

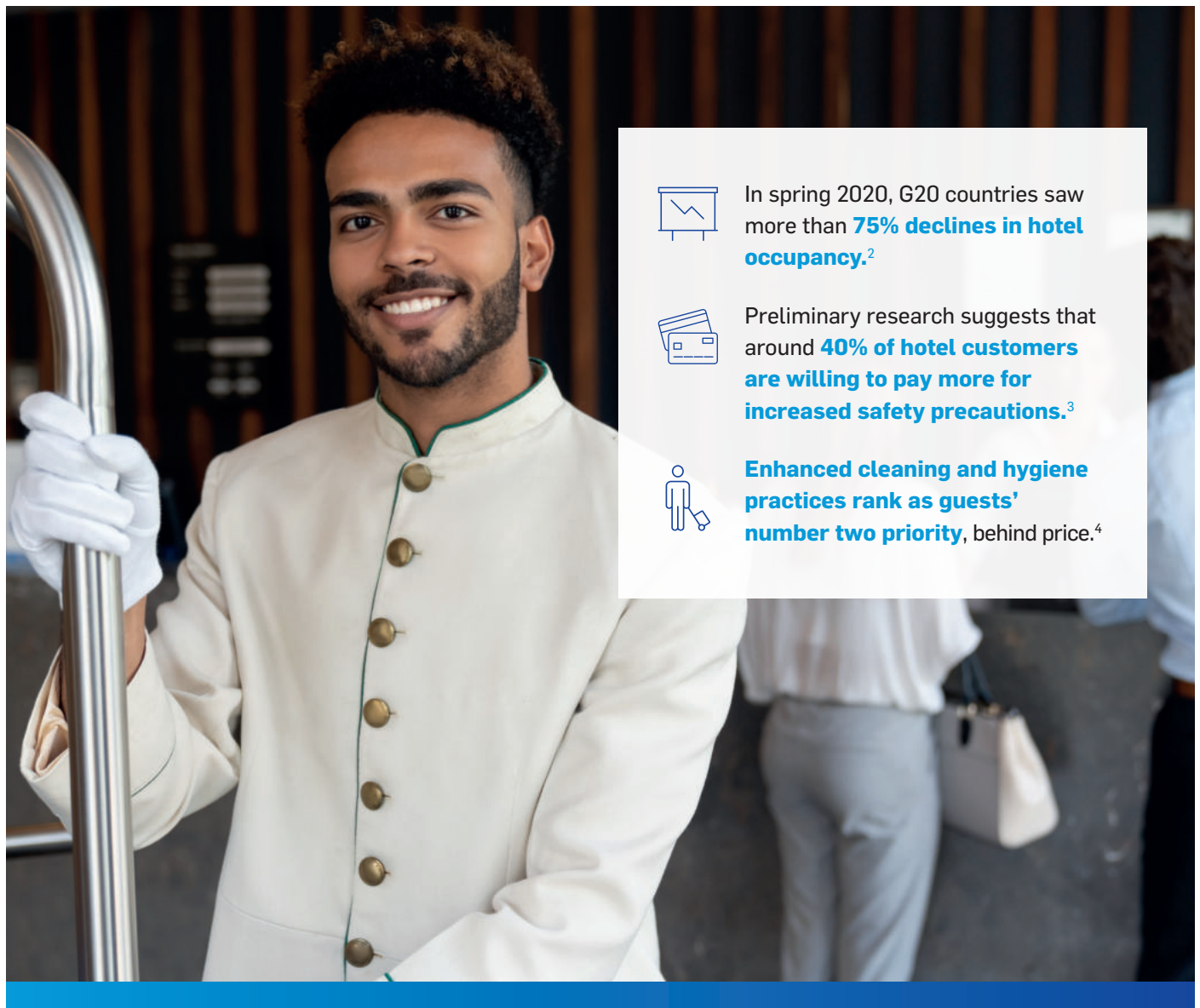


INSIGHTS INTO HEALTHIER INDOOR ENVIRONMENTS: HOSPITALITY

The hospitality industry has been one of the hardest hit by the COVID-19 pandemic. As hotel owners and operators look to rebound from historically low occupancy rates, they must address safety concerns to restore guest confidence – and healthy building strategies are a key. A healthier indoor environment can help promote guest and employee safety in the short term, while enhancing the guest experience well into the future.

