



# Energy-Related Changes in Office Buildings Following the COVID-19 Pandemic

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## Executive Summary

This report describes energy-related changes to 68 office buildings following the COVID-19 pandemic. The data come from an exploratory, web-only survey conducted in 2023 with a convenience sample.<sup>1</sup> We conducted the survey to learn about changes to commercial buildings brought about by the COVID-19 pandemic. The results inform questionnaire development for the next *Commercial Buildings Energy Consumption Survey* (CBECS). The results do not represent the commercial building population in the United States.

We found that the number of people decreased in many of the responding office buildings, especially in large office buildings and office buildings with multiple businesses or organizations. The decreases were often the result of transitions to working from home and virtual meetings. Although we did not design our survey to find office vacancy rates, some respondents reported that tenant vacancies affected occupancy. For some administrative and professional office buildings, fewer employees also reduced the number of energy-consuming office devices, such as computers, printers, and photocopiers. We may expect that fewer people and office devices in office buildings could lead to lower energy costs. However, most respondents to our survey reported that energy costs increased.

The office building type may be related to the effects of working from home. The number of employees in the building from day to day varied “a lot” among more respondents for administrative and professional offices than for all other office types combined. We also found that more respondents for administrative and professional offices reported decreases in office devices, such as computers and printers, because employees were working from home more than all other office types. Other office types include government offices, medical offices, mixed-use offices, banks or other financial institutions, call centers, city hall or city center offices, and nonprofit offices.

Respondents for office buildings described changes to their building’s heating, ventilation, and air conditioning (HVAC) systems and to air filtration. Almost half reported a change in air filtration. For office buildings with filters with Minimum Efficiency Reporting Value (MERV) ratings, filters were often upgraded to rating 13, which is consistent with recommendations by the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE). Also consistent with ASHRAE recommendations, some office buildings rebalanced or adjusted HVAC settings to increase total airflow. Some increased the intake of outside air beyond minimum settings.

A few respondents provided reasons for the HVAC changes they made in response to the COVID-19 pandemic. For example, respondents mentioned health and safety recommendations from experts or from certifying entities. Our survey asked about changes from 2019 to 2023, and how long these changes will persist remains unclear.

We found that adding portable air cleaners to office buildings was not common. Less than one-quarter of respondents for offices reported that they added at least one portable air cleaner. Adding between

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<sup>1</sup> A convenience sample is a nonprobability-based sample in which sample units are chosen because they are easily accessible, available, or willing. The starting sample of about 16,000 people used for this survey was comprised of people who were easy to contact using email.

two and five portable air cleaners was most common among the offices in our responding sample that added them.

Although our survey did not ask direct questions about building automation systems (BAS), we found that some respondents from large office buildings described the impact of BAS on energy consumption. Many of these systems respond to occupancy changes. As occupancy patterns change, systems that automatically adjust for the presence or absence of people take on greater importance in energy management.

## Background and Motivation

The COVID-19 pandemic may have brought about lasting changes in commercial buildings, so we want to make sure that our questionnaire for the next *Commercial Buildings Energy Consumption Survey* (CBECS) includes relevant measures. We administered this survey to prepare for the next CBECS collection. The exploratory survey had two primary goals:

- To learn about changes in commercial building equipment, space usage, and practices that affect energy consumption patterns
- To learn what information is difficult for commercial building respondents to provide

Across the responding sample of 271 buildings, we found more office buildings than any other building type. Although this sample does not represent all commercial buildings nor all offices, we found patterns in the data related to offices. We compiled major findings about the office buildings in our responding sample ( $n=68$ ) to share with the public.

## Methods and Limitations

We used a convenience sample<sup>2</sup> to conduct the survey. The results from the survey are neither generalizable to the U.S. commercial building stock nor to U.S. office buildings.

We used data we gathered during the 2018 CBECS to send this survey's invitations. We contacted people to complete the survey who were affiliated with sampled commercial buildings from the 2018 CBECS for whom we had an email address. About 3% of all emails resulted in a survey response.

We had an email address if interviewers for the 2018 CBECS collected one while visiting the building. Because interviewers for the 2018 CBECS were often in contact with people at sampled buildings who ultimately refused to participate, almost one-half of the email addresses (44%) corresponded to a nonresponding sample unit from the 2018 CBECS collection.

We programmed and administered the survey using Qualtrics, an online survey software. In the first month of data collection, we sent email invitations to over 8,000 people using the primary or only email address on file for CBECS sample buildings. In the second month of data collection, we sent email invitations to secondary email addresses, when available, for buildings for which we had not received a response. In some cases, the secondary email addresses were for a second person affiliated with the building. In other cases, the secondary email addresses were alternative spellings or second email addresses for the same person we contacted in the first month. No two email addresses were contacted about the same building in the same month. For most people, we knew the corresponding building address. When we had the building address, we used it in survey invitation emails.

