Install Occupancy Sensors (Arc 2.7135)

(The analysis below was extracted from one of the assessment reports by the Clemson University Industrial Assessment Center (IAC). This is only an example recommendation and hence, not all the background information and sources for numbers are included here.)

Est. Electric Consumption Savings	= **24,498 *kWh/yr***
Est. Electric Consumption Cost Savings	= **$1,344.97*/yr***
Est. Electric Demand Savings	= ***0 kW/yr***
Est. Electric Demand Cost Savings	= **$0*/yr***
Est. Total Cost Savings	= **$1,344.97*/yr***
Est. Implementation Cost	= **$623**
Simple Payback Period	= **5.6 *months***

Recommended Action:
It is recommended to install occupancy sensors in rooms and areas that are not used constantly to prevent nonessential lighting in unoccupied rooms.

Background:
The breakroom, office space, bathrooms, and certain sections of the facility, are not constantly in use and therefore run the risk of leaving lights on longer than necessary. If occupancy sensors are installed, the lights will be automatically turned on and off when appropriate and eliminate the possibility of human error where people forget to turn the lights off and waste the energy in that area.

Anticipated Savings:
The areas decided upon for occupancy sensors came from looking at what areas are not constantly occupied during the hours of operation. After determining which areas that includes, the number of occupancy sensors to be installed was found as well as the cost of installing the occupancy sensors. Turning off unnecessary lighting and installing occupancy sensors will contribute to reduction in electricity consumption. For example, we suggested installing occupancy sensors in Training room, which according to the management is occupied about 30% of the time during working hours. The electricity consumption saving due to installing sensor in this area can be determined as follows:

$$ECSs = TW \times H1 \times U = 2{,}046 \text{ kWh/yr.}$$

Where ECS_s is the electric consumption savings due to sensors, *TW* is the total wattage of the lighting, H_1 is the operating hours of the fixtures, and *U* is the percentage of unoccupied times. The time that each room currently has the lights on varies, but each room is occupied roughly 30% of the time that it is currently on. Accordingly, the estimated annual *electric consumption savings, ECS*, for installation of the proposed lamps, occupancy sensors, and elimination of unnecessary lighting is determined by the following relation:

$$ECS = CN \times CFW \times H1 - PN \times PFW \times H2$$

Where:

CN	= Number of current fixtures,
PN	= Number of proposed fixtures,
CFW	= Power rating of current fixtures, (kW),
PFW	= Power rating of proposed fixtures, (kW),
H1	= Operating hours of fixtures, (hr./yr.)
H2	= New operating hours of fixtures, (hr./yr.)

ECS = 24,498 kWh/yr

The estimated annual *electric consumption cost savings, ECCS,* that results from installation of the proposed lamps, occupancy sensors, and elimination of unnecessary lighting is determined by the following relation:

$$ECCS = ECS \times \$0.0549/kWh$$

ECCS = 24,498 × \$0.0549/kWh = \$1,345

The estimated annual *electric demand savings, EDS*, for installation of the proposed lamps, occupancy sensors, and elimination of unnecessary lighting is determined by the following relation:

$$EDS = \frac{CN \times CFW - PN \times PFW}{1000\ kW} \times 12\ months/yr.$$

$$EDS = \frac{8180 - 8180}{1000\ kW} \times 12\ months/yr.$$

EDS = 0 kW

The estimated annual *electric demand cost savings, EDCS,* for installation of the proposed lamps, occupancy sensors, and elimination of unnecessary lighting is determined by the following relation:

$$EDCS = EDS \times \$4.7219/kW$$

EDCS = 0 kW × \$4.7219/kW = \$0

The *total cost savings, TCS*, associated with installation of the proposed lamps, occupancy sensors, and elimination of unnecessary lighting is determined by the following relation:

$$TCS = (ECCS + EDCS)$$

TCS = (\$1,345 + \$0) = \$1,345

Table 1. Current Lighting Data for Suggested Occupancy Sensor Locations

Location	Light Type	# of Fixtures	# of Bulbs per Fixture	Total # of Bulbs	Wattage (W)	Annual Hours	Total wattage (W)	Total consumption (kWh)
Small Conference Room	T12	5	3	15	34	260	510	132600
Computer Room	T12	6	2	12	34	8760	408	3574080
Canteen	T12	10	3	30	40	8760	1200	10512000
Restrooms	T12	21	2	42	34	8760	1428	12509280
Education Rooms	T8	32	2	64	40	104	2560	266240
Nurse's Office	T12	5	2	10	34	3650	340	1241000
Main Conference Room	T12	17	3	51	34	3900	1734	6762600
Total			17	224	250		8180	34997800

Table 2. Proposed Lighting Data for Suggested Occupancy Sensor Locations

Location	Light Type	# of Fixtures	# of Bulbs per Fixture	Total # of Bulbs	Wattage (W)	Annual Hours	Total wattage (W)	Total consumption (kWh)
Small Conference Room	T12	5	3	15	34	78	510	39780
Computer Room	T12	6	2	12	34	2628	408	1072224
Canteen	T12	10	3	30	40	2628	1200	3153600
Restrooms	T12	21	2	42	34	2628	1428	3752784
Education Rooms	T8	32	2	64	40	31.2	2560	79872
Nurse's Office	T12	5	2	10	34	1095	340	372300
Main Conference Room	T12	17	3	51	34	1170	1734	2028780
Total			17	224	250		8180	10499340

Implementation Cost:

The following relation determines the estimated implementation cost, IC, associated with installation of the occupancy sensors:

$$IC = N \times IFC$$

Where:

N = Number of installed sensors

IFC = Installed cost, ($/fixture)

The cost of purchasing and installing one occupancy wall sensor is $89 for a standard model. With 7 occupancy sensors, the total implementation cost is $623.

Implementation Cost = $623

Simple Payback Period:

The *simple payback period, SPP*, is the time required to pass before the estimated total cost savings equal the estimated implementation cost, and is calculated by:

$$SPP = \frac{IC}{TCS} \times 12\ months/yr.$$

$$SPP = \frac{\$623}{\$1345} \times 12\ months/yr.$$

SPP = 5.6 months