TO MAXIMIZE THE COSTS OF ELECTRONIC EQUIPMENT, PLUG LOAD ENERGY MANAGEMENT IS CRITICAL

This product application report provides relevant information regarding the importance of using ESP's eCommandCenter for plug load energy management.

ABSTRACT

This product application paper seeks to explain the relevance of plug load energy management to companies looking to grow profits and implement sustainability initiatives. Recent research reveals how executives, customers, firms, and organizations are paying more attention to the benefits of plug load energy practices. Additionally, ESP's eCommandCenter will be presented as a premium solution to meet energy management needs.

INTRODUCTION

Energy usage is quickly