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:

\[ ECS = TW \times H_1 \times U = 2,046 \text{ kWh/yr}. \]

Where \( ECS \) 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:

\[ ECS = CN \times CFW \times H_1 - PN \times PFW \times H_2 \]
Where:

\[
\begin{align*}
CN &= \text{Number of current fixtures}, \\
PN &= \text{Number of proposed fixtures}, \\
CFW &= \text{Power rating of current fixtures, (kW)}, \\
PFW &= \text{Power rating of proposed fixtures, (kW)}, \\
H1 &= \text{Operating hours of fixtures, (hr./yr.)}, \\
H2 &= \text{New operating hours of fixtures, (hr./yr.)} \\
\end{align*}
\]

\[
ECS = 24,498 \text{ kWh/yr}
\]

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:

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

\[
ECCS = 24,498 \times $0.0549/kWh = $1,345
\]

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:

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

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

\[
EDS = 0 kW
\]

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:

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

\[
EDCS = 0 kW \times $4.7219/kW = $0
\]

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

<table>
<thead>
<tr>
<th>Location</th>
<th>Light Type</th>
<th># of Fixtures</th>
<th># of Bulbs per Fixture</th>
<th>Total # of Bulbs</th>
<th>Wattage (W)</th>
<th>Annual Hours</th>
<th>Total wattage (W)</th>
<th>Total consumption (kWh)</th>
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<tbody>
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<td>5</td>
<td>3</td>
<td>15</td>
<td>34</td>
<td>260</td>
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<td>30</td>
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<td>34</td>
<td>8760</td>
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<td>104</td>
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<td>266240</td>
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### Table 2. Proposed Lighting Data for Suggested Occupancy Sensor Locations

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<tr>
<th>Location</th>
<th>Light Type</th>
<th># of Fixtures</th>
<th># of Bulbs per Fixture</th>
<th>Total # of Bulbs</th>
<th>Wattage (W)</th>
<th>Annual Hours</th>
<th>Total wattage (W)</th>
<th>Total consumption (kWh)</th>
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<tr>
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<td>10499340</td>
</tr>
</tbody>
</table>

**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:*

\[
SPP = \frac{IC}{TCS} \times 12 \text{ months/yr.}
\]

\[
SPP = \frac{623}{1345} \times 12 \text{ months/yr.}
\]

\[
SPP = 5.6 \text{ months}
\]