# Lighting Analysis Worksheet


Installing occupancy sensors and time controls to operate lighting systems can often be a wise investment. With the appropriate tools and knowledge, justifying their installation or checking their operation is a relatively simple task. In addition to the necessary equipment for conducting these types of studies, the Energy Center Tool Lending Library makes available a Microsoft Excel spreadsheet to assist you in importing and analyzing data to answer the questions:

- What are the potential savings associated with a specific time schedule?
- Are the lights on when no one is in the room?
- Are the lights off when they are scheduled to be on?
- Are the lights on when they are scheduled to be off ?

The spreadsheet is designed for use with data from Hobo dataloggers, but can also be used as a stand-alone tool to determine potential savings from user-defined lighting schedules. It has automated functions which import and analyze lighting operation and occupancy data. The subroutines have been written to analyze the data and generate a modest report based on eight days' data. This time period is easily extended for longer studies.

Lighting operation data is collected using a Hobo Light and occupancy data is collected by using a modified infrared motion sensor with a Hobo Volt.

## From the Main Menu

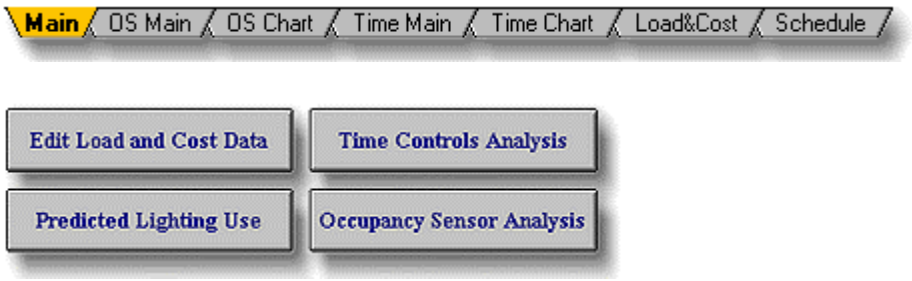
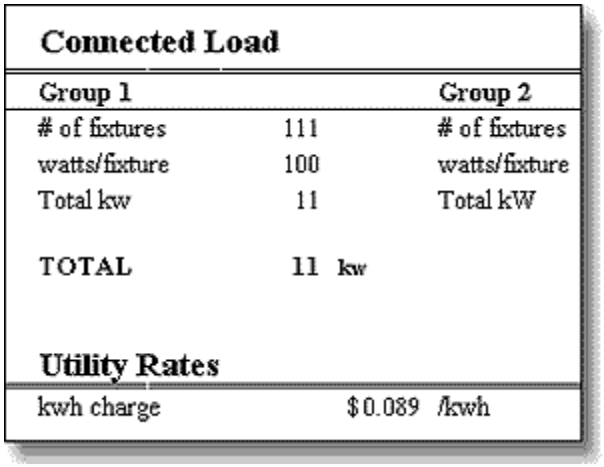



***Figure 1*** *Introductory screen for Lighting Analysis spreadsheet*

The spreadsheet will open to the *Main* screen. Begin by entering information about the lighting system's wattage and local utility rates. Go to this worksheet by clicking on the "Load&Cost" tab at the bottom of the screen or by clicking on the "Edit Load and Cost Data" button. You can jump to the related descriptions in this web page by clicking on the buttons in Figure 1.

## Load and Cost Data

Main | OS Main | OS Chart | Time Main | Time Chart | **Load&Cost** | Schedule



**Connected Load**

| Group 1 | | Group 2 |
|---|---|---|
| # of fixtures | 111 | # of fixtures |
| watts/fixture | 100 | watts/fixture |
| Total kw | 11 | Total kW |
| TOTAL | 11 kw | |

