

## Patient Room Lighting Systems

### Summary of Responses to a Nurse Survey

The healthcare industry in the United States accounts for over 16% of the nation's gross domestic product, and 9% of the energy used in commercial buildings. U.S. healthcare facilities are estimated to spend nearly \$9 billion on energy annually, which translates in a typical hospital to over \$13,500 per bed spent on energy. As shown in Figure 1, the energy use intensity (kBtu/ft<sup>2</sup>) of hospitals exceeds most other types of buildings, and is roughly three times that of office buildings. Lighting systems are a critical part of the hospital energy story, with over 40% of the electricity use in healthcare facilities attributed to lighting (Figure 2).

Reducing healthcare lighting energy consumption is challenging. Medical procedures and routine tasks require high light levels, and the recommended light levels may be higher than the levels provided by conventional healthcare lighting systems. Further, a growing understanding of the non-visual effects of light, as well as the importance of light in creating a pleasant environment, lead to a need for next generation lighting systems that provide flexibility, but may also require higher installed power densities than the simplistic systems of the past.

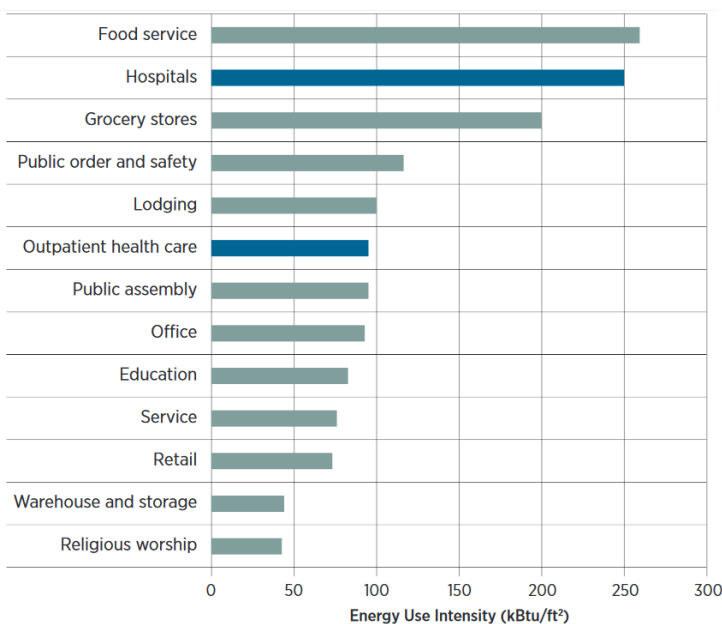


Figure 1. The energy use intensity of hospitals compared to other types of buildings.

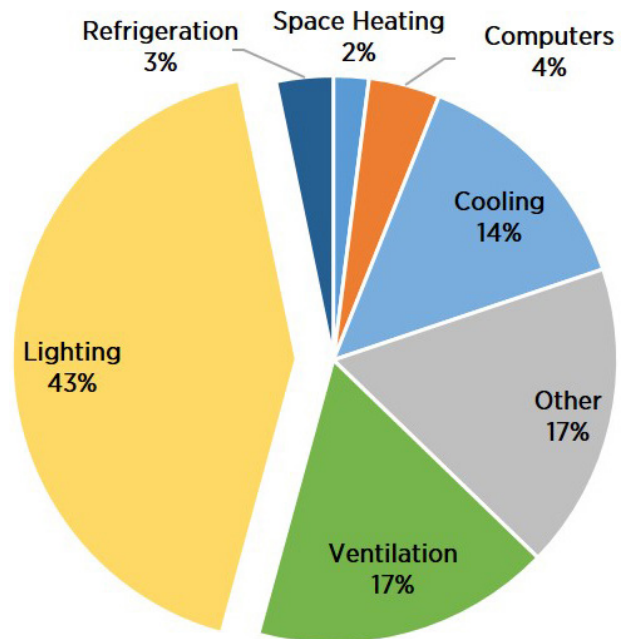


Figure 2. Average electricity end uses in healthcare facilities. Statistics from DOE Advanced Energy Retrofit Guide for Healthcare Facilities (2013) and EIA Commercial Buildings Energy Survey (2003).

The U.S. Department of Energy (DOE) is supporting the development and implementation of next generation healthcare lighting systems. As part of this effort, DOE developed an online nurse survey that was administered by a non-profit healthcare organization that manages multiple hospitals in the Pacific Northwest. In August 2015, 252 nurses at four hospitals voluntarily answered questions about the lighting in the patient room where they most often work. The primary goal was to determine what is needed in an ideal patient room lighting system, with a secondary goal of identifying opportunities for increasing energy efficiency.

