# Recommendation 2: Install Motion Sensors for Production Area Lighting

Recommended Action

It is recommended to install motion sensors for the production area lighting with low occupancy percentage.

Summary of Estimated Savings and Implementation Costs

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| --- | --- |
| Annual Cost Savings | $700 |
| Implementation Cost | $420 |
| Payback Period | 8 months |
| Annual Electricity Savings | 11,865 kWh |
| ARC Number | 2.7135.3 |

Current Practice and Observations

Leaving lights on when they are not needed is a large cause of wasted lighting energy. By wiring occupancy sensors or timers into the lighting circuits, lighting usage can be eliminated during unoccupied periods. In addition, occupancy sensors can be installed to create lighting zones, which allow lights to be turned on only in the area of occupancy and not turned on for the whole floor. There are several types of occupancy sensors available, including infrared, ultrasonic, and dual technology (our recommendation). Infrared units turn the lights on and off by detecting differences in the heat given off by a human body and the surroundings. These units are directional and work best in active areas, such as in an enclosed office where the light switch area has a clear view of the entire area. Ultrasonic sensors are fairly non-directional and work by bouncing ultrasonic sound waves off objects in the room and are activated when the sound waves return to the unit at either a faster or slower rate, indicating that someone has entered the room. Ultrasonic sensors should not be installed in areas where there is high airflow or vibration, small, unenclosed areas, or areas with ceilings above fourteen feet. Dual technology units include both IR and ultrasonic detection. These units turn lights on when both technologies detect motion and remain on as long as one of the technologies detects motion. The main benefit from dual technology is a reduced occurrence of false triggering; however, they are the most expensive of the three units mentioned. It is recommended to install a motion *dimmer* due to the availability of dimmable LEDs which are more successfully implemented in the manufacturing space.

**Anticipated Savings for Resin Warehouse:**

For occupancy sensors, the percent operating hour reduction is dependent upon the frequency that an area is occupied. This value can be measured using motion detecting sensors or estimated by using electric utility studies that estimate the fraction of lighting hours wasted. The area is occupied approximately 50% for the considered operating hours. Some lights will be left on for fire safety etc. The estimated electricity savings, ES, is calculated using the following relations:

ES1 = N1 × CFW1 × OH1 × (100% - FR1) / C1

where

N1 = Number of LED bulbs in resin warehouse; 56

CFW1 = Power rating of each LED bulb in area; 60 W

OH1 = Operating hours: 3,120 hrs/yr (12 hours per day, 5 days per week, 52 weeks per year)

FR1 = Fraction of operating hours during which area is occupied; 50%

C1 = Conversion constant; 1,000 W/kW

ES1 = 56 × 60 W × 3,120 hrs/yr × 50% / (1000 W/kW)

= 5,240 kWh/yr

**Anticipated Savings for Machine Shop:**

For occupancy sensors, the percent operating hour reduction is dependent upon the frequency that an area is occupied. This value can be measured using motion detecting sensors or estimated by using electric utility studies that estimate the fraction of lighting hours wasted. The area is occupied approximately 30% for the considered operating hours. Some lights will be left on for fire safety etc. The estimated electricity savings, ES2, is calculated using the following relations:

ES2 = N2 × CFW2 × OH2 × (100% - FR2) / C1

where

N2 = Number of LED bulbs in machine shop; 8

CFW2 = Power rating of each LED bulb in area; 50 W

OH2 = Operating hours: 4,160 hrs/yr (16 hours per day, 5 days per week, 52 weeks per year)

FR2 = Fraction of operating hours during which area is occupied; 30%

C1 = Conversion constant; 1,000 W/kW

ES2 = 8 × 50 W × 4,160 hrs/yr × (100% - 30%) / (1000 W/kW)

= 1,165 kWh/yr

**Anticipated Savings for Building 2:**

For occupancy sensors, the percent operating hour reduction is dependent upon the frequency that an area is occupied. This value can be measured using motion detecting sensors or estimated by using electric utility studies that estimate the fraction of lighting hours wasted. The area is occupied approximately 30% for the considered operating hours. Some lights will be left on for fire safety etc. The estimated electricity savings, ES3, is calculated using the following relations:

ES3 = N3 × CFW3 × OH3 × (100% - FR3) / C1

where

N3 = Number of LED bulbs in building 2; 25

CFW3 = Power rating of each LED bulb in area; 50 W

OH3 = Operating hours: 6,240 hrs/yr (24 hours per day, 5 days per week, 52 weeks per year)

FR3 = Fraction of operating hours during which area is occupied; 30%

C1 = Conversion constant; 1,000 W/kW

ES3 = 25 × 50 W × 6,240 hrs/yr × (100% - 30%) / (1000 W/kW)

= 5,460 kWh/yr

The total estimated energy conservation

ES = ES1 + ES2 + ES3

= 5,240 kWh/yr + 1,165 kWh/yr + 5,460 kWh/yr

= 11,865 kWh/yr

Therefore, the annual cost savings, ACS, can be estimated as follows:

ACS = ED × Electricity cost

= 11,865 kWh/yr × $0.059/kWh

= $700/yr

Implementation Costs

The implementation cost for this recommendation includes the equipment and labor costs required for the new occupancy sensors installation. The material cost for each occupancy sensor and related wiring and consumable material is about $100 with applicable rebates. A total of three occupancy sensors are estimated to be required for current plant area lighting control. Thus, related total material cost is about $300. Considering 1 hour being required for installation of each sensor at a labor rate of $40/hr, the total labor cost is $120. Therefore, the total implementation cost for this recommendation is approximately $420.

**The annual electricity savings for this recommendation will be 11,865 kWh. The estimated annual cost savings is $700 and, with $420 in implementation costs, the payback period will be about 8 months.**

Implementation Cost References

The below links are for implementation cost references. We do not endorse/recommend these brands or products. Furthermore, these products may or may not be suitable for the application. The client should contact a vendor(s) to conduct a detailed study of the process, in order to determine the best product for the recommended application.

* <https://www.mcmaster.com/7477K36/>
* https://www.grainger.com/product/LITHONIA-LIGHTING-Occupancy-Sensor-Hard-Wired-20VE50