Strategies for Controlling Plug Loads:

A Tool for Reducing Plug Loads in Commercial Buildings

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Introduction

Plug loads are often left out of energy savings measures considered in commercial buildings; however, as the heating, cooling, and lighting systems become more efficient, especially in high-performance commercial buildings, plug loads consume an increasingly large percentage of total building energy use and can directly account for up to 50% of a building's energy load. Indirectly, they contribute to cooling and cooling related fan loads.

Plug loads can be difficult to manage, because they are often small, diverse, and scattered throughout a building. The building owner purchases some of the plug loads, some are designed into the building, and some are purchased by the tenant. Strategies for reducing plug loads vary depending on each power-consuming item. This often makes it difficult to methodically save energy. This document contains a worksheet to inventory and evaluate methods for minimizing the energy plug loads consume. More details about setting up a process for minimizing plug load energy can be found in two NREL publications (NREL 2013b and 2013c).

Managing Plug Loads

Steps:

1. List all the current and expected future plug loads in the building.
2. Create categories for how the loads could be managed. As a starting point, use the following example categories:

    a. **Purchase ENERGY STAR® products.** These products are the most energy efficient in their class. ENERGY STAR creates a minimum standard and qualified products are the most efficient in their class. Many products are certified by ENERGY STAR, meaning that they meet a minimum energy efficiency standard. Alternatively, the Energy Guide labels can be used to select products that are near the lower end of the energy scale (less kWh). The list of ENERGY STAR-certified products is a good starting point for finding efficient plug load equipment. For computer and related hardware, the ENERGY STAR settings must be enabled. See http://www.energystar.gov/products/certified-products.

    b. **Motion Activated Switch or Power Strip.** The key to reducing plug loads is to turn products off when they are not being used. One strategy is to use an activity monitor power strip (a type of advanced power trip) or a motion controlled wall switch that turns outlets off. When no activity is detected, the circuits are de-energized. These should be used only if automatic on is critical for success, such as in a retail display area. These require a small parasitic load to remain activated, which means that a small amount of power is required for each controller to operate.

    c. **Use remote switch power strips.** These require a user to push a switch to activate the load and are appropriate for office environments. They can be either wall-mounted switches with controlled outlets or power strips. Timer power strips and vacancy timers will turn off after a set time without motion. You should specify units that have zero parasitic loads when off.

d. **Use master-controlled power strips.** This type of plug strip has a master outlet where an appliance is plugged in. The plug strip senses the current in this outlet, and when there is no current, the rest of the plug strip turns off. An example would be an office where the computer is the master and the other office plug loads, including lamps and printers, are the slaves.

e. **Use a time clock to set outlets for operational hours.** Use a simple time clock or the energy management system to control outlets in the space. When the building is unoccupied, the outlets are de-energized. This is ideal for retail environments where the store hours can be programmed to turn endcaps, kiosks, and vending machines off during nonoperational hours.

f. **Use a manual switch.** A user should be able to turn off all loads, either with switches on the hardware or with a wall switch connected to outlets. For example, in a retail environment peripheral equipment can be turned off based on the "checkout" light switch where the same switch is tied to the peripheral equipment in that checkout lane.

g. **Purchase products with auto off.** Equipment should automatically turn off to a near zero state after a period of nonuse. This is similar to computers with ENERGY STAR options enabled, where the computer will turn off after a period of nonuse. Charging stations should be specified to have minimum parasitic loads after charging is completed. Some small appliances, such as coffee makers, can be purchased to automatically turn off after a specified amount of time.

h. **Take no action.** In some cases, none of the above actions can be taken and "no action" is specified for those plug loads. However, these loads should be placed on a list for reduction opportunities.

3. Fill out the plug load worksheet (see Table 1) and create policy around identified loads. Table 1 is provided as a worksheet. See Table A-1 for an example with grocery stores. Plug loads often fall into multiple categories.

Table 1. Plug Load Matrix

Plug Load	ENERGY STAR Products	Motion-Activated Switch or Strip	Time-Out/Vacancy Based Switch or Strip	Load Sensing to Master	Time Clock on Operating Hours	Manual Switch	Product with Auto/Off	No Action	Comments

Appendix A Grocery Store Example

The following table is an example of Table 1 for grocery stores.

Table A-1. List of Plug Loads in a Typical Grocery Store and Strategies for Reducing the Energy Consumption

Plug Load	ENERGY STAR Products	Motion-Activated Switch or Strip	Time-Out/Vacancy Based Switch or Strip	Load Sensing to Master	Time Clock on Operating Hours	Manual Switch	Product with Auto/Off	No Action	Comments
Two-way radio charging station							x		
Air compressor, cake decorations			x				x		
Battery charger, single battery							x		
Battery charging station, portable printer/label machine							x		
Battery charging station, wireless scanning tool							x		
Beverage refrigerator	x				x				Set thermostat to 39°–45°F for nonperishable items.
Blood pressure monitor					x				
Break room refrigerator	x								One 18 ft^3 unit per 50 employees. Use the smallest possible unit.
Bug lamp					x				
Charger for floor washer								x	Specify unit with low or no parasitic at end of charge.
Coffee grinder station					x				
Coffee maker, break room					x		x		Auto off is a standard safety feature on many makes and models
Coin exchange customer kiosk					x				
Computer monitor, checkout area				x		x			Switch with lane-occupied switch

Plug Load	ENERGY STAR Products	Motion-Activated Switch or Strip	Time-Out/Vacancy Based Switch or Strip	Load Sensing to Master	Time Clock on Operating Hours	Manual Switch	Product with Auto/Off	No Action	Comments
Conveyor belt				x		x			Switch with lane-occupied switch
Credit card scanner				x		x			Switch with lane-occupied switch
CRT TV	x								Replace with light-emitting diode monitor
Customer convenience barcode scanner					x				
Customer water purifier/dispenser					x				
Demagnetizer				x					
Desktop computer	x						x		Set sleep mode to 5 minutes; consider laptops, which are more energy efficient
Display lighting, coffee grinder station			x						
Drinking fountain					x				
DVD rental station					x				
Electric wheelchair							x		
Employee badge reader								x	
Floor cleaner								x	
Label writer	x			x					
Modem								x	
Plug-in fans		x							
Point of sale: cash register terminal							x		Specify with built-in low-power/sleep mode.
Point of sale: barcode scanner and scale				x					Tie to “Lane in Use” light or sleep mode of point-of-sale device
Printer	x						x		Sleep mode at 5 minutes

Plug Load	ENERGY STAR Products	Motion-Activated Switch or Strip	Time-Out/Vacancy Based Switch or Strip	Load Sensing to Master	Time Clock on Operating Hours	Manual Switch	Product with Auto/Off	No Action	Comments
Reverse osmosis systems water use meter								x	
Reverse osmosis systems water system								x	
Scale					x		x		
Security monitor	x	x							Use flat screens. Note that many images can be displayed on a single screen.
Self-checkout point-of-sale terminal					x				
Slicer							x		
Solenoid for produce sprinkler system								x	
Task light	x	x	x		x		x		
Vending machine	x	x			x				Use only light-emitting diodes

Appendix B Additional Resources

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