As a convenience sample, the survey sample was not designed to represent all commercial buildings or their respondents. Buildings that were easier to contact for CBECS are in the sample because we have

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email addresses for them. Further, we received more responses from people who responded to the 2018 CBECS collection than from people who had not responded. You can find more information about the CBECS sample on our webpage, [How We Chose Buildings for the 2018 CBECS](#). If we had compiled the convenience sample for the survey in another way, the results in this report may have been different.

One other limitation of these results relates to measurement error. We designed our survey to measure persistent changes in buildings, that is, changes that have continued since the COVID-19 pandemic. However, several write-in responses led us to conclude that the reference period for questions was not consistently interpreted among respondents. Some respondents reported to us in open-ended responses that the changes in building practices that they identified in the closed-ended questions were no longer taking place. Because we have no measure of how consistently respondents interpreted the intended reference period of the survey, we cannot quantify this potential measurement error.

### **Characteristics of offices in the responding sample**

The results in this report represent only the sample of 68 sufficiently completed surveys<sup>3</sup> about offices that we received. These results do not represent the U.S. commercial office building stock.

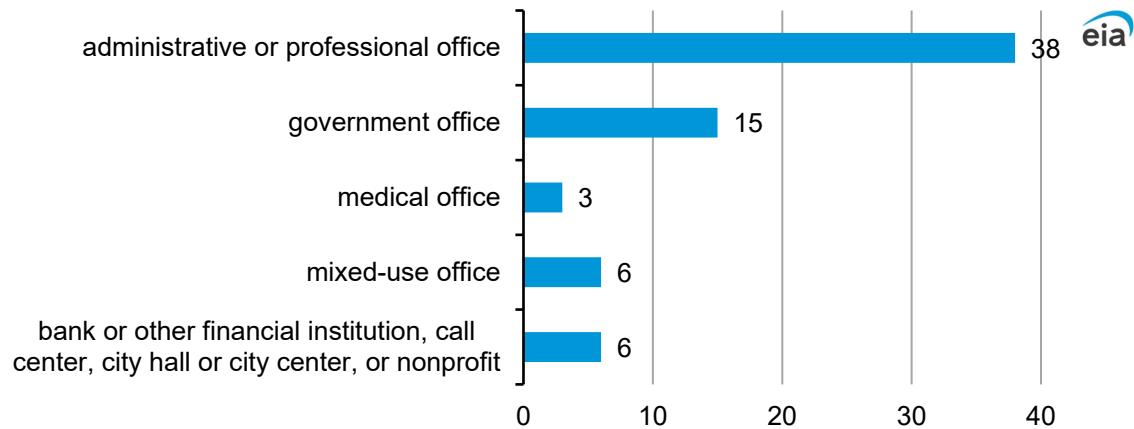
Most offices in the responding sample (38 of 68) were administrative or professional office buildings. Fifteen were government office buildings. Three buildings were medical offices, which means that the business or organization occupying the space provided medical services without using diagnostic equipment such as x-ray machines.<sup>4</sup> Six buildings were mixed-use offices. Six buildings were another type of office, including bank or other financial institution, call center, city hall or city center, or nonprofit (Figure 1).

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<sup>3</sup> All but two office building respondents completed all questions in the survey. Two respondents responded to only the first half of the survey.

<sup>4</sup> You can find more information about medical offices and outpatient health care buildings in [CBECS Building Type Definitions](#).

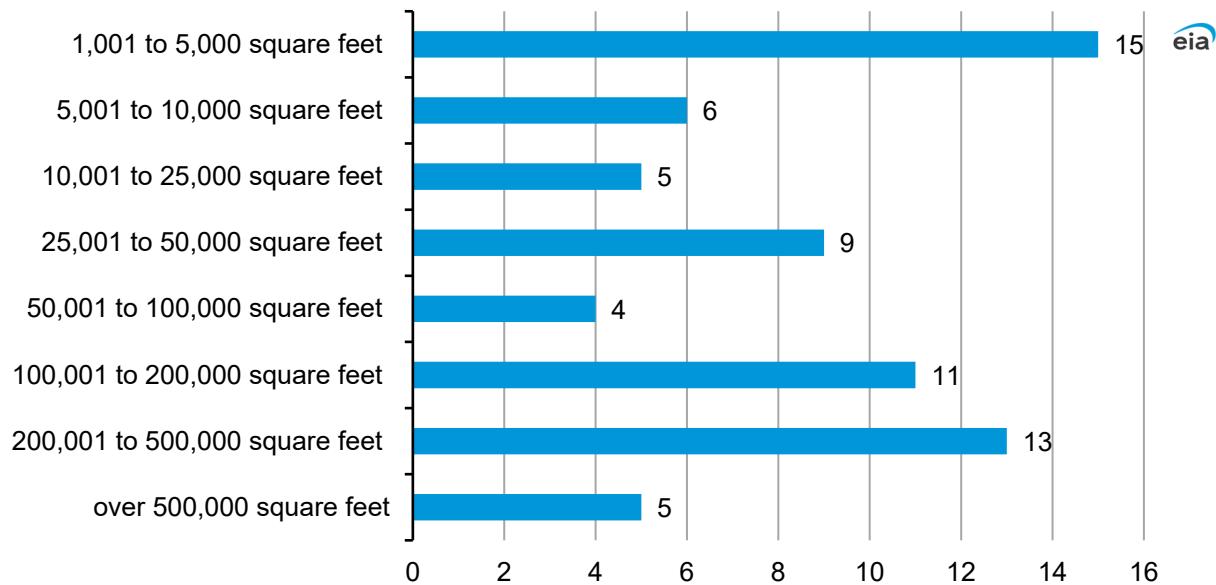
**Figure 1. Types of office buildings in responding sample**  
number of buildings



