**Sustainability proposal**  
Lighting System Installation

Hutchens House

Submitted by:

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Missouri State University

Student Government Association



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1. **Identification of Sponsors**
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1. **Description of Proposal**

**General Description**

This proposal is recommending that Missouri State University Residence Life conducts the installation of 116 Light Occupancy Sensors within Hutchens House Residence Hall. If approved this energy conservation method will result in a reduction of the electricity consumed by the lighting fixtures within Hutchens House common areas. These sensors are projected to decrease the amount of energy consumption by 33% which will save Missouri State University $3,813 per year in energy costs. These Light Occupancy Sensors will have a simple payback within 29 months of completed installation.

**Proposal Details**

Necessary Parts as detailed in an estimate compiled by Pilar Karlen, Energy Manager

* (6) **ADT2000C**: Dual (ultrasonic and passive infrared) motion sensor. 2000sq.ft 360o coverage.
* (48) **ATU2000C**: Ultrasonic minor motion detector. 2000sq.ft 360o coverage.
* **ATU500C**: Ultrasonic minor motion detector. 500sq.ft. 180o coverage.
* **ATP1600W**: Passive Infrared low voltage sensor with photocell and isolated relay. 1600sq.ft.
* (55)**CU300A**: Control Unit for automatic-on operation
* **AAR**: Add-A-Relay for use with OU series control units and Hubbell ATD, ATU, and ATP series celling and wall mount sensors
* (5) **wS2000I**: Passive Infrared Wall Switch, manual adjusting, selectable manual/auto-on, dual-voltage, and 3-way capable.
* **AWMG**: Wall mount wire guard
* **HMHB2LV**: Standard Fluorescent high bay PIR sensor
* (1) **DHIP**: Daylight harvesting: indoor photocell
* (1) **DSHCM**: Daylight harvesting control module
* (1) **DT2000W**: Digital Timer Wall Switch: Dip switch enabled preset intervals, user adjustable up to 4 hours, 3-way capable, includes on/off momentary push button switch feature.

(See Appendix A)

**Detailed Description**

The main laundry room would have two of the Ultrasonic minor motion detectors installed within the ceiling, and one control unit for automatic-on operation installed within the wall. The basement will have three of the Dual (ultrasonic and passive infrared) motion sensors installed, two in the study/activity area, and one in the computer lab area installed within the ceiling. Four of the Ultrasonic minor motion detectors installed, two in the hallway by the laundry, one in the elevator lobby and one in the east hallway installed in the ceiling as well as five of the control units for automatic-on installed in the wall of each location listed above. Each of the locations in the basement listed above will require one of the control units for automatic-on operation producing a total need for five units. In addition to the motion detectors and the control units the basement will also require installation of one Passive Infrared Wall Switch with manual adjusting/ selectable auto-on in the laundry area, as well as one Digital Timer Wall Switch: Dip switch enabled preset intervals for the maintenance shop; both of these items shall be installed within the walls, and the shut off times for these lights will be ½ hour.

The first floor of Hutchens House will require nine of the Ultrasonic minor motion detectors installed as follows: Three within the ceiling of the main south hallway (east and west), and within the main north hallway (east and west), two within the guest housing hallway, and one in the lobby ramp area. The first floor study lobby will require one Daylight Harvesting control module, and one Daylight harvesting photocell. All locations that have the ultrasonic motion detectors installed on the first floor will require one of the control units for automatic-on operation installed, producing a need for five units.

Floors two through seven will require a total of 25 Ultrasonic minor motion detectors installed as follows, two in each of the east hallways on each floor, two in the west hallways of each floor, and one in each elevator lobby. Each location will also require one of the control units for automatic-on operation which will yield a need for 18 of these control units. Three Passive Infrared Wall Switches, with manual adjusting/ selectable manual or auto-on will be needed for each study room in Hutchens House located on floors two, four and six.

The eighth floor of Hutchens House will require six of the Ultrasonic minor motion detectors, two in the recreation area, as well as two in the east hallway and two in the west hallway. The eighth floor will also require one of the Passive Infrared Wall Switches, with manual adjusting/ selectable manual or auto-on for the rest room/ recreation area. Each of the ultrasonic motion detector locations will also require one of the control unit for automatic-on operation installed producing a need for three units.

Upon installation of the light sensors within the areas listed above the average annual energy savings would be that of 75% in the basement computer lab, the study lounges on the 2nd, 4th, 6th, and the restroom/recreational area on the 8th floor 50% in the main laundry room, the study and activity area in the basement, the basement laundry area, and the basement maintenance shop, the recreation area on the 8th floor, and 40% savings within the 1st floor lobby/ study area. Savings of 25% would be seen in the elevator lobby in the basement and floors one through eight, the hallway by the laundry area within the basement, and within the east and west hallways on floors one through eight. With all of the sensors installed the calculated average yearly energy savings would be $3,812.63, and an average payback of 29 months. With this lighting system installed the university would save enough money from energy reduction to completely pay for the initial installation of the motion sensor system within a two year time period.

