

## Research Q&amp;A

# How Bedroom Temperature, Ventilation Affect Sleep Quality

**SYDNEY**—The microclimate that your bedding creates affects your sleep comfort more than your bedroom's temperature does, according to a recent *Science and Technology for the Built Environment* article.

“Associations of Bedroom Temperature and Ventilation with Sleep Quality” studied the effect of bedroom environmental quality on the quality of sleep in a field study conducted in Sydney, Australia. Researcher Richard de Dear, Ph.D., discussed the study with *ASHRAE Journal*.

## How does this research differ from other research about bedroom temperature and sleep?

The overwhelming majority of earlier research on this topic has been conducted in the artificial laboratory setting, which, at best, can only approximate real bedroom environmental conditions and the experience of those conditions by “real” subjects, as opposed to most laboratory studies in this field using university student subjects.

The Sydney research project described here is one of the few surveys conducted in normal residences with non-student subjects. This was one of the rare studies to draw causal linkages between bedroom environmental conditions and sleep quality of non-student subjects. In this sense, our naturalistic (conducting surveys in

normal residences, with non-student subjects) research design makes the findings more generalizable to the population at large.

## How can this research further the industry's knowledge on this topic?

We think the main implication of this study into the operation of sleeping environments is that bedroom ventilation should be prioritized over thermal environmental conditions.

Why? First, because IAQ seems to have a more direct impact on both subjective and objective metrics of sleep quality. Second, because we can easily adapt the sleeping microclimate underneath bedding where it counts most by tuning its insulation properties to suit a range of bedroom temperatures.

## What lessons, facts and/or guidance can an engineer working in the field take away from this research?

Retrospective estimates of nocturnal thermal comfort (i.e., morning-after perceptions) seem to be unrelated to objective bedroom thermal conditions during sleep. ASHRAE defines thermal comfort as “that state of mind that expresses satisfaction with the thermal environment,” but sleeping persons are oblivious to that state of mind—at least within the moderate range of bedroom

## Industry Roundup

### 2022 AHR Expo Opens Registration for Las Vegas Show

**WESTPORT, CONN.**—The AHR Expo (International Air-Conditioning, Heating, Refrigerating Exposition) is scheduled return to Las Vegas Jan. 31–Feb. 2, 2022. The show would be the industry's first major in-person gathering following pandemic shutdowns. *Source: AHR Expo*

### USDA: Freezing Alternative Could Save Energy

**ALBANY, CALIF.**—Shifting to a new food freezing method could make for safer and better-quality frozen foods while saving energy and reducing carbon emissions, according to a new study by the United States Department of Agri-

culture and University of California-Berkeley scientists. The study discusses isochoric freezing, a new freezing method that works by storing foods in a sealed, rigid container filled with a liquid such as water. *Source: USDA*

### Simulation Tool Creates Digital Twin of All U.S. Buildings

**OAK RIDGE, TENN.**—ORNL researchers have developed a modeling program that provides estimated energy details for all 129 million buildings across the U.S. using publicly available data. The modeling software suite simulates the energy profile of buildings and can be used to look at entire blocks and neighborhoods, which can help owners and utilities make informed decisions on how to best improve energy efficiency. *Source: ORNL* ■

thermal environments. This may partly be because we sleep in a distinct microclimate underneath bedclothes, not in the actual room environment per se.

Bedroom air quality tells a different story; a simple, objective measurement of bedroom air quality (namely CO<sub>2</sub> concentration) deteriorates throughout the course of our sleep, particularly in rooms having minimal air change rates. Upon waking, our subjective impression of the air quality, or “air freshness,” during our sleep is dominated by our immediate perceptions upon waking, when objective conditions are likely to be their worst. While that immediate air quality impression upon waking may differ from the average air quality of the bedroom throughout the sleep period, it is still correlated. Our subjective perceptions of “air freshness” are statistically associated with objective ventilation rate (CO<sub>2</sub>).

So, what is the connection between bedroom environmental quality (thermal and IAQ) and sleep quality? First, we found that objective thermal conditions in the bedroom were associated with objective sleep quality metrics (i.e., measurement by wearable sleep-trackers),

whereas subjective thermal comfort assessments were not. However, objective IAQ (CO<sub>2</sub>) in the bedroom was associated with objective sleep quality metrics, as was subjective IAQ (“air freshness”) with subjective sleep quality ratings.

Read the full Q&A: <https://tinyurl.com/bjbmbuwz> ■

## Can Past Failures Create Tomorrow's Buildings?

“We need to be able to be more honest about what doesn't work and share those failures so that our next projects can be better,” says John

Straube, Ph.D., P.Eng., Associate Member ASHRAE.

Listen to Straube and Joseph Lstiburek, Ph.D., P.Eng., Fellow ASHRAE, discuss why human judgment is critical to a better built environment, on the latest episode of *ASHRAE Journal Podcast*.

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