Data source: U.S. Energy Information Administration, 2023 exploratory web survey conducted by the *Commercial Buildings Energy Consumption Survey* program

The office buildings in the survey vary in size. Over one-third of offices (24 of 68) were between 100,000 and 500,000 square feet. Fifteen of the offices were in the smallest size category, between 1,001 and 5,000 square feet. Fewer than 10 offices fit into any one other size category (Figure 2).

**Figure 2. Size categories of office buildings in responding sample**  
number of buildings

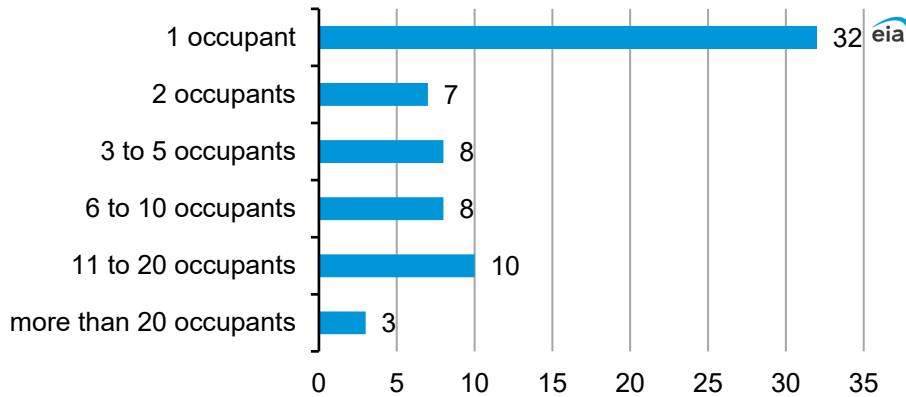


Data source: U.S. Energy Information Administration, 2023 exploratory web survey conducted by the *Commercial Buildings Energy Consumption Survey* program

Almost half of the office buildings (32 of 68) were single-occupancy buildings. Others ranged from having 2 occupants to more than 20 occupants (Figure 3).

**Figure 3. Number of businesses or organizations occupying each office building in responding sample**

number of buildings



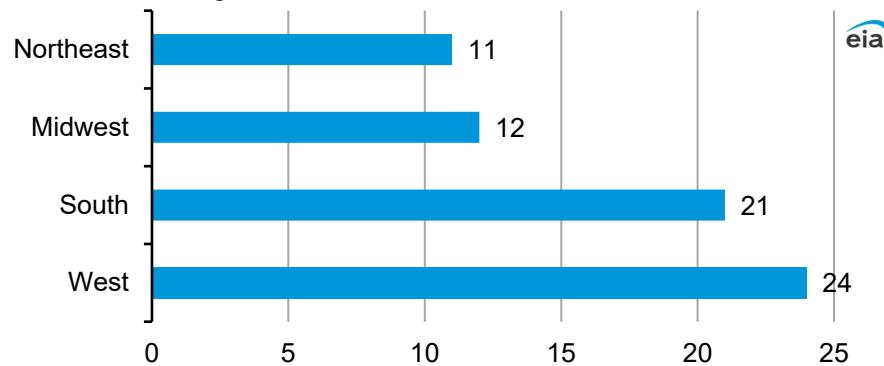
Data source: U.S. Energy Information Administration, 2023 exploratory web survey conducted by the *Commercial Buildings Energy Consumption Survey* program

About one-third of the offices in the sample (22 of 68) were on a campus of some kind (not shown in a figure). The exploratory survey did not collect information about the type of campus, although the buildings were likely on office campuses and education campuses.

Offices in the sample of responding buildings were distributed somewhat evenly across the country. However, more buildings were in the West (24 of 68) and the South (21 of 68) than in the Midwest (12 of 68) or the Northeast regions (11 of 68) (Figure 4).