THE NEED

The ability to safely welcome back guests is critical to the very survival of many hotels and the financial well-being of the millions of people they employ. Current evidence has not identified hotel buildings among the highest-risk environments for COVID-19 transmission or superspreading events.¹ Still, hotels must improve perceptions of real and perceived safety concerns through risk reduction strategies and education in order to attract customers to visit.²



In spring 2020, G20 countries saw more than **75% declines in hotel occupancy.**²



Preliminary research suggests that around **40% of hotel customers are willing to pay more for increased safety precautions.**³



Enhanced cleaning and hygiene practices rank as guests' number two priority, behind price.⁴



THE QUANTIFIABLE BENEFITS OF HEALTHIER HOTELS

Creating healthier indoor environments is essential to combating the spread of COVID-19 and continuing to reopen the industry. But research has shown the benefits go beyond infection control. Factors including humidity, lighting, noise and even a sense of security can impact guest sleep, concentration and overall health. With this in mind, addressing the challenges of the COVID-19 pandemic also presents opportunities to improve the guest experience and deliver on shifting expectations moving forward.

HEALTH AND INFECTION CONTROL

Low humidity can **increase virus survival time in the air.**⁵

Touchless access may be highly visible and reduce customers' perceived risk. The use of mobile and kiosk check-in machines also facilitates distancing and minimizes personal interaction.⁶

SLEEP QUALITY

There is a body of literature that supports that **air temperature may be associated with sleep quality.**⁷ In fact, common complaints from hotel guests include difficulty regulating room temperature.

One of the greatest potential impacts of lighting, both during the day and at night, is its effect on sleep. It is well studied that **providing enough light at the right time of day (e.g., in the morning) may improve sleep quality.**⁸

SECURITY AND STRESS

When the body's sense of security is threatened, a cascade of biological **"flight or fight" responses are triggered**, producing stress-induced hormones like adrenaline and cortisol.⁹

Over time, **elevated levels of these hormones in the body can suppress the immune system** and exacerbate other inflammatory conditions.¹⁰



ASSESSMENTS



UPGRADES

ACTIONABLE STRATEGIES AND SOLUTIONS

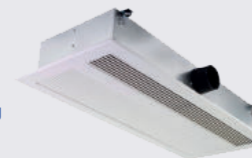
There is no single strategy for creating and sustaining healthier hotel environments. **Carrier can help inspire confidence in returning to normal with a layered defense approach, implementing all levels of control strategies**, which can help reduce risk and maximize benefits.

For engineering controls, Carrier can provide expert guidance to help support hospitality customers with solutions and services for the entire lifecycle. We've outlined a few specific areas here.

VENTILATION

Strategies

- Buildings should eliminate or reduce air recirculation – improving the intake of fresh outdoor air – to the greatest extent possible.
- The use of active chilled beams for building air conditioning can provide the opportunity to achieve low sound levels since fans or compressors are not located in or near occupied spaces.¹¹



Solutions

- Our rooftops unit (RTU) can improve the intake of fresh outdoor air, providing a reliable, flexible and energy-efficient solution for healthier indoor environments.
- Our air handling units (AHU) provide a cost-effective improvement by inhibiting bacterial and microbial growth on the interior of the unit.



FILTRATION

Strategies

- In buildings with mechanical ventilation systems, existing filters can be upgraded to filters with efficiency ratings of at least F7 (ePM2.5 >65%), and up to the highest fine particle classification or even HEPA filters, if the available pressure drop of the system enables.
- Portable air cleaners with high-efficiency particulate air (HEPA) filters may be useful to supplement fresh and clean air and reduce exposures to airborne particles.

And because potential viral sources could be in various locations within a room, it may be beneficial to have several units that meet the target clean air delivery rate (CADR) values rather than a single larger unit. Portable units are also recommended when budget constraints prevent other recommended capital improvements.



