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How to Improve Indoor Air Quality While Minimizing Energy Consumption

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Executive summary

In the wake of the COVID-19 pandemic, building owners and facility managers are reexamining operational strategies while preparing for new ways of working. Undoubtedly, there will be a new level of demand for building practices that increase occupant comfort.

This white paper focuses on how building owners and facility managers can meet these new needs by improving indoor air quality. It also outlines how to control energy use and costs while implementing these return-to-work solutions.

Introduction

As building occupants return to the workplace after the COVID-19 pandemic, they're coming back with new expectations regarding indoor air quality (IAQ), including improved ventilation, air filtration, and sanitization. Optimizing IAQ often requires more energy from the HVAC and other building systems.

How can building owners and facility managers meet new IAQ expectations for the return-to-work without leading to significantly higher energy consumption?

This white paper explores answers, covering the following topics:

- Section 1: Why IAQ matters to building owners, facility managers, and occupants
- Section 2: How to improve IAQ in buildings
- Section 3: How to increase energy efficiency

Why IAQ matters to building owners, facility managers, and occupants

IAQ is an increasingly important aspect of building management, and elevating it creates benefits for all building stakeholders. A recent white paper developed by AECOM and Schneider Electric™: Ensuring Occupant Health: Key Findings and Insights from Global Study of 21 Office Buildings explored case studies illustrating the connections between indoor air quality, ventilation, and occupant comfort.

Here are a few real-world examples of ways facility managers have improved IAQ per the report:

1. Building occupants complained about temperature issues. After reviewing the trend data, facility managers changed the airflow and temperature setpoint. The indoor air quality (IAQ) comfort score **improved 21 points** over two months.
2. Building occupants complained about an odor. The VOC sensor trend revealed concentrations in the mornings, so airflow adjustments were made.
3. A building had poor ventilation based on carbon dioxide (CO_2) levels and heat gain from large windows. By increasing the airflow and adding window shades, **the IAQ comfort score increased from 77 to 94 over three months**.

As shown by these case studies, there is a need to track compliance and ensure employees feel safe when returning to their workplace. Both subjects deserve attention together, as they are not mutually exclusive.

After all, **humans spend nearly 90 percent of their time indoors;** it's imperative building owners and managers focus on the impact buildings have on each individual.

The business case for safety and wellness

Companies recognize there is value in a health promotion strategy as described in Healthy Buildings: How Indoor Spaces Drive Performance by Harvard professors Joseph G. Allen and John D. Macomber. The U.S. spends roughly 18 percent of its gross domestic product on healthcare costs. That cost is often tied to employment and covered, partially or fully, by an employer.

To put this in perspective, consider the commonly referenced 3-30-300 rule from JLL. For every $3 a company spends on utilities, it spends $30 on rent, and $300 on employees. Leaders often fixate on that one percent for utilities. However, they can affect bottom lines more effectively by addressing people — namely, their health and productivity. One way to accomplish this is ventilation for improved IAQ.

ASHRAE established a standard that sets an "acceptable" level for healthy ventilation

— not a recommended or optimal level. Even when buildings are built to that minimal standard, it is common to see those buildings operating below said standard, particularly since many buildings are not set up to measure that level. However, doubling the minimum standard has a positive effect. It decreases sick days (1.6 less) and increases productivity anywhere from two to ten percent. But increasing air intake and cooling / heating it to optimal temperatures requires energy and, thus, cost.

Do those costs outweigh the benefits? Let's look at an example.

Assume a small company has 80 employees. Using the JLL rule as a baseline:

- Payroll runs $6 million ($75,000 yearly average)
- Rent is $600,000
- Utilities are $60,000
- Revenue is two times the payroll amount, thus $12 million
- After all expenses and taxes (30 percent), there's a net income of about $2,338,000.

What happens to the bottom line if utility costs are cut by 20 percent? That's $12,000 in savings, or 0.005 percent. Energy savings are important to a business's bottom line and the environment. However, financial gains from energy improvements are small compared to gains from employee productivity.