**Proposed Installation Locations**

|  |  |
| --- | --- |
| Basement   * Study and Activity Area * Computer Lab Area * Elevator Area * Laundry Area * Maintenance Shop * Hallway by Laundry * Hallway East | 1st Floor   * Main Hallway South (East-West) * Main Hallway North (East-West) * Lobby Study Area * Lobby Ramp Area * Guest Housing Hallway |
| 2nd Floor   * East Hallway * West Hallway * Elevator Lobby * Study Lounge | 3rd Floor   * East Hallway * West Hallway * Elevator Lobby |
| 4th Floor   * East Hallway * West Hallway * Elevator Lobby * Study Lounge | 5th Floor   * East Hallway * West Hallway * Elevator Lobby |
| 6th Floor   * East Hallway * West Hallway * Elevator Lobby * Study Lounge | 7th Floor   * East Hallway * West Hallway * Elevator Lobby |
| 8th Floor   * East Hallway * West Hallway * Recreation Area * Rest Room- Recreation Area * Main Laundry Room |  |

**Additional Uses/ Benefits**

Some additional benefits that would be present with the addition of occupancy sensors within Hutchens House would be less lightbulbs used. Currently the lights are on more than they are needed. With the addition of these occupancy sensors the lights would be on a fraction of the time that they are on now extending the life of each lightbulb; the amount of time that employees spend changing lightbulbs will also decrease. This would be an additional source of savings with this project. Another added benefit associated with the reduction of lightbulbs consumed would be less waist product in landfills and toxic chemicals consumed by Missouri State University. Currently the bad lightbulbs have to be processed by the campus Environment Management Office due to mercury in the bulbs. After these bulbs are cleansed of the mercury they are sent to a disposal site. So with the installation of the occupancy sensors Missouri State University will save on lightbulb costs, and reduce the amount of waste that the University creates.

**Drawbacks**

Some of the potential drawbacks of this project would be the issue of the lights within the study rooms, and/or the laundry rooms. This issue faced with these locations would be that if an individual is in these rooms for an extended period of time the lights could kick off. This can be avoided by moving around every so often, and with the shut off times being set to ½ hour at first with the option to extend the time before shut off as needed by the Missouri State Housing and Dining Maintenance staff.

**Necessary Modifications**

The necessary modifications to existing structures would be the addition of the control unit, installation of the motion detectors and other sensors within the drop ceiling/ top of the walls; and raceways will have to be installed for the hard ceilings. However the control units should be able to be located in the same place as the existing light switches. Furthermore some additional electrical wire will be needed to properly install all of the sensors.

1. **Estimated Cost of Project** ($ 9,187.85est.)

**Alternative Solutions**

In the event that Missouri State University does not have sufficient funding to complete the entire proposal I recommend that the light sensors are placed within the main laundry room, basement, first floor, and the eighth floor of Hutchens House. This would drop the price down to an estimated $4,099.40 with a $300.00 add in for installation equipment (raceways and wiring).

The second most desirable option that Missouri State University should pursue in the event that there is insufficient funding for the entire project would be to install the occupancy sensors within the main laundry room, basement, eighth floor, and the study lounges located within Hutchens House. This would result in an estimated price of $2,572.15 with a $200.00 add in for installation equipment (raceways and wiring). These two options have been based on which areas showed the most percentage of energy saved along with consideration of if the project should go over scheduled time the least amount of students affected by any inconveniences.

**Complete Cost Breakdowns**

|  |  |  |
| --- | --- | --- |
| **Location** | **Cost** | **Payback (in months)** |
| Main Laundry Room | $240.50 | 8.65 |
| Basement (Study/ Activity Area) | $281.50 | 14.73 |
| Basement (Computer Lab) | $152.50 | 5.85 |
| Basement (Elevator Lobby) | $132.00 | 30.39 |
| Basement (Laundry Area) | $40.50 | 2.94 |
| Basement (Maintenance Shop) | $53.00 | 1.79 |
| Basement (Hallway by Laundry area) | $240.50 | 34.61 |
| Basement ( East Hallway) | $132.00 | 37.99 |
| 1st Floor Main Hallway (south) | $349.00 | 53.36 |
| 1st Floor Main Hallway (north) | $349.00 | 71.14 |
| 1st Floor Lobby (study area) | $349.00 | 44.46 |
| 1st Floor Lobby (ramp area) | $132.00 | 26.91 |
| 1st Floor Hallway (guest housing) | $240.50 | 30.76 |
| 2nd Floor Hallway (east) | $240.50 | 30.76 |
| 2nd Floor Hallway (west) | $240.50 | 30.76 |
| 2nd Floor Elevator Lobby | $132.00 | 30.39 |
| 2nd Floor Study Lounge | $40.50 | 15.54 |
| 3rd Floor Hallway (east) | $240.50 | 30.76 |
| 3rd Floor Hallway (west) | $240.50 | 30.76 |
| 3rd Floor Elevator Lobby | $132.00 | 30.39 |
| 4th Floor Hallway (east) | $240.50 | 30.76 |
| 4th Floor Hallway (west) | $240.50 | 30.76 |
| 4th Floor Elevator Lobby | $132.00 | 30.39 |
| 4th Floor Study Lounge | $40.50 | 15.54 |
| 5th Floor Hallway (east) | $240.50 | 30.76 |
| 5th Floor Hallway (west) | $240.50 | 30.76 |
| 5th Floor Elevator Lobby | $132.00 | 30.39 |
| 6th Floor Hallway (east) | $240.50 | 30.76 |
| 6th Floor Hallway (west) | $240.50 | 30.76 |
| 6th Floor Elevator Lobby | $132.00 | 30.39 |
| 6th Floor Study Lounge | $40.50 | 15.54 |
| 7th Floor Hallway (east) | $240.50 | 30.76 |
| 7th Floor Hallway (west) | $240.50 | 30.76 |
| 7th Floor Elevator Lobby | $132.00 | 30.39 |
| 8th Floor Recreation Area | $240.50 | 27.69 |
| 8th Floor Rest Room/ Recreation Area | $40.50 | 15.54 |
| 8th Floor Hallway (east) | $240.50 | 30.76 |
| 8th Floor Hallway (west) | $240.50 | 30.76 |
| **Total:** | **$ 7,253.50** | **22.83** |
| Contingency Fund (10%): | $ 725.35 |  |
| \*Installation Equipment: | \*$1,200.00 |  |
| **Total (After Contingency):** | **$9,187.85** | **28.92** |