Solutions

- Carrier filtration technologies include various ePM filters and HEPA filters for particulate matter. Carrier also offers devices using UVC light, which are intended to target pathogens, and UV photocatalytic oxidation to help remove volatile organic compounds and improve indoor air quality (IAQ).
- Carrier's OptiClean™ air scrubber uses HEPA filtration to provide cleaner indoor air.* An easy way to supplement an HVAC system without replacing or modifying existing equipment, the OptiClean plugs into a standard outlet and can be easily rolled into guest rooms or other areas of a hotel.



*HEPA filter is 99.97% effective for particles that are 0.3 microns or larger.



CONTROLS AND SERVICES

Strategies

- **Ensure that there is adequate ventilation and filtration** through a process of commissioning and testing. Commissioning and testing should be performed by trained individuals and should be performed at regular intervals.
- **Testing can be done through the use of low-cost IAQ monitors.** If CO₂ concentrations are measured at levels below 1,000 ppm while facilities are occupied, then the outdoor air ventilation is likely performing according to acceptable minimum standards. Higher CO₂ concentrations may indicate that other strategies for increasing outdoor air ventilation are necessary.
- To promote healthy indoor environments, **real-time monitoring for a variety of pollutants and IAQ parameters** including (but not limited to) carbon monoxide, ozone, volatile organic compounds, formaldehyde and other aldehydes, temperature, humidity, noise and light are recommended.

Solutions

- **Remote Airside Management** provides continuous validation of IAQ parameters, periodic checks of equipment health and continuous airside commissioning, enabled by a command center.

- Hotels should implement **multi-parameter IAQ monitoring** to baseline performance, identify deficiencies and enable demand control ventilation for specific contaminants of concern. IAQ monitoring can also confirm the effectiveness of filtration and air purification in the building.

- **Carrier's best-in-class BluEdge® service platform** offers indoor air quality assessments, wellness services, retro-commissioning and more. As a result, hotels can operate at their peak performance, providing lower energy and maintenance costs and a more productive, healthier building environment.



PREDICTIVE MAINTENANCE

- Remote connection through BMS manages IAQ and ventilation in line with best practices
- Make changes and fix issues remotely
- Optimize maintenance and operational costs
- 24 x 7 command center



HVAC EUROPEAN DIGITAL PORTAL (ABOUND™ HVAC PERFORMANCE)

- Provide advanced remote analytics
- Optimize energy efficiency, equipment uptime, occupant comfort and operational productivity
- Actionable insights by different communication protocols
- Optimize autonomously or through a remote application



RETROFIT SPARE PART SOLUTIONS

INNOVATIVE TECHNOLOGIES

- M5 filters
- New filtering media technologies
- High filtration efficiency of PM2.5 particles

ADD-ON RETROFIT ALTERNATIVES

- AHU-UVC add-on kits
- Carbon surface & F7 filtering technology options
- Add-ons are easy to install in the universal frames of existing AHUs
- Effective against viruses, bacteria, small particles and VOCs

RANGE OF FILTRATION SOLUTIONS

- High-efficiency filtration solutions
- A large variety of air filters
- Solutions for our full product range (AHU, RTU, TFCU)
- More than 1300 references of air filters to cover all sizes / filtration needs

THE BOTTOM LINE

A positive guest experience has always been critical to the success of any hotel property. Now, as the industry looks to navigate through and recover from the global COVID-19 pandemic, healthy building solutions and strategies will drive those experiences and ensure the health and safety of guests and employees. To learn more about healthy building solutions and strategies for hospitality, [connect with a Carrier expert today.](#)

¹ Baker, Peckham and Seixas (2020)

² Shin and Kang (2020)

³ Gursoy and Chi (2020)

⁴ American Hotel and Lodging Association's State of the Hotel Industry (2021)

⁵ Kudo et al. (2019); Marr, Tang, Van Mullekom and Lakdawala (2019); Morris et al. (2020)

⁶ Shin and Kang (2020)

⁷ Lan, Pan, Lian, Huang and Lin (2014)

⁸ Boubekri, Cheung, Reid, Wang and Zee (2014); M. G. Figueiro et al. (2017); M. Figueiro and Rea (2016)

⁹ Widmaier, Raff, Strang and Vander (2008)

¹⁰ Khansari, Murgo and Faith (1990); Padgett and Glaser (2003)

¹¹ Alexander and O'Rourke (2008); Murphy and Harshaw (2011)