Now, let's take another look at the hypothetical scenario and increase the ventilation rates. In the Healthy Buildings book, the authors say that an increase in ventilation rates would equate to about $40 more per year per person (sensors and smart building applications can drop this figure into the single digits). This would add $3,200 in utility costs.

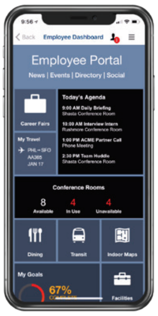
Now, let's look at the benefits. Using the numbers above, let's start with decreased sick time. Based on assumed workdays a year (calculating paid time off, weekends, holidays, etc.) — a two-day decrease in sick time would equate to about one percent of an employee's hours for the year, and sick time means cost with no positive return. Thus, there's a potential to recoup roughly $60,000 in lost costs, or 2.5 percent. Now, let's consider increased productivity. Assuming a two percent increase, revenue grows by $240,000. In short, **increasing ventilation rates costs $3,200 more a year in utilities, but a company could gain nearly $300,000 in productivity and reduced sick time.**

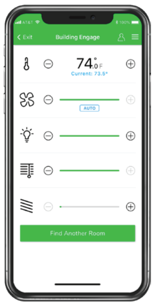
Post-pandemic factors

As previously mentioned, building owners and facility managers must contend with an array of pandemic-related concerns. Employee vaccination, temperature checks, and socially distanced spacing are just a few of these new considerations. For occupants to feel comfortable returning to the office — and thrive in their workplace — they require a space that is safe, comfortable, and clean.

Modern building systems can track safe distance practices in occupied areas, rooms, and desks. They can also report when IAQ levels are outside acceptable ranges. Non-compliance alerts for issues such as over-occupation can go to facility staff through the building management systems (BMS) or an employee mobile app. The white paper, "Ensuring Occupant Health: Key Findings and Insights from Global Study of 21 Office Buildings" goes into detail on this type of system and its application.

Below is an example of an employee mobile app that not only controls environmental comfort but can include employer-pushed information on the latest safety measures.




The true value of a building is not energy; it's the people. The purpose of a building isn't to save energy (though doing so can save money), but for human occupation. Healthy buildings enhance occupant safety, productivity, and the bottom line.

How to improve indoor air quality in buildings

The measures building owners and facility managers take to improve IAQ for returning occupants are outlined below. They include air changes per hour and humidity control.

Air changes per hour (ACH) and high-efficiency air filters

In the past, BMSs helped improve a building's energy efficiency. And, as more people reenter buildings post-pandemic, there will be even greater demand on building infrastructure.

As of the date of this publication, ASHRAE Standard 62.1 recommends three ACHs to remove 95 percent of the contaminants in well-mixed commercial office buildings. The standard also recommends installing high-efficiency MERV-13 or greater air filters to reduce the risk of airborne viruses. Other sources recommend up to six air changes an hour to prevent the spread of viruses.

According to the ASHRAE Epidemic Task Force Building Readiness Guide 10-20-20, the increased energy required to go from 20 percent to 90 percent outside air doubles the amount of chilled water energy necessary to condition the new air. For reference, to calculate your ACH, you need to measure the cubic feet per minute (CFM) of your air distribution device(s), multiply by 60, then divide the total by the total cubic feet of the room or area served.

To learn more about best practices and compliance for simplifying and automating infectious disease risk management, download the white paper: "Reducing Infectious Disease Risks with Smart Building Technologies and Management Systems."

Humidity and occupancy flush control

In addition to ACH and high-efficiency filters, ASHRAE Standard 55-2017 recommends indoor humidity levels be maintained between 40 percent to 60 percent to reduce exposure to infectious particles and viral illness transmission. In certain regions of the U.S., these actions may increase building energy costs.

For buildings that aren't occupied 24 hours a day, ASHRAE Epidemic Task Force Commercial Guide 8-17-20 recommends a pre- or post-occupancy flush with outdoor air to remove the bio-burden. Flushing a building for the time required to achieve three air changes of outdoor air is also recommended. Again, this may also increase energy costs.

Both humidity and occupancy flush control strategies require installing sensors and a BMS equipped to respond to these changes. ASHRAE recommends monitoring and trending indoor humidity levels and alarming on levels outside of 40 to 60 percent. These are just a few of the ASHRAE recommendations for building readiness that will affect energy costs and comfort.