**Figure 4. Census regions of office buildings in responding sample**

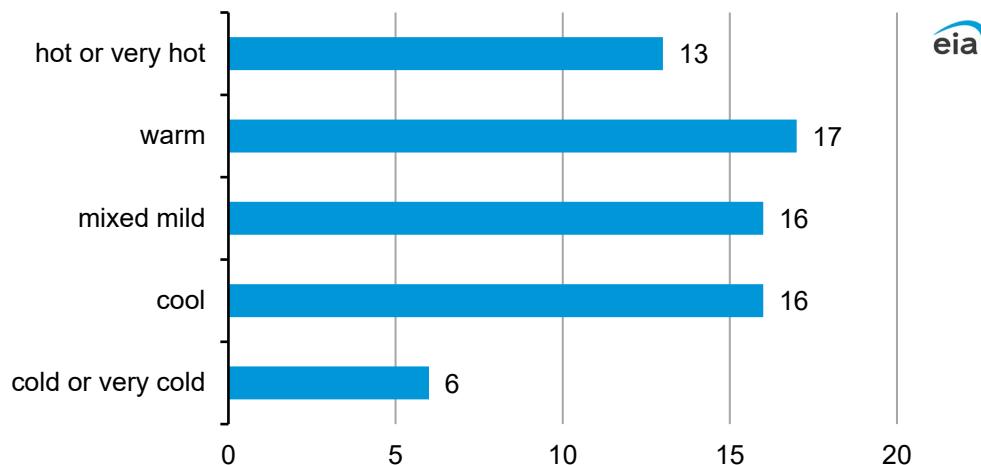
number of buildings



Data source: U.S. Energy Information Administration, 2023 exploratory web survey conducted by the *Commercial Buildings Energy Consumption Survey* program

Buildings were placed into the same climate zones<sup>5</sup> used in the 2018 CBECS. Although only six offices were in the cold or very cold climate zone category, at least 13 buildings were in each of the other four climate zone categories: hot or very hot, warm, mixed mild, and cool (Figure 5).

**Figure 5. Climate zones of office buildings in responding sample**  
number of buildings



Data source: U.S. Energy Information Administration, 2023 exploratory web survey conducted by the *Commercial Buildings Energy Consumption Survey* program

## Results

### Employees

#### *Number of employees in office buildings*

We asked, “Is the number of employees in this building during a typical shift higher, about the same, or lower now in 2023 compared to before the pandemic began in 2019?” We provided the following response options:

- Higher number of employees in this building in 2023 compared to 2019
- About the same number of employees in this building in 2023 compared to 2019
- Lower number of employees in this building in 2023 compared to 2019

We found that the number of employees in almost one-half of office buildings (30 of 66) in our responding sample decreased following the pandemic. All but 1 of the respondents for these 30 buildings confirmed that the decrease was the result of employees working from home that began during the pandemic.

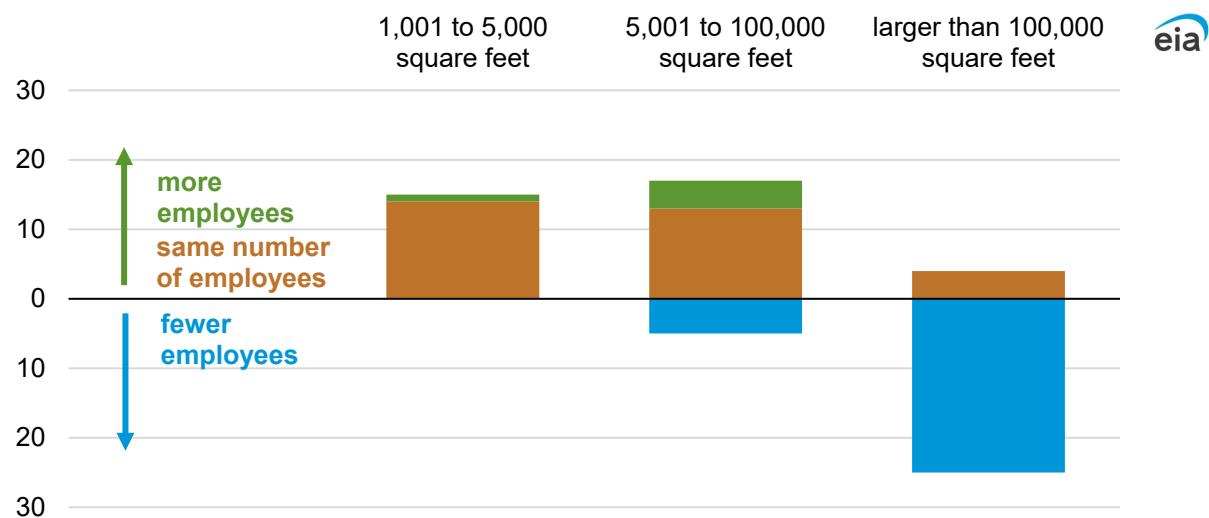
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<sup>5</sup> For 2018, CBECS used [climate zone categories](#) based on groups created by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) as designated in ANSI/ASHRAE Standard 169-2021, *Climatic Data for Building Design Standards*.