Nurses with varying ages and years of experience completed the survey. They worked in a newly constructed children's hospital, an older hospital with some renovated patient rooms, and two older hospitals (one urban and one suburban). The nurses rated and ranked the aspects of lighting that helped or hindered their performance of tasks and rated the quality of the lighting in different areas of the patient room. They also indicated whether or not they used supplemental lighting, and what they used. One question asked the nurses to select different words to describe the patient room lighting. They were also asked to list the best feature of the lighting system, and how lighting systems could be improved.

DOE will post a full report with the nurse survey results on the Solid-State Lighting website when it is available. For now, the next page features some of the over 600 comments that the nurses offered as an optional part of the survey. These comments provide important insights into patient room lighting from the nurses' perspective, and the fact that they took the time to provide this input indicates how important lighting is to them.

## Selected Comments

### Light Level

Light level was ranked as the number one attribute that affected the nurses' ability to perform their professional duties. The nurses commented about not having enough light for IVs and for assessment and care of skin, wounds, ulcers, and lower extremities; however, too much light for the patients was also a frequent comment. The computer area was noted as having both too much or too little light.

"I find when I turn the bright light off they [patients] often say "Oh thank you!" Not realizing it was even affecting them."

"Many of the wounds I look at are in the feet and lower legs. The lights are at the head of the bed and I get back lighting. I have to use a flashlight to see the wounds well enough to assess."

"The lights that families have a problem with are the ones that come from the hallway at night and the brightness of the city lights at night."

"At night it is difficult on us to go from dimly lit rooms to extremely bright rooms like the med room, by the end of my shift."

### Controls

Controls were identified as the second most important attribute by the nurses. When considering the best thing about the patient room that they work in the most, 79% of the 175 comments were related to controls, with 12% addressing control location and 10% addressing lighting zones. The positive effect of controls was succinctly summarized by several nurses, others identified areas for improvement.

"Our unit recently got adjustable light controls which has really helped. We can dim the lights when the patient is resting before or after surgery, turn BRIGHT lights on for the hard to start IVs, modify lights during patient care."

"I feel the flexibility of the lighting allows me to complete my job duties, but also bring as much comfort as possible to the patient and their families, during the night. Love the control that the staff and the family have over our lighting system."

"There are 5 different ways to control 5 different lights. Please make them all consistently the same somehow."

"100 different buttons and places to hide them."

"There are also so many lights it becomes a little ridiculous and confusing for families."

"The variance of natural/artificial light is sometimes difficult."

"If lighting is needed, it would be nice to be able to turn it on remotely, because sometimes you are all set up to do a procedure and realize that you need a little more light."

### Dimming

When commenting on the best thing about the lighting in the patient room that they work in the most, nearly one-third of the 175 comments mentioned dimming as a positive attribute or desired attribute of the patient room.

"I love having dimmer switches in the patient care rooms, as it allows me to bring just enough light to see what I'm doing, but also to keep patients comfortable, as bright fluorescent light seems to make people anxious."

"Dim night lights help [me] check on patients without disturbing their slumber and are comforting to dying patients."

### Nighttime Navigation

Nighttime navigation had over twice as many poor ratings as any other area in the patient room, and was the area with the most poor ratings for each of the four hospitals. A range of measures were taken by nurses to provide nighttime lighting, from barcode scanners to bathroom lights.

"We all use the bathroom light with door open as a low light option in the middle of the night as to not jar the patient awake."

### Supplemental Lighting

Sixty-eight percent of the 252 nurses completing the survey reported using supplemental lighting in addition to the patient room lighting, with 24% mentioning the use of a flashlight in their comments. The most common uses of supplemental lighting, in order of frequency, were catheter procedures, IV procedures and night lighting.

"Flashlights are very necessary for me to do my job. I'm always having to change out the flashlight batteries each week."

"Sometimes I will turn the harsh room lights off and do my care by the light of extra lights (bathroom light, otoscope, flashlight)."

### Other Attributes

Overall, color was less important to the nurses than controls and light level, but was more important than the other attributes nurses were asked about including flicker, shadow, patterns and glare. The spectral properties of light have received increased attention in the lighting industry, specifically as related to healthcare; however, nurses' concerns regarding light level and controls should remain major considerations when designing the next generation of patient room lighting systems.

"I love having OPTIONS of lighting. To be able to sneak in at 4 am and turn on a tiny light in the nursing area, which does not shine on the family or patient as they are sleeping, is amazingly wonderful to have. Otherwise, us night nurses use the light from the IV pump, or maybe a flashlight - but you can't hold the flashlight AND use your hands to do tasks."