One interesting note to this discussion centers around thermal health as it relates to gender. Although ASHRAE argues that comfort standards are updated regularly, more than half of the studies on gender and temperature reveal that women and men, generally speaking, have different preferences for air temperature. Looking forward, requiring a future of hyper-personalization and hyper-localization of thermal conditions to create zones of "personalized indoor health" may improve occupant satisfaction.

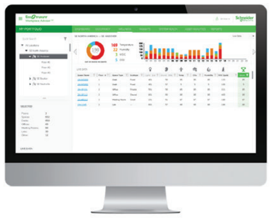
Confirm optimal humidity

Ensure optimal humidity levels and meet recommended health building range prescribed by ASHRA & EPA

Check air circulation

Confirm adequate air circulation across building, monitor CO2 & VoC levels where employees gather

Monitor rise of VoC



Ensure adequate cleaning through indirect VoC monitoring and maintain odor levels

How to improve energy efficiency

It is important to note that these recommendations to improve IAQ may increase overall energy use and, consequently, energy costs. Therefore, it is also important to consider strategies to improve energy efficiency.

Energy conservation measures

What can building owners and facility managers do to offset the increased energy use and costs associated with the return to work?

The energy conservation measures (ECMs) identified below were developed while working with building owners over several years.

Low cost ECMs

- Setpoint refinement
- Night and weekend setup / setback
- Occupancy-based control
- Simultaneous heating / cooling equipment lockout
- Optimal start / stop
- Variable frequency drives
- Retro-commissioning

Intermediate cost ECMs

- Advanced lighting control
- Advanced occupied based control
- IAQ dashboard
- Main building electric, water, and gas metering
- Central plant optimization

Higher cost ECMs

- High-efficiency HVAC equipment

- Modernized BMS
- Submetering and energy monitoring

Low cost ECMs

Setpoint refinement

Building owners and facility managers should review current and pre-pandemic BMS setpoints modes to accommodate changing occupancy levels.

Below are strategies to maintain comfort conditions while using minimal energy to operate.

- Unoccupied areas: Setpoints typically run 55° F in the winter and 85° F in the cooling season.
- Occupied areas: Setpoints typically run 68° F in the winter and 78° F in the cooling season.
- Hot water temperature: You can achieve a one percent reduction in energy usage for every one degree change of setback, which can save up to five percent in energy costs

Keep in mind, a building still needs to remain at humidity levels between 40 – 60 percent.

If a building does not have individual room or zone control, consider upgrading or replacing the BMS with a system that features temperature setpoint control. In occupied areas, providing individuals control over their environment (temperature, fan speed, lighting, etc.) may help with overall satisfaction and, potentially, productivity.

Night and weekend setup / setback

Reviewing current BMS setpoints for after-hours operation is another way to control energy use and costs. There is a potential to save 8 – 10 percent in energy while still protecting the building in extreme cold or hot weather.

Typical setbacks are 55° F in the winter and 85° F in the cooling season. Again, remember to include humidity control override to prevent mold issues and to stay within the ASHRAE recommended range.

Occupancy-based control

As employees return to work, review how they may potentially use the space in a building. In particular, identify potential unoccupied areas that can be put in a setback mode for lighting and HVAC.

The easiest and lowest cost ECM is a simple wall switch-type **lighting control** occupancy sensor on the electrical circuit that uses infrared or ultrasonic sensors.

- Infrared detects temperature changes within range of the sensor
- Ultrasonic uses high-frequency sound to detect occupancy

Figure 1

Standard standalone motion detector

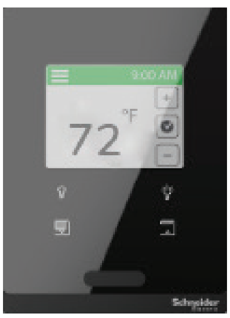


Figure 2

Living space temperature sensor with motion detection, lighting, and blind control

There are also sensors with both infrared and ultrasonic technologies for better accuracy but they do cost more.

For HVAC area control, a zoned BMS with temperature sensors and built-in occupancy sensors is an effective solution.