A similar number of respondents to the question (31 of 66) reported that the same number of employees were in the building. Five respondents reported that the number of employees in the building was higher in 2023 than in 2019, including one building that provided coworking office space for workers employed by different businesses.

The number of employees in small office buildings was much less affected by the pandemic than the number of employees in larger office buildings in our responding sample. Out of the 15 office buildings sized 1,001 to 5,000 square feet, the number of employees stayed the same in 14 of them. However, out of the 29 office buildings larger than 100,000 square feet, 25 reported a lower number of employees. Results from the 24 mid-size offices (5,001 to 100,000 square feet) were mixed (Figure 6).

**Figure 6. Responses to question about the number of employees in the building during the main shift in 2023 compared with 2019, by office building size category**  
number of buildings



Data source: U.S. Energy Information Administration, 2023 exploratory web survey conducted by the *Commercial Buildings Energy Consumption Survey* program

This same pattern held true for the number of businesses or organizations in the building. Among the 32 office buildings with only one business or organization, the number of employees stayed about the same in about two-thirds of them ( $n=20$ ). Conversely, about one-half (7 out of 15) of office buildings with two to five businesses or organizations and about three-quarters (17 of 21) with six or more businesses or organizations, reported a change in the number of employees.

### *Number of employees in offices and costs of energy*

Our survey asked, "Overall, have you noticed a change in the energy bills since 2019? Please consider the energy bills for all sources, including electricity, natural gas, propane, fuel oil, and district heat." We provided the response options:

- The overall cost of energy has increased since 2019.
- The overall cost of energy has decreased since 2019.
- No change in the overall cost of energy since 2019.
- Don't know.

Over one-half of office building respondents who answered the question (38 of 66) reported higher energy costs, compared with 9 respondents who reported lower costs and 13 who reported no change. Of the nine respondents reporting lower energy costs, all but two (7 of 9) reported fewer employees in the office.

We asked, "Do you think the change in energy bills is due mostly to changes in this building, changes in the cost of the energy source(s), or changes in both?" Five of the seven respondents with fewer employees and lower costs attributed changes in energy bills to changes in the building. The other two attributed the lower costs to both changes in the building and changes in energy source costs. One respondent wrote, "...as a result of vacant floors, we changed the number of operating hours for unoccupied floors. Also, for occupied floors, we reduced the exchanges of air for most floors because the number of employees decreased."

Although nine office respondents reported lower energy costs, most reported higher costs. This trend was true for many of the offices, even when the number of employees working in the building had decreased. One respondent wrote, "The energy we spend is less useful as the buildings are not fully occupied but HVAC systems remain the same size."

### *Day-to-day variability in number of employees in the building*

We asked, "Thinking of times when the building is open, how much does **the number** of employees inside the building change from business day to business day?" We provided the response options:

- A lot
- Some
- A little
- None

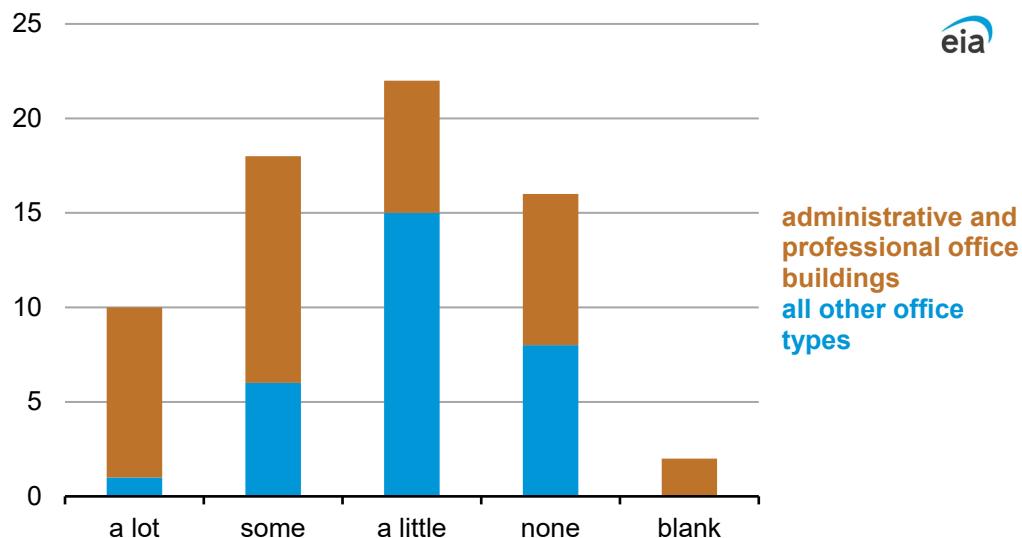
Overall, almost one-third of the offices in our responding sample (22 of 68) selected "a little." About one-quarter selected "some" (18 of 68), and another one-quarter selected "none" (16 of 68). Ten buildings, about 15% of the responding office sample, chose "a lot."