(See Appendix A)

The addition of a 10% contingency has been added into the proposal in case of any additional parts, sensors, or other costs are found during the installation process of the occupancy sensors by the installer that may have been left out of the initial bid.

Installation costs will be $1,882.10 (32.45per hour @ 58 hours). \*The installation equipment needed will be wiring and raceway materials to link up the sensors to both the electrical wires in existence as well as the control switches. However Missouri State Residence Life, Housing and Dining Services is willing to absorb this cost as it is their electrician who will be installing the sensors throughout Hutchens House (see letter of support for details).

**Ongoing Costs**

Any ongoing costs of the proposed occupancy sensors will be considered normal maintenance costs for lighting fixtures. In addition any of the ongoing costs or maintenance not covered by the manufacturer warranty will be covered by the Residence Life, Housing and Dining Services (see letter of support). Upon installation the occupancy sensors will save Missouri State University approximately $317.72 per month they are functioning. This would average out to around $3,812.64 per year that Missouri State will be saving from energy costs. So if approved the lighting project would not only have little ongoing costs, but it would have the possibility of saving Missouri State a substantial amount of money instead of costing the University money to maintain them.

1. **Completion Timeline**

Each sensor has an estimated installation time of 30-90 minutes. The number of sensors suggested within this proposal is 116. The project will take place when the students will be least inconvenienced (during the summer, winter and spring breaks). The installation will be finalized within one year of approval (when/if funding is approved).

1. **Estimated Lifespan**

The average estimated lifespan for occupancy sensors is around 12 to 15 years. (lightsearch.com/resources/lightguides/sensors.html) During this timeframe the sensors would save a minimum of $ 45,751.68 for Missouri State University in energy costs.

1. **Justification**

If approved this project to install the occupancy sensors will help the residents of Hutchens House, the University, as well as the community of Springfield. This proposal will accomplish these goals by illuminating the hallways better during night hours, saving the University on energy costs and consumption, as well as reducing the size of Missouri State’s carbon footprint and the amount of damage to the environment. If approved not only would the occupancy sensors save the University money, and free up funds for improvement in other areas on campus, as well as promoting a more sustainable, and cleaner environment for the entire city of Springfield.

The occupancy sensors will help the students by illuminating the hallways and study rooms upon entry into these areas verses half of the lights being turned off during the night time hours by the Resident Assistants (RAs). These occupancy sensors will also eliminate the need to fumble around looking for a light switch when utilizing the study rooms, the lights will simply turn themselves on when the student enters the room.

After installed the occupancy sensors will save Missouri State University on average $3,812.64 per year ($317.72 per month) in utility costs. This also means that the system will effectively pay for itself slightly over two years after installation. That being said upon completion of this project the University will have freed up over $3,000 that can be put towards improving other areas of the campus.

This lighting system will save an estimated reduction in Carbon Dioxide equivalent to 38 metric tons or 82,800 pounds per year. For a comparison this would be the equivalent of 40,341 pounds of coal burned, 89,422 miles driven by a passenger car, or 87.3 barrels of oil consumed. This benefits the city of Springfield directly by reducing the amount of greenhouse gas emissions, CO2 emissions, and the carbon placed in to the ecosystem.

The reason we are choosing to select Hutchens House for the sensor installation is that it is the flag ship in a way for Missouri State University. All new students reside in Hutchens House during their SOAR period as an introduction into life at Missouri State University. So we decided that Hutchens would be the best place to install these sensors because it will show the majority of incoming students and their families that Missouri State University is a sustainable campus and cares about both its students and the environment.

**University Support**

**Appendix**

**Appendix A:**