Guidance on how to save duplication costs using the BMS occupancy sensors in lieu of installing a standalone device is covered in the Intermediate cost ECM section.

Figure 3

Engage mobile app for individual space control

Another method to control occupancy involves using a mobile app to schedule the required lighting and HVAC zones or areas. This technology also provides occupants the ability to reserve conference rooms, and touchless control over their environment (lights, temperature, blinds, etc.).

One additional occupancy control strategy includes using sensors that count people entering a building or gathering in a particular area, and sharing this data with a modern BMS. From there, the BMS can use this information to set the HVAC system to the occupied mode, adjust the CO_2 levels, change fan speed, etc.

Simultaneous heating / cooling equipment lockout

It is often more difficult to implement energy savings strategies to aging HVAC systems. Depending on the building's heat gain for example, more AC usage may be required, even in the winter.

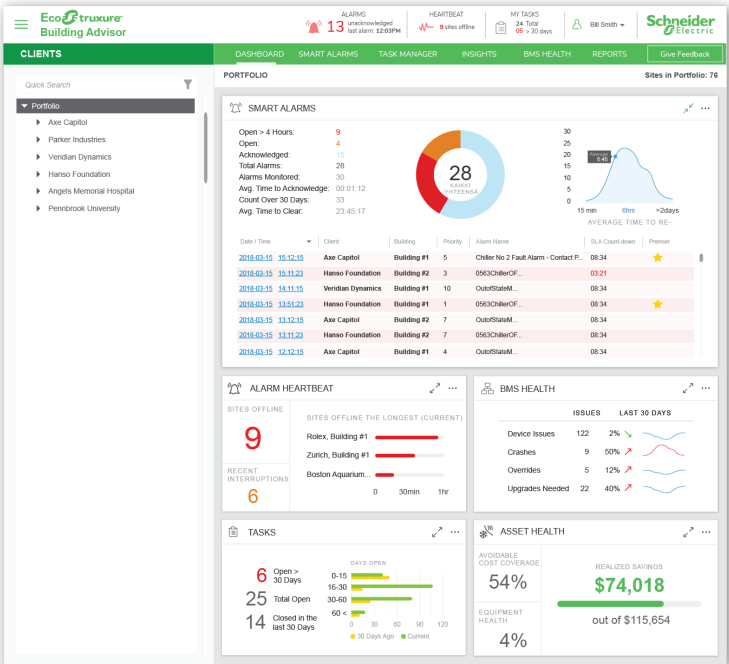


Figure 4

EcoStruxure™ Building Advisor dashboard

An easy way to save energy in occupied buildings with modern HVAC systems involves turning off the heating in the summer and AC in the winter. This includes the associated pumps and tower fans during certain outdoor air temperature conditions.

Locking out the mechanical heating / cooling with the outside air economizer mode is another way to save energy. During the right outdoor temperature (typically below 55° F) and humidity levels, outside air can be brought in to provide "free cooling," especially during the spring and fall.

Today there is HVAC fault detection software available to identify when the economizer mode is running and the mechanical heating / cooling is still active.

Note: If the building complies with ASHRAE 90-1 2016 Section 6.4.3.12 Economizer Fault Detection and Diagnostics, a fault detection system is required to monitor the operation and status.

Optimal start / stop

Another easy way to save energy is turn off equipment when it's not needed. The question is: How soon should the HVAC system start to reach the required temperature and air changes needed for morning occupancy? The same question applies to shutting down the equipment when the building becomes unoccupied.

As previously noted, ASHRAE recommends flushing with three outdoor air changes before the building is occupied. Consider this standard when starting up the building using the optimal start program.

So, what is the optimal start and stop? The optimal start adjusts equipment start times based on the building demand. It considers outside conditions, interior conditions, and history. Not starting equipment earlier than necessary ensures proper comfort levels at occupied time, as well as energy savings, particularly during mild weather conditions. Modern BMS can provide this optimal start, but often, the program is disabled or needs modification to work correctly. This is especially true now with the new recommended building flush.

Note: Proper sensors to gauge outdoor air temperature, inside building temperatures, and outside air data are required to implement this strategy.

