

DEMAND SIDE ENERGY MANAGEMENT AND CONSERVATION PROGRAM Measurement and Verification Program

Lighting Upgrade Savings Calculation Steps and Parameters:

1. Pre-retrofit - Measure illumination levels (average foot-candles) per room BEFORE retrofits. Retrofits are designed to provide recommended illumination levels per the Illuminating Engineering Society of North America (IESNA); there is generally either a reduction or (more often) an increase in light levels and a decrease in energy consumption after the retrofits.
2. Pre-retrofit - Measure electrical power before retrofits
 - a. Measure power draw (kilowatts, kW) per light switch
 - b. Divide measured kW by the number of identical fixtures powered from that light switch to yield watts per existing fixture; this project involved measurement of dozens of fixture configurations.
 - c. Observe burnout factor (% of existing lamps removed or burned out)
3. Pre-retrofit - Measure operating hours for the lights in each room
 - a. Assign a usage category to each room in all buildings (e.g. classroom, office, lecture hall, corridor, etc)
 - b. Install lighting loggers in a sampling of each category of room to determine typical operating hours for each category
4. Calculate existing annual electrical usage in a room by room spreadsheet using watts/fixture, burnout factor (0.9), operating hours and production cost of electricity (main Campus) or City electric rates (PRC) as applicable.
5. Post-retrofit – measure illumination levels in each room; adjust the levels (e.g. use different power ballast) if needed to meet IESNA targets or best achievable.
6. Post-retrofit – Measurements and Savings Calculations
 - a. Measure watts/fixture (power draw at light switch)
 - b. (Operating hours are unchanged)
 - c. Calculate electrical usage and savings in room by room spreadsheet
 - d. Subtotal savings by building/campus/project and as otherwise directed
7. Deliverables
 - a. All Measurement & Verification (M&V) deliverables as follows to be included in a separate tab(s) of the final as-built lighting room-by-room inventory spreadsheet:
 - i. Operating hours per room usage category
 - ii. Pre-retrofit energy measurements for sampled fixtures
 - iii. Post-retrofit energy measurements for sampled fixtures
 - iv. Summary savings [report](#)
 - b. For each of the items above, the M&V deliverables requested here meet the Federal Energy Management Program (FEMP) intent for a “Post-Installation Report.”