**Utility Rates**

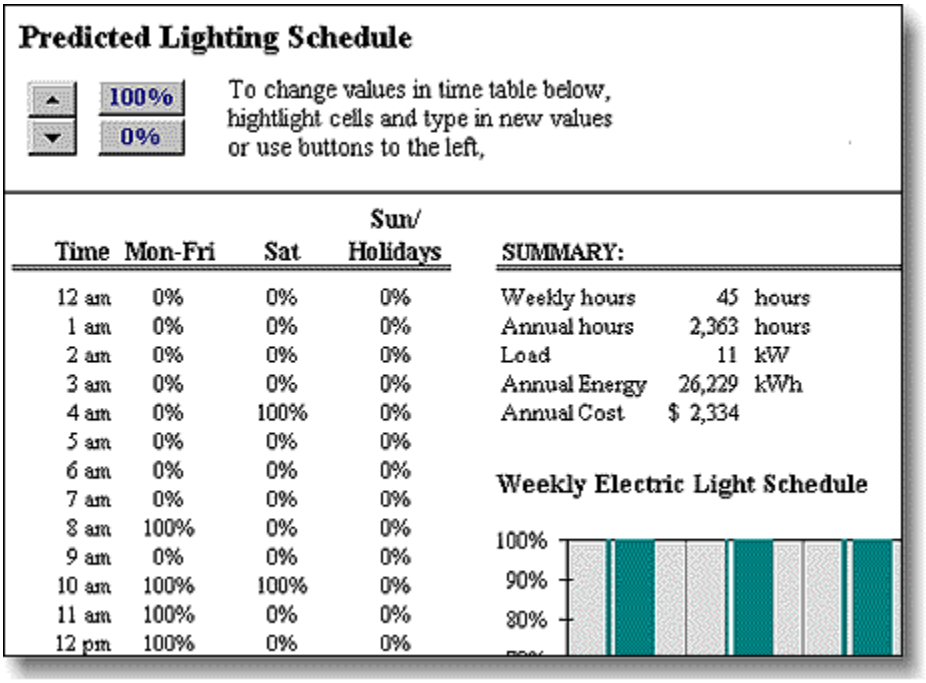
| | | |
|---|---|---|
| kwh charge | $0.089 | /kwh |

Here, you enter information on load and energy costs for up to three lighting systems. (Groups 1, 2 and 3) This information will be used throughout the spreadsheet.

***Figure 2*** *Screen for entering load and utility rates data*

## Evaluating the Operation of Existing Lighting Controls

Main | OS Main | OS Chart | Time Main | Time Chart | Load&Cost | **Schedule**



**Predicted Lighting Schedule**

100%
0%

To change values in time table below, hightlight cells and type in new values or use buttons to the left,

| Time | Mon-Fri | Sat | Sun/ Holidays |
|---|---|---|---|
| 12 am | 0% | 0% | 0% |
| 1 am | 0% | 0% | 0% |
| 2 am | 0% | 0% | 0% |
| 3 am | 0% | 0% | 0% |
| 4 am | 0% | 100% | 0% |
| 5 am | 0% | 0% | 0% |
| 6 am | 0% | 0% | 0% |
| 7 am | 0% | 0% | 0% |
| 8 am | 100% | 0% | 0% |
| 9 am | 0% | 0% | 0% |
| 10 am | 100% | 100% | 0% |
| 11 am | 100% | 0% | 0% |
| 12 pm | 100% | 0% | 0% |

**SUMMARY:**

| | | |
|---|---|---|
| Weekly hours | 45 | hours |
| Annual hours | 2,363 | hours |
| Load | 11 | kW |
| Annual Energy | 26,229 | kWh |
| Annual Cost | $ 2,334 | |

**Weekly Electric Light Schedule**

100%
90%
80%

***Figure3*** *User-defined lighting schedule screen*

The spreadsheet has a time control schedule allowing you to input the percentage of lights that are on in any given hour of the day (Fig 3). To change the values in the table, highlight the cell or cells and use the up/down arrow buttons to increment the highlighted values by 5% per click or click on the 0% or 100% buttons to insert those values. Days are categorized into weekdays (Mon through Fri), Sat, and Sun/Holidays. After defining the schedule, the spreadsheet will calculate the weekly and annual hours of operation.

# Exploring Potential Savings for Time Controls


From the Main Menu click on "Time Control Analysis" or click on the "Time Main" tab at the bottom of the screen.

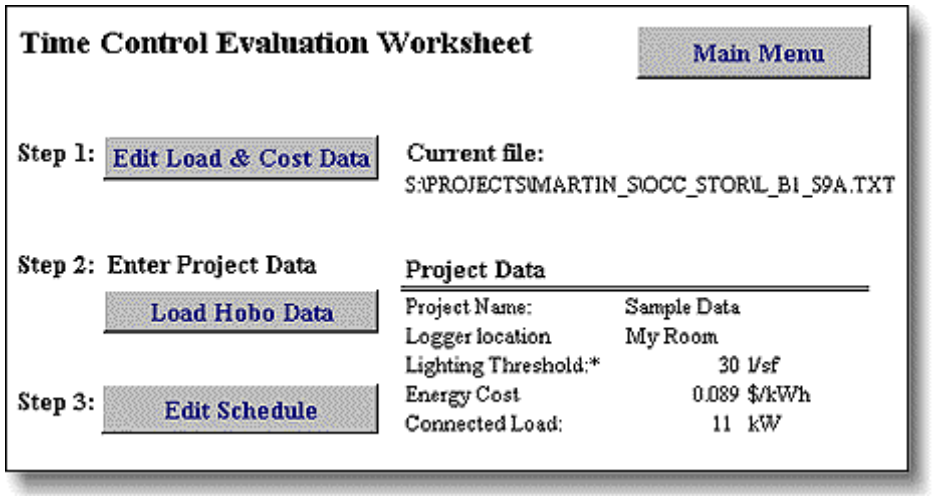



***Figure 4*** *Time Controls screen*

The spreadsheet can also be used to evaluate a space's lighting operation patterns based on data from a Hobo Light logger. The individual worksheets within the spreadsheet are designed to walk you through the procedure. Simply follow the steps from top to bottom.