Optimal stop is adjusting the stop time based on the "flywheel" or "coasting" effect, to shut down equipment before unoccupied building hours. In one case study, a school district used this feature to shut down mechanical cooling / heating by 30 minutes for functions outside of scheduled classes, like PTA meetings. This not only saved energy but ensured meetings ended on time.

Note: It is important to keep ventilation fans running during optimal stop times to comply with the air changes per hour.

Variable frequency drives

Figure 5
S-flex VFD

Due to the installation cost, variable frequency drives (VFDs) can be considered an intermediate cost ECM. However, this strategy has a quick payback period of two years or less in most applications.

VFDs control the motor speed to match the required load and can be used for pumps and fans. Motor-installed VFDs should remain in "auto" position and not overridden in the BMS software. In working with clients over the years, good applications include installation on both constant and variable volume chilled water air handing unit fans, primary and secondary chilled / hot water pumps, cooling tower fans, and even centrifugal chillers.

The power consumed by the motor varies with the cube of the speed. Thus, it is the key to energy savings. Based on the actual HVAC load, a VFD can reduce substantial amounts of energy. For example, reducing the speed by 20 percent results in a 50 percent decrease in electric consumption.

VFDs can also be used as a motor "soft-start" to reduce mechanical stress and, depending on utility demand rate structure, demand- limiting cost savings.

Retro-commissioning

Retro-commissioning is the process of getting a building back to its original design in both operation and energy performance. This typically includes determining if the BMS' control sequence operates per the original design intent, including overridden programs. In addition, point-to-point sensor checkout and calibration should be performed to the manufacturer's recommendation.

In a study of 60 buildings, over 50 percent had control problems, 40 percent experienced HVAC equipment issues, 30 percent of the sensors were not operating correctly, and 25 percent of the economizer and VFDs did not perform as intended.

Retro-commissioning can save between 5 – 20 percent of a building's energy cost with a typical payback of one to two years. The latest BMS technology has software options to log sensor data and aide in retro-commissioning — helping benchmark energy costs against other buildings in the area.

Note: Building Owners and Management Association (BOMA) is a great resource to determine the average energy cost per square foot in your region based on building type.

Installing software tools to provide continuous proactive commissioning is an alternative to conducting a one-time retro-commission program. Running daily HVAC system checks ensures the entire system is operating as originally intended and sequenced. This system check is also referred to as HVAC "fault detection," where the program compares sensor data and operating conditions, and reports on:

Figure 6

Schneider Electric EcoStruxure Building Operation with Building Advisor

1. Avoidable energy waste
2. Comfort issues
3. Maintenance needs

Here is one example of a room temperature overview and building energy signature to help in retro-commissioning and fault detection analytics.

Intermediate cost ECMs

Advanced lighting control

A standalone occupancy sensor can be installed in place of the wall switch. This type of local control does have some drawbacks because it can be overridden or placed in a non-ideal location to detect motion. Bathrooms are a great example of a space where the occupancy sensor may turn off the lights while occupants are still in the restroom. Also, common areas are another example of a lighting zone that may turn off if occupancy is not detected.

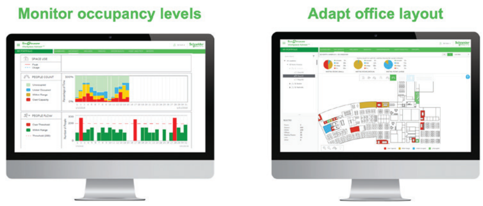
Managers can use occupancy-based sensors and BMS time-of-day light schedules for advanced control — enabling energy savings without impacting employee satisfaction and safety. The latest ASHRAE 90.1-2016 section 9 requires this level of advanced lighting control for both interior and exterior lights.

The next level of lighting control involves on / off control and dimming based on light levels. For areas exposed to outside daylight, blind control can provide best-in-class energy savings while improving employee satisfaction. Newer buildings may even have active glass technology on the exterior of the building that allows for controlling light levels based on sun exposure. The latest BMS technology allows employees to control their individual lighting and blinds from a mobile app to improve comfort and satisfaction.