We found differences in day-to-day variability in the number of employees in the office when comparing administrative or professional office buildings with all other office buildings, which includes:

- Government offices
- Medical offices
- Mixed-use offices
- Banks or other financial institutions
- Call centers
- City hall or city center offices
- Nonprofit offices

Compared with all other subcategories of offices, a larger number of administrative and professional office building respondents reported that the number of employees in the building changed “a lot” from day to day or changed “some” from day to day. Nine of the ten office building respondents who chose “a lot” were reporting about administrative or professional office buildings. Twelve of 18 building respondents who selected “some” were reporting about administrative or professional offices (Figure 7).

**Figure 7. Responses to question about day-to-day variability in number of employees in building, by type of office building**  
number of buildings



Data source: U.S. Energy Information Administration, 2023 exploratory web survey conducted by the *Commercial Buildings Energy Consumption Survey* program

### Nonemployees in office buildings

Office buildings can have occupants who are not employees. For instance, customers may come for administrative services, other workers may come for meetings, or there may be ground-level food service that is open to the public. We asked, “Next, we have a few questions about the number of **non-employees** in this building. By non-employees, we mean customers, clients, guests, patients, members of the public, and other visitors to this building. Is the number of non-employees in this building during a

typical day higher, about the same, or lower now in 2023 compared to before the pandemic began in 2019?" We provided the same response options as for the question about employees, allowing respondents to tell us if the number was about the same, higher, or lower. Nonemployee occupancy in office buildings was less affected by the pandemic than the occupancy of employees.

Of the 66 office buildings for which nonemployee occupancy was reported, the number stayed about the same in two-thirds (n=44). Nonemployee occupancy was lower in less than one-quarter of the office buildings in our responding sample (n=16), and respondents reported that the decreases were due to the COVID-19 pandemic in 15 of those buildings.

Similar to employees, nonemployee occupancy was predominantly affected by the pandemic in large buildings. Of the 16 office buildings that reported lower nonemployee occupancy, 14 were larger than 100,000 square feet.

For those with lower nonemployee occupancy, respondents provided reasons for the decreases, such as videoconferencing and in-person services moved to online or telephone services. For example, one respondent wrote, "More customers contacted the office either by phone or online to conduct business in the office that previously had been done in person." Another wrote, "All of our services to the community were put online for processing, eliminating the need to come on site." Two respondents cited tenants vacating, which led to fewer visitors to the office.

## Office devices

The number of office devices decreased in administrative and professional office buildings in our responding sample because more employees were working from home. We asked, "Now we have a few questions about some of the equipment in this building. Since 2019, has the number of office devices such as computers, printers, and photocopiers in this building changed at least partly because of the COVID-19 pandemic?" We provided the response options:

- The number of office devices changed since 2019, but not because of the COVID-19 pandemic.
- The number of office devices changed since 2019 because of the COVID-19 pandemic.
- The number of office devices has stayed about the same since 2019.

Anyone who chose one of the first two responses was asked, "Please describe in your own words why the changes in the number of computers, printers, photocopiers, and other office devices happened."

Twelve respondents from administrative or professional office buildings (12 of 38) provided responses related to fewer employees working in the building. For example, one respondent wrote, "People are working from home, so we have less computers, printers, and phones." Another respondent wrote, "Due to telecommuting, many people switched to laptops from desktops. I.T. [Information Technology] has begun phasing out desktops and issuing docking stations to many people so they can seamlessly switch back and forth."

Two respondents from administrative or professional office buildings described vacated tenants as a reason for decreases in office device usage. One respondent wrote, "We had three large tenants whose leases ended...and they vacated the building."

In contrast, in other office types, only 3 of 30 respondents clearly stated that office device usage had decreased. Two of the three respondents specified that some employees no longer work in the building.

## HVAC changes

We asked, "These next questions are about renovations, upgrades, and replacements. Since 2019, which types of renovations and upgrades have been done at this building? *Please select all that apply or, if none, select the last option.*" We provided 13 response options plus the option to select "None of the above renovations, upgrades, or replacements since 2019."

About one-half of offices in our responding sample (36 of 68) reported changes to HVAC equipment or settings by selecting the response, "HVAC (heating, ventilation, or air conditioning) equipment upgrade, replacement, or change in settings (Example: changing HVAC settings to increase air flow)." However, only 10 offices changed the HVAC specifically because of the COVID-19 pandemic. All but 2 of these 10 offices were administrative or professional office buildings. One-half of them (5 of 10) were single-occupancy office buildings. All 10 of these buildings were larger than 10,000 square feet.

