Customer Advanced Technologies Program Tech Brief

Eskaton Circadian Lighting Project (Phase 2)

May 8, 2018

Project Description

During 2016, SMUD worked with Eskaton to test tunable-white LED lighting for seniors who reside at Monroe Lodge, one of Eskaton's independent living facilities. Eskaton chose to use Stack Lighting's LED light bulbs. These light bulbs offered several interesting features and communicated via a wireless network. Based upon the success of the first project[1], Eskaton decided to expand their efforts to include ten more apartments and some common areas (e.g. dining room).

The main objective of the second project was to gain a better understanding of circadian lighting and additional potential benefits for Eskaton's residents. Specifically, Eskaton was keenly interested in leveraging Stack's integrated motion sensors for monitoring the safety and well-being of their residents. Unfortunately the results of this second project were very mixed.

On the positive side, the new lighting system is expected to save an estimated 60% in energy costs. Participating residents also now have much better lighting thanks to the new floor lamps, table lamps and light fixtures installed by the project team. However, the project team also experienced some significant challenges.

Halfway through the project, Stack announced that they were no longer producing their own light bulbs. Instead, Stack chose to leverage popular tunable-white light bulbs from other reputable manufacturers. This decision resulted in several consequences including a seven month delay in the project.

Ultimately Stack chose to use OSRAM's LED light bulbs. Although these bulbs provide many desirable features, they do not include integrated motion sensors. Because of this, Eskaton chose not to explore using the Stack system for anything beyond its lighting capabilities.

[1]To learn more about the first project please download the full report at https://www.smud.org/en/Business-Solutions-and-Rebates/Business-Rebates/Advanced-Tech-Solutions

In terms of lighting, the new system offers many of the same features developed during the first project including automatically changing the color temperature, motion-activated lights and a night-time navigation mode. However, while learning to control the OSRAM light bulbs the team encountered some problems. Unfortunately these issues caused some residents to become dissatisfied with the system.

Originally, this project included lighting upgrades for ten apartments but due to a variety of reasons, only eight were completed. After establishing the final list of participants, the project team visited each of the apartments. During this initial visit, the team obtained illumination measurements, recorded information about the lighting and interviewed the residents. Based upon these findings, the team developed a personalized lighting plan for each resident.

New Lighting System

The new lighting system included a variety of table lamps, floor lamps and new fixtures (similar to the ones shown in **Figure 1** below). All of the new lamps and fixtures featured multiple sockets to increase the amount of available light. Two weeks after installation, the Stack light bulbs, hubs and motion sensors were installed.

Figure 1: The new lighting system included a variety of table lamps, floor lamps and new fixtures.

Results

Energy savings: the average connected lighting load (i.e. Watts) for the Stack system was around 60% lower than the original lighting system. This is impressive since the project team had to add so many additional floor and table lamps to provide adequate illumination levels. The calculated wattages and savings for the six apartments are shown in **Figure 2** below.

Scenario	Total W	Avg. / Apt	Savings
Original Lighting	3,217	536	n/a
Stack Lighting	1,927	321	60%

Figure 2: Connected lighting load

Interviews: Overall opinions regarding the new lighting were mixed. Although most of the residents were pleased with the new floor and table lamps, they had some concerns about the Stack system. During the project, Stack made two programming oversights which adversely affected the results:

- **Motion sensors:** Since the OSRAM light bulbs did not include integrated motion detectors, the project team installed battery operated wireless sensors in key locations. In order to maximize energy savings, Stack set the sensor time-out delays for 20 minutes. However, since older people tend to be not as active, Eskaton asked Stack to set the time delay for longer periods.

  Unfortunately, this change was not made quickly enough and the lights turned off on one resident at night. She became upset and asked for the system to be removed immediately.

- **Dimming:** It is a well-established fact that people need more light as they grow older. This is the main reason the project team chose to install lamps and fixtures with multiple sockets. Originally, the Stack lights were set to operate at 100% output while allowing the residents the ability to dim them via wireless wall switches.

  Unfortunately a software update caused several of the systems to operate at reduced light output. This resulted in unacceptable light levels for some of the residents (**Figure 3**). Although Stack responded promptly to the situation after being notified, the problem occurred during the weekend and wasn't corrected until Monday afternoon. Consequently, one resident became upset and asked the team to remove the Stack lighting system.

Figure 3: During a programming update, Stack inadvertently reduced the light output to 60% of maximum. This resulted in unacceptable light levels for some of the residents.

Conclusion

Although this project included significant challenges, it provided some valuable insights:

- Since Stack has chosen a new strategic direction, their system is still in the development phase. This project has helped them improve their system and learn more about lighting applications for seniors.

- Eskaton has learned a great deal about circadian lighting and will be making several design improvements for their new and remodeled apartments.

- SMUD has learned more about lighting needs for seniors and has developed some very practical approaches to help meet these needs.

Acknowledgments

SMUD wishes to thank and acknowledge the management, staff and residents of Eskaton's Monroe Lodge and Stack Labs for making these projects possible.