Exterior lighting control can also be controlled with light level sensors and BMS time-of-day scheduling. ASHRAE 90.1-2016 requires external lighting power to be reduced by 30 percent after normal business hours and 50 percent for parking lighting power when there is no activity for a predetermined time frame.

Advanced occupancy-based control

In addition to the details noted in the low cost ECM section, HVAC controls can link with other systems like security card access, intrusion, camera systems, and workspace management systems, triggering the occupied mode.



Set capacity thresholds for room, floor or building level to know when the occupancy is exceeding limits.

Analyze how occupants are using individual & collaborative spaces to adapt the workplace mix of spaces.

Another integration strategy to lower energy costs connects conference room booking system software to the BMS' open API or mobile app. This allows more advanced control of HVAC systems to operate only when needed and to pre-condition the room. Doing so ensures occupant comfort at the start of the meeting. When the BMS knows when the room is booked, software can override the room occupancy sensor to ensure the lights stay on once it senses the first person entering the room. It can also open and close the blinds based on daylight level control. In addition, linking the BMS to the room or desk reservation system opens up the ability to send email, text, or app notifications to the cleaning crews. Lighting and blind control also complies with the 2015 International Green Construction Code Chapter 6, 605.1.1.1 & 608.5.

Simplify access to digital tools and information

Enable access to critical digital services in a unified app, for teams rotating back into office and those working from home.

IAQ dashboard

It's now possible to create real-time dashboards that visualize current IAQ and occupancy. The dashboard can appear in a lobby, on an operator's devices, and even on a mobile app. That transparency bolsters confidence among occupants that the building is actively monitoring IAQ and occupancy.

Advisory software, such as EcoStruxure™ Building Advisor, can integrate with existing third-party equipment.

Main building electric, water, and gas metering

Understanding building energy use requires real-time monitoring. Connecting the main building's electric, water, and gas meters to the BMS measures the energy use to create a baseline profile is recommended.

As the BMS monitors the building's utility usage, it can send proactive alerts when exceeding predetermined baselines. For example, many electric companies charge for demand (kW) based usage, and even have a "ratchet demand cost" penalty. This means you are charged your highest monthly demand (kW) over an extended period of time, even if you don't use that much energy. Some customers pay more on their electric bill for demand (kW) by hitting this peak penalty than from running the equipment.

Metering a building's energy data conforms to the 2015 International Green Construction Code Chapter 6, 603.3 and 603.5, for areas of the country that have

Figure 7

Electric, gas, and water meters with pulse signals to the BMS

adopted this code. The BMS must store this data for no less than 36 months in real-time at 15-minute intervals.

Central utility plant optimization

The central utility plant is typically the largest energy user in a building or campus. It is not uncommon to have over 30 percent of the power required to run a building consumed at the central utility plant.

Improving the efficiency of the central plant can have a significant effect on energy savings, cost savings, and sustainability.

Optimizing a central plant begins with assessing the state and capabilities of the key energy consumers. These items may include:

- Water-cooled chillers / compressors
- Air-cooled chillers / compressors
- Chilled water and condenser water pumps
- Cooling tower fans and pumps
- Heating hot water / steam boilers
- BMS control of the central plant
- Energy codes and required standards

While assessing these components, it is important to note several key parameters of the existing equipment.

- Age: When equipment is near the end of its lifecycle, newer, more efficient equipment may be the best choice (this topic is covered in advanced cost ECMs). If the equipment is more current, reviewing how the equipment is used and modifying its operation may be the most effective choice.
- Capacity (horsepower / tonnage / BTUs, etc.): Knowledge of the equipment capacity helps determine the answer to several important questions. Is there enough cooling capacity for the load in the building? Is there too much cooling capacity with current occupancy levels?
- Mechanical state: Running a central plant at optimal efficiency requires well-maintained equipment. If the equipment is poorly maintained, it may not respond to the demands of a new sequence of operations.
- Overall serviceability: Optimizing a central plant will, in most cases, involve modifications to the sequence of operation in how the chillers, pumps, towers, and boilers operate. Is the equipment in place up to the task? Are there spare and replacement parts available for the existing equipment? Many older central plants have chillers that are using older and, in some cases difficult-to-source refrigerant. Is this a time to consider upgrading to a more environmentally friendly refrigerant?

