Measurement and Verification Report

Fill in this template to provide a complete account of the M&V methods used in your project. In addition to completing the indicated fields, please also provide a process and instrumentation diagram of the technology's installation, or a simplified block diagram.

Project Title: Appraisers Project Plan: Wireless Controls and Retrofit LED Lighting Demonstration

Investigators: Francis Rubinstein

Investigator Organization: GSA Green Proving Ground

Technology Name: Wireless Controls and Retrofit LED Lighting

Brief Description of Technology:

A Light Emitting Diode (LED) is a semiconductor that produces light through electroluminescence. Although first used primarily as indicator lamps, innovations in design has allowed LEDs to cover a wider set of lighting needs, including replacing linear fluorescent luminaires for general office lighting. Today's LED fixtures can provide illumination levels close to that required by P-100 at an efficiency that slightly exceeds that of modern fluorescent lighting systems. Modern fluorescent luminaires can achieve efficacies around 85 lm/W and have a typical life time of 20,000-30,000 operating hours. Market ready LED luminaires are currently achieving efficacies of 90 to 110 lm/W. Even more important, the rated life of most market ready LED fixtures in 2010 was already greater than 50,000 hours with some models as high as 75,000 hours [5] [7]. However, despite these advantages, linear fluorescent lamps still comprise over 70% of the lamp distribution in commercial buildings, while LEDs have a much smaller market share.

Furthermore, advanced lighting controls also remain a significant and largely untapped energy savings strategy. Controls currently available include continuous dimming, institutional tuning, fine-tuned occupancy sensing, daylight harvesting, and personal control. Continuous dimming in overhead fixtures allows for transition between light levels with minimal disturbance to the occupant. Institutional tuning and scheduling allows building managers and tenants to decrease energy consumption by programming default light levels within the lighting management system that reflect areal and/or building policies. Occupancy sensors reduce electrical demand by adjusting light levels or turning lights on or off in an area in response to the presence or absence of an occupant. Daylight harvesting similarly employs photosensors to reduce electrical demand in response to daylight levels. Finally, personal control allows occupants to adjust their individual light levels to suit their personal preferences.

Location Information

Building Name: United States Immigration Station and Appraisers Stores (commonly referred to as the Appraisers Building)
Address and City: San Francisco, CA
Description of Building:

The United States Immigration Station and Appraisers Stores (commonly referred to as the Appraisers Building) is a sixteen-story building located in San Francisco, CA. The Appraisers Building was originally designed in 1939 although construction did not end until 1944 due to wartime delays. The exterior of the building is predominantly concrete with long swaths of vertical windows. The study area is located in the northwest portion of the third floor (A3NW), following the perimeter of the building along the north and west sides and houses workers from the Department of Homeland Security.

The study area, A3NW, consists of one large open waiting room, five open office areas, three private offices, a reception room, a storage room, and the corresponding corridors, covering approximately 7,220 square feet. Based on floor plans sent by GSA on November 6, 2012, the open office areas encompass 39 workstations. The workstations are located along the perimeter of the open office area or are grouped together in pods of four or six. Windows appear to be 5' wide and located along the perimeter in pairs. The pairs of windows are located approximately 23 feet apart on center, providing a significant potential for daylighting in the study area. A3NW's existing lighting system is currently comprised of (88) recessed 2x4 parabolic troffers typically spaced 6' by 8' on center and (24) recessed can fixtures. Assuming that the recessed can fixtures require 10 W/fixture, the existing lighting system results in an installed LPD of 1.1 W/ft2.

Building size: 7,220 square feet
Climate zone: Click here to enter text.
Building owner: General Services Administration
Building operation hours: 6:30 AM – 4:30 PM
Documentation of the building's base year condition: Click here to enter text.
Any significant equipment problems: Click here to enter text.

Technology Objectives, Metrics and Potential Issues

Objective	Metrics	Equipment	Potential issues
Energy Savings	Light data loggers will note when lights are on or off and once ballasts from the pre-retrofit fixtures are tested by LBNL, the power drawn by these fixtures will be known and subtracted from the metered value for that circuit.	(4) HOBO 4-Channel Pulse Input Data Logger (UX120-017) (4) Advanced Pulse WattNodes (WNB-3Y-480-P Opt P3, Hz=50/50/50) (9) CTs (CTM-0360-020) (8) HOBO U12 Light Data Logger (MAN-U12-012)	Energy savings may be impacted if occupancy patterns change during study period
Photometric Performance	Extensive photometric characterizations will take place during the pre-retrofit and post-retrofit site characterization visits after hours. During the data retrieval visits, cursory photometric measurements will be taken to gauge daylight effects.	Spectrometer (Konica Minolta)	None specified
Occupant Satisfaction	Surveys will be administered on paper as requested by the building manager. Occupant responses will be recorded anonymously.	Paper survey	None specified
Other	Photos of relevant surfaces (desktop, cabinets, carpet, ceiling), fixtures, and switches will be taken for documentation purposes.	Digital camera	None specified

M&V Instrument List

4) HOBO 4-Channel Pulse Input Data Logger (UX120-017)
(4) Advanced Pulse WattNodes (WNB-3Y-480-P Opt P3, Hz=50/50/50)
(9) CTs (CTM-0360-020)
(8) HOBO U12 Light Data Logger (MAN-U12-012)

Spectrometer (Konica Minolta)
Paper survey

Digital camera

Cost of Installing M&V Verification

Total cost of instruments and ancillary equipment: Click here to enter text.

Total cost of labor: Click here to enter text.

Labor skill sets used (Electrician, HVAC technician, etc.):

- Click here to enter text.
- Click here to enter text.
- Click here to enter text.

Name and contact information of contractors used for installation:

Click here to enter text.

Data Transmission and Analysis

Method used to transmit data from demonstration site to the lab (select all that apply):

☒ Data files manually downloaded from loggers and emailed to lab

Period of data file download and transmission (Weekly, monthly, etc.): Data retrieval every two weeks

☐ Automated transmission of data

Transmitted via: ☐ Cellular modem ☐ Other: Click here to enter text.

☐ Other: Click here to enter text.

Special issues with transmission:

None listed.

Format in which data was transmitted to lab (.csv, .xlsx, etc.): Not specified

Software used to analyze data: Not specified

Methods used to analyze data:

None specified

Methods used to present data:

None specified

Other Comments

No comments.