By clicking the "Load Hobo Data" button, the spreadsheet will prompt you to select the file containing the data from the HoboLight datalogger. Find that file and click on "OK". It will then update the graph showing the operation of the lights over the monitoring period. With this information, you can compare the measured operation of the lighting system to its operation if time controls are used. Or you can compare it to the existing schedule if you entered that schedule into the Predicted Lighting Schedule.

# Exploring Potential Savings for Occupancy Sensors

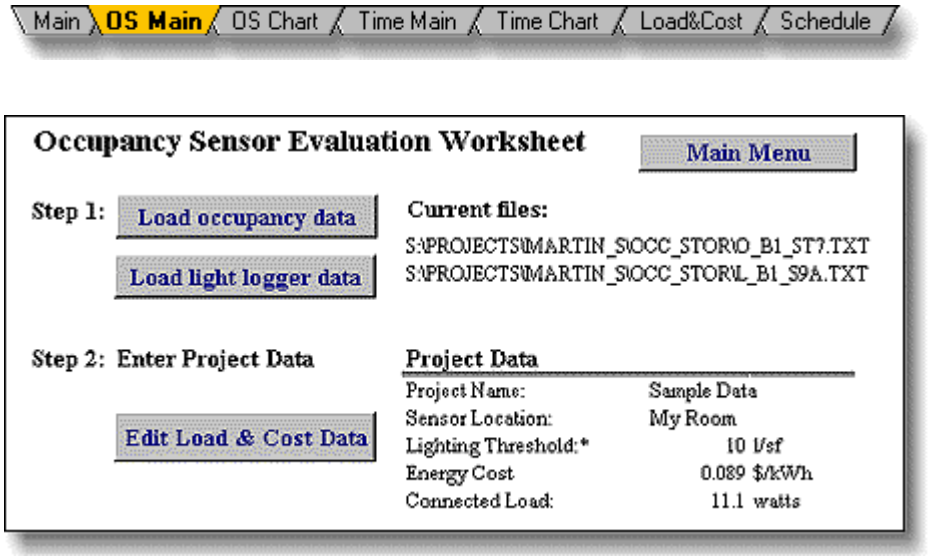



***Figure 5*** *Screen for entering occupancy sensor information*

To evaluate potential savings, you will need to import the light-use data from the Hobo Light and occupancy data from the Hobo Volt. With this coincident data, the spreadsheet will generate information about potential savings if an occupancy sensor were installed in the test space. Another automatically generated graph shows the unoccupied periods when the lights could have been turned off. The spreadsheet calculates potential savings for that week and estimates annual savings.

