the following information:

- An overall score between 1 and 10 characterizes the energy efficiency of a building
- An assessment of an individual system's energy efficiency within the building
- Total estimated energy use by end use (lighting, heating, cooling, hot water) under standard conditions
- Opportunities to upgrade efficiency as well as an improved score based on making recommended upgrades

GRANTS, INCENTIVES, REBATES AND ENERGY PERFORMANCE

Grants, incentives, and rebates may help pay for or offset energy performance upgrades. Interested building owners can reach out to local utilities and research the availability of government grants. There are also budget-neutral ways to pay for energy efficiency upgrades, such as an energy savings performance contract (ESPC) when working with an energy service company (ESCO). Best practices regarding ESPCs and ESCOs are available on the U.S. DoE website.

CERTIFICATIONS AND RATINGS AVAILABLE

Certifications and ratings can provide a benchmark and demonstrate the efforts taken to achieve and maintain a healthier, energy-efficient and more sustainable building. Certifications confirm the health, energy efficiency and sustainability efforts within a building, helping to create a competitive differentiator. The partner engaged to create a healthier and more sustainable building should help translate the requirements in the certifications to a set of solutions necessary to meet those requirements. An effective monitoring system and dashboard can help facilitate the gathering and submission of requirements to achieve the initial certification or rating, as well as maintain the credential with recurring submissions over time. Several certifications and ratings exist:

Healthy buildings-focused certifications

- Fitwel
- RESET
- WELL

Healthy buildings and sustainability-focused certification

- NABERS

Sustainability focused certifications

- BREEAM from the Building Research Establishment (BRE)
- Energy Star from the U.S. Department of Energy and Environmental Protection Agency
- Green Star Rating from Green Building Council Australia
- LEED from the U.S. Green Buildings Council

While a certification may focus more on healthy or sustainability, there is often cross-over in the topics given the increasing correlation between the two topics.

GETTING STARTED

CONDUCT RESEARCH

Understand what rules and regulations govern your region and the types of upgrades you want to make.

ESTABLISHING A BASELINE

Conduct an audit of how your building performs relative to healthy building and energy use parameters to understand where savings could be achieved. A third-party assessment may be effective for this step.

SET GOALS FOR IMPROVEMENT

Set realistic and achievable goals for improving sustainability and healthy building parameters and then create a realistic timeline and roadmap for implementation based on those end goals and any constraints (e.g., budget, procurement, implementation).

CHOOSE TECHNOLOGY AND SERVICES APPROPRIATE FOR THE GOALS

- Create a plan for upgrades with a holistic view.
- Ensure the solution is serviceable and maintainable so it remains effective for the long term.
- Choose technologies and services that can deliver verifiable results to help demonstrate the effectiveness of performance and return on investment.

KNOW WHAT TO LOOK FOR IN A VENDOR

Below is a checklist of considerations to keep in mind when approaching a healthy and sustainable building partner for a solution. Choose a partner that can provide:

- A holistic approach to healthy and sustainable buildings
- A track record of relevant experience and breadth of expertise
- A willingness to partner starting from the assessment phase throughout implementation of the solution, including long-term support
- The ability to understand, adhere to and articulate the impact of relevant standards and compliance requirements
- The ability to provide a comprehensive solution set
- Digital transformation experience with the latest IoT developments in building controls, cloud capabilities, AI and ML
- The ability to provide a solution with an easy interface and good usability – a healthy and more sustainable building should be easier (not harder) to work with
- Adaptability, scalability and maintenance
- Willingness and ability to assist in sourcing options for funding, such as help writing grant applications or serving as an ESCO for an overall ESPC contract (in the case of energy improvement projects)

SUMMARY

There isn't one solution that can improve sustainability and indoor air quality, while controlling operational costs. A combination of the preceding solutions can help support sustainability and healthy building goals. A strategy involving multiple factors to help make meaningful improvements provides the best solution. It's not an "either/or" situation. All of these solutions may provide value and help create a healthier indoor environment while supporting sustainability goals.

Choosing technologies and services that enable a healthier, more sustainable building aligned with your organization's goals doesn't have to be daunting.

Check out Honeywell's **solutions** to understand how you can transform your building portfolio to support your sustainability efforts.

Contact Honeywell

SPEAK TO AN EXPERT

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