We provided respondents with a list of eight types of changes that may have been made to the building's HVAC system to increase ventilation and asked them to select all that applied to their buildings. Consistent with ASHRAE recommendations, some office buildings (5 of the 10 that reported HVAC changes because of the COVID-19 pandemic) increased the use of outside air beyond minimum settings.

In addition to increasing outside air, one office respondent provided a write-in response to indicate that the building added a bipolar ionization system, which is an emerging HVAC technology for cleaning air. Respondents for three of the offices that increased outside air reported running outside airflow for about two hours before and after the office was occupied. Two office buildings rebalanced or adjusted HVAC to increase total airflow, and one of the two also added ultraviolet germicidal irradiation, which is designed to lessen the spread of airborne pathogens.

### *Reasons for HVAC changes in response to the COVID-19 pandemic*

We showed respondents a list of all the upgrades, renovations, and building changes they reported that were made at least partially because of the COVID-19 pandemic and asked, "Listed below are all the building renovations and upgrades that you mentioned were related to the COVID-19 pandemic. In the space below, please briefly explain how each renovation/upgrade was related to the pandemic." Eight of the 10 respondents with HVAC changes answered this question. All eight described changes to ventilation or filtration. In a question at the end of the survey about other changes to the building because of the COVID-19 pandemic, one respondent reported that the office benefitted from new, more efficient chillers and multi-zone air handlers.

Most of the eight responses to our question about how HVAC upgrades or renovations were related to the COVID-19 pandemic described the HVAC changes in detail. However, two respondents also mentioned that they were adhering to recommendations. One respondent wrote, "Increase in airflow and running two hours prior to and after occupying building were instituted in alignment with recommended practice." One respondent made changes to attain a Fitwel Viral Response Module

certification, which is a certification created by the U.S. Centers for Disease Control and the U.S. General Services Administration focused on occupant health and wellness specific to respiratory infections.

The survey asked about changes between 2019 and 2023 with the expectation that respondents would only tell us about changes that have persisted beyond the height of the COVID-19 pandemic in 2020. However, one respondent reported that HVAC settings have now returned to pre-pandemic protocols. The response suggests to us that some answers to closed-ended questions may have related to temporary changes rather than permanent ones. How long changes to HVAC settings persist remains unclear.

## Air filtration

We asked, "Since 2019, have there been upgrades or changes to the type of air filtration systems or air filters used in this building?" Almost one-half (31 of 68) of respondents for office buildings reported a change in office building air filtration. Among these, 25 respondents indicated that the building's filters had Minimum Efficiency Reporting Value (MERV) ratings. MERV ratings are helpful in comparing the performance of different filters; the higher the MERV rating, the better the filter is at trapping specific types of particles. All but four (21 of 25 respondents who received the question) reported that at least one filter in the building had been upgraded to a higher MERV rating.

### *MERV filter ratings*

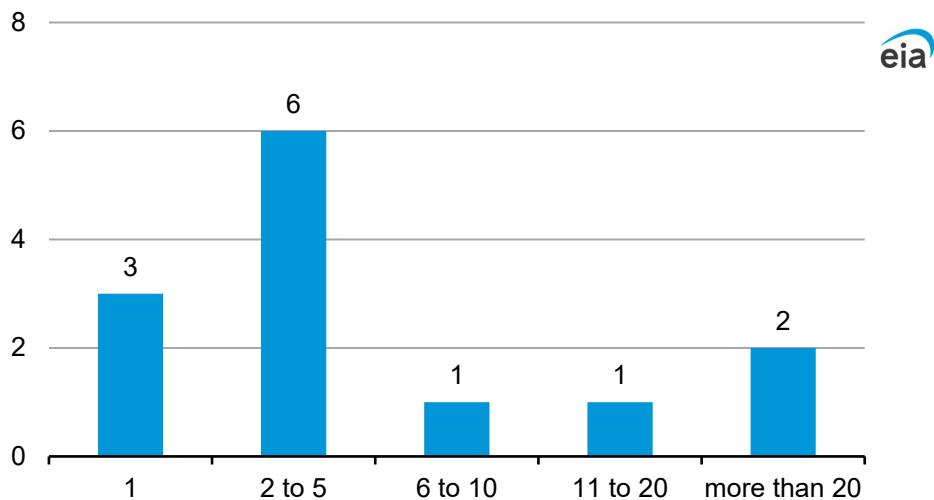
When asked for the old and new MERV ratings for the most recently replaced filter, most respondents who could provide the information (11 of 21) reported that filters had been upgraded to MERV rating 13, which is consistent with ASHRAE recommendations. Most of these respondents (7 of 11) indicated that the old filter ratings were MERV 8. Among other respondents reporting MERV filter rating values, 3 upgraded to filters with ratings below 13, and 3 upgraded to filters with ratings above 13.