As an example, consider a building with an existing 1,000-ton chilled water central plant. In the original design, 1,000-tons of cooling was needed to condition the space at 100 percent occupancy. In a partial return to work scenario, another option is "partial load efficiency." In this case, a building may operate for extended periods of time at less than full capacity. How efficient is this central plant (kW / ton) when running partially loaded?

Strategies to consider in converting controls of the central plant:

- Programming variable speed flow on both the chilled and condenser water pumps
- Configuring a primary / secondary loop chilled water pumping sequence
- Implementing chilled water temperature setpoint reset. The ideal delta temperature across the chiller is 12 to 14 degrees.
- Instituting adaptive control logic and equipment staging with the BMS, factoring in occupancy and environmental conditions (this is also important when limiting a new demand (kW) peak during equipment startup)

By integrating the central plant BMS to share data with other smart building technologies like power management, workplace management, and fault detection, you can gather information on how the space needs to be conditioned based on utilization. Logic can then react to this data on a real-time basis. The overall goal of optimizing a central plant is to minimize energy consumption (kW / ton) while still satisfying the required building environmental conditions.

We recognize that some of the measures associated with central plant optimization may involve a higher degree of cost. It's important to be aware of the Coronavirus Air, Relief, and Economic Security Act of 2020 (CARES Act). The CARES Act provides various tax benefits to building owners for HVAC improvements and other non-structural building upgrades. In addition, many electrical utilities have rebate programs in place to fund central plant efficiency upgrades. These tax benefits and rebates can improve the return on investment (ROI) for implemented ECMs.

Advanced cost ECMs

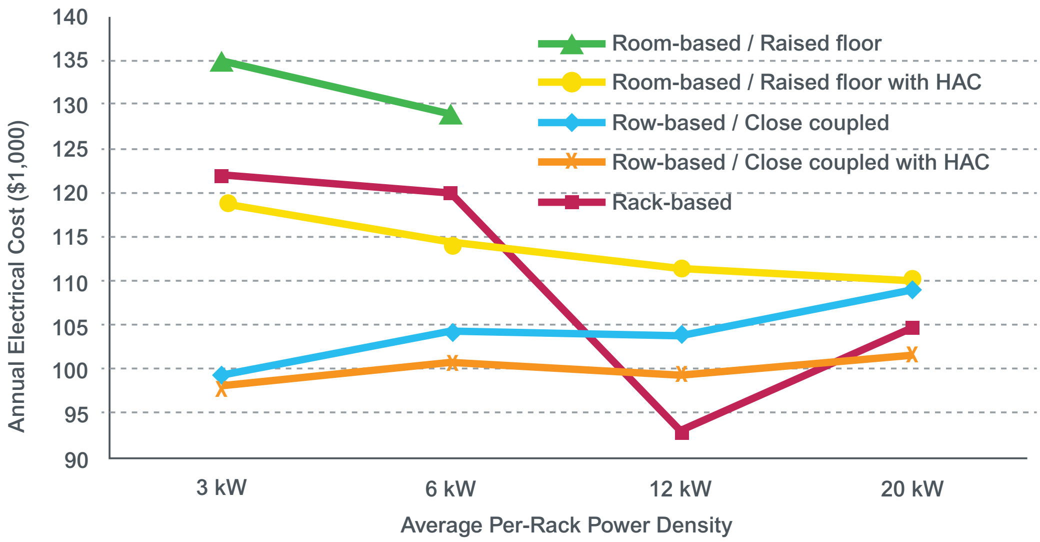
High-efficiency HVAC equipment

Installing high-efficiency HVAC equipment in a new building or replacing older systems will save energy but the payback period typically exceeds five years. Sometimes, this makes financial sense, such as with old chillers. For example, replacing a 20-year-old chiller with a new high-efficiency unit reduces energy use, provides environmentally friendly refrigeration, and lowers maintenance costs. The more the building operates, the better the return on investment. A mechanical engineer can help determine the lifecycle cost.