# Graph of Actual Light-Use Patterns vs. Scheduled Patterns

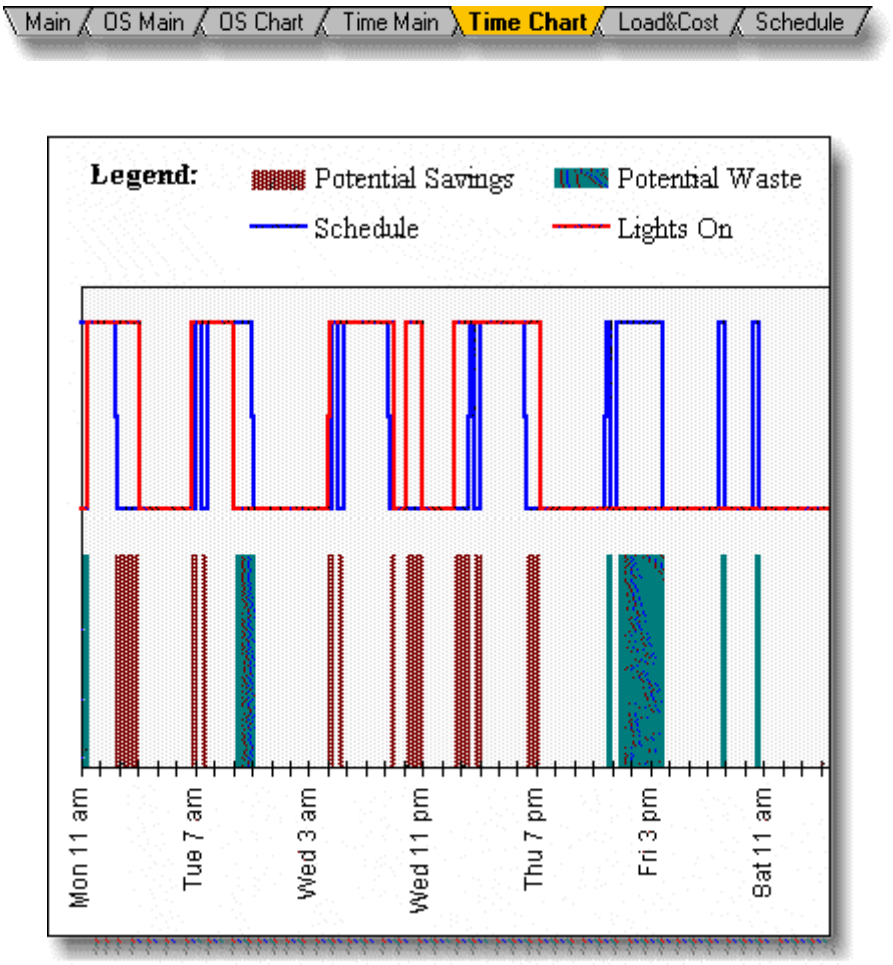



***Figure 6*** *Graph of measured light versus scheduled light in system operation*

In Figure 6 above, the top graph plots the user-defined lighting schedule against the lights' measured run time from Hobo data. The bottom graph identifies potential waste and savings based on a simple comparison of the Hobo data. For example, if the lights are off during times when they have been programmed to be on, the schedule can be changed to save energy. This is labeled as **potential waste**. **Potential savings** identify when lights are on during hours when the lights are scheduled to be off. In this case, energy is saved by reducing use of the space during unscheduled hours.\

## Graph of Actual Light-Use Patterns vs. Occupancy Patterns

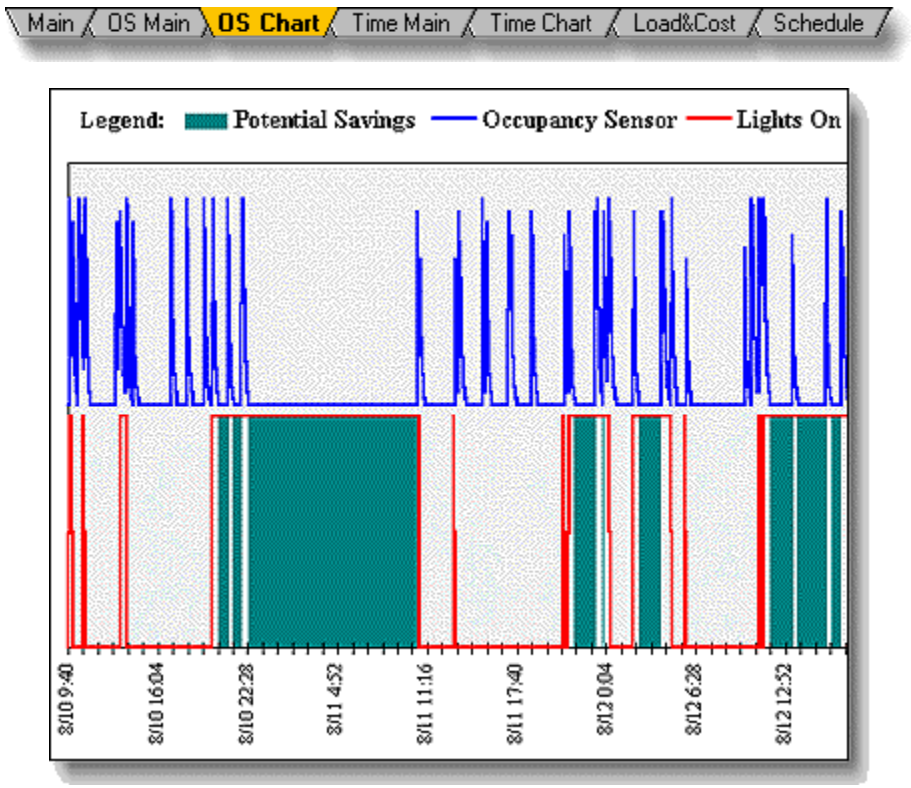



***Figure 7*** *Graph of occupancy patterns vs. light use patterns*

Similar to the previous graph, this graph compares two variables. The graph in Figure 7 plots measured light use patterns versus occupancy patterns and helps to answer the questions:

- *Are the lights on when no one is in the room?*
- *What, if any, are the potential savings if an occupancy sensor controlled the lights in the space?*

## Obtaining a Copy

This spreadsheet is available for your use. Click here to obtain a copy, peclight.exe [self-extracting zip file 328k].