### *Portable air cleaners*

We also asked respondents about portable air cleaners. We asked, "Since 2019, how many portable air cleaners have been added in the building, if any?" For offices in our responding sample, adding portable air cleaners was not common. About three-quarters of the offices for which we have data (50 out of 66) added no portable air cleaners (Figure 8).

At least one respondent from all subcategories of office buildings in our responding sample except for call centers reported adding one or more portable air cleaners, suggesting that the equipment is not unique to one type of office. Only three of the respondents who reported adding portable air cleaners were in multiple-occupancy buildings. Most were in single-occupancy buildings. However, this survey result may be because in multiple-occupancy buildings, tenants add portable equipment without telling building managers; survey respondents for multiple-occupancy offices may not know what equipment is in each room. Adding portable air cleaners was more common among the small office buildings in our responding sample than the medium or larger offices.

**Figure 8. Responses to question about number of portable air cleaners added among office buildings that reported one or more number of buildings**



Data source: U.S. Energy Information Administration, 2023 exploratory web survey conducted by the *Commercial Buildings Energy Consumption Survey* program

## Building automation systems (BAS) in large office buildings

Most of the questions on the exploratory web survey were closed-ended, where respondents had to choose from a set of provided responses or leave the question unanswered. However, some questions asked respondents to provide additional clarification or to answer a question in their own words.

One question was asked only of the 17 office respondents who reported a change in energy bills that was due at least partly to changes in the building. It asked, “Please describe in your own words the changes in this building that you think had the most impact on the change in energy bills.” Four respondents, three of whom were answering about offices over 100,000 square feet, mentioned building automation in their responses.

One respondent, who reported an overall decrease in the cost of energy because of changes in the building, wrote, “[The] building implemented automation software...in 2019. This examines building energy and equipment data to identify issues, faults and opportunities for improved system performance and savings.”

Another who reported lower energy costs because of building changes explained, “Since 2019, we implemented occupancy-based [variable air volume] (vav) controls. We also replaced all lights with LED and...smart controls [for lighting]. We implemented a static pressure and discharge air temperature reset control strategy. We made sure the outside air economizers worked properly. This building uses 50% less energy today than 2019.”

Conversely, another respondent at a large building reported a relationship between the building's outdated BAS and cost increases. He reported that both price increases in energy sources and changes in the building contributed to higher energy costs at the building. The building's BAS was at the end of its lifespan and slated for upgrade.

## Conclusions

We received responses to our exploratory web survey from enough office building respondents from across the United States to hint at possible impacts of the COVID-19 pandemic on office buildings. Our survey was not designed to produce results that represent commercial buildings, so the patterns we see here may not be present in the entire U.S. office building population. However, the results suggest changes to look for in the next full-scale CBECS administration, because they may characterize important shifts in U.S. office building energy consumption patterns.

The strongest pattern we observed in our sample of responding offices ( $n=68$ ) was fewer people inside of office buildings, especially among large offices. The apparent decrease was predominately the result of more employees working from home. We also found anecdotal evidence of reduced tenancy and increased vacancy in multiple-occupancy office buildings. In addition, some office building respondents described ways in which visitors to the buildings have decreased. People have developed ways to conduct business without meeting face-to-face at the office, including virtual meetings.

Working from home affected administrative and professional office buildings in our sample more than other office types, such as government buildings, medical offices, call centers, city hall offices, nonprofit office buildings, and mixed-use offices. Respondents for administrative and professional office buildings reported more variability in the number of employees in buildings from day to day. More of these respondents also reported fewer office devices due to more employees working from home. According to the nationally representative data in CBECS [Building Type Reports](#), 57% of U.S. offices were administrative or professional office buildings in 2018. Therefore, employees working from home has likely affected most U.S. office buildings.

We also observed that some office buildings changed HVAC settings in response to the COVID-19 pandemic. Modifications included increasing outside air and upgrading air filters. To what degree these modifications will persist is unclear. Some office buildings reported HVAC setting changes that they have already rolled back.

We found that adding portable air cleaners in office buildings was not very common. Among the respondents to our survey, more respondents from single-occupancy office buildings reported adding portable air cleaners than from multiple-occupancy office buildings. We are unsure if this is related to patterns in the population or is the result of respondents for multiple-occupancy buildings being less likely to know each tenant's room-specific equipment.

Although our survey did not ask specifically about building automation systems, we found that some respondents, particularly for large office buildings, emphasized BAS energy consumption impacts. These systems may have played a large role in controlling energy efficiency in office buildings because they responded to the occupancy changes that the COVID-19 pandemic brought on.

We are designing the next CBECS questionnaire. We plan to build on what we learned from this exploratory survey by holding discussions with managers of commercial buildings about issues such as ways to measure occupancy, especially as it relates to working from home and BAS uses. The survey and further discussions will help us update the questionnaire to best reflect the landscape of commercial buildings following the height of the COVID-19 pandemic.