Another application involves replacing older computer room air condition (CRAC) units with newer technology such as in-row computer cooling. In-row computer cooling also helps data centers eliminate the need for a raised floor system, saving capital costs.

An article by ENERGY STAR®, "Install In-Rack Or In-Row Cooling — The Limitations Of Room-Based Cooling Solutions," and the Schneider Electric white paper "Choosing Between Room, Row, And Rack-Based Cooling For Data Centers" both describe this method of IT rack cooling, and how it can save more than 50 percent in fan power consumption.

The chart below illustrates the low annual cooling costs associated with in-row-based cooling.



Modernized BMS

Advanced BMSs provide more visibility and control over abuilding's conditions than legacy systems. Not only are these modern BMSs likely to have more rigorous cybersecurity protection, they also enable sophisticated capabilities when it comes to IAQ monitoring and energy efficiency.

Modernizing your BMS isn't a big expense when implementing alternative funding options such as a service and modernization plan, energy credits, and performance contracting.

Submetering and energy monitoring

In addition to the "main building" monitoring described in intermediate cost ECMs, there are opportunities to identify other sources of excess energy usage by submetering individual energy loads. Submetering allows for granular monitoring of electrical, gas, water, steam, and other systems to help benchmark baseline performance, detect anomalies, and set alarms.

Here are a few examples:

1. Chilled or hot water plant BTU usage monitoring to measure complete system efficiency
2. Cooling tower makeup water flow to detect excessive usage
3. Tenant electrical meter load(s) for billing energy usage

ASHRAE 90.1 and the International Green Construction Code require submetering to determine electric usage, broken down by lighting, plug, and HVAC loads. One of the most inexpensive and low-risk methods to meter electric usage per source involves designing meter intelligence into the electrical gear at the factory. Advances in technology now include electric circuit breakers and electric trip units with built-in intelligence such as energy usage (kW/kWh), without the need for a downstream external meter. This saves material duplication costs and lowers the project risk because it is factory-commissioned.

In addition to energy code requirements, other certifications like LEED score points for monitoring systems like rainwater, landscape water, domestic water, and geothermal water. Another example is ASHRAE 90.1 2016 Chilled Water Plant Monitoring section, which requires new and existing plants to measure electric efficiency based on kW / ton cooling operating efficiency. This requirement involves metering the chillers and pumps electric current draw and BTU energy data to comply.

Conclusion

This document provided practical guidance on preparing a building system for return to work. It offered details on the benefits of IAQ, as well as possible improvements to enhance IAQ and increase employee safety and wellness. It also addressed the ECMs that can offset the energy of these return to work strategies.

Using the verification and IAQ scoring tools such as the ARC reentry benchmarking platform affiliated with the U.S. Green Building Council and the International WELL Building Institute will help reassure occupants the building meets current safety standards. There are systems available that can link the data from an existing BMS' IAQ and occupancy sensors directly into the ARC reentry platform to help with building scoring and occupant visibility.

To perform at peak operating levels, healthy building technologies must be extensively integrated. Accomplishing this includes:

- Adopting high-efficiency standards provided by ASHRAE, LEED, and the International Green Construction Code to meet or exceed local energy codes
- Using the guidelines outlined in "The Building Operator's Guide To Keeping Occupants Safer And Healthier" and "Efficient Buildings In Unprecedented Times: 15 Steps For Efficient Low-Occupancy Buildings"

Further, ongoing commissioning is a needed to keep track of potential energy savings and occupant health issues. A useful software tool for continuous buildings commissioning is HVAC fault detection, which offers early identification of safety, comfort, and energy problems. In addition, verification tools such as the ARC reentry benchmarking platform and the UL Verified Healthy Buildings Program help reassure occupants that the building is ready for their return.

A final note — a professional engineer and associated service provider should be included in the review when changing a building's original design. It is also a best practice to include a test and balance company, building automation system "master system integrator," and other construction-related contractors in the review. As noted in "Ensuring Occupant Health: Key Findings And Insights From Global Study Of 21 Office Buildings," occupants don't always understand the technical nature of how health and wellbeing factors affect individuals. However, architects, engineers, and the real estate community do, and their expertise is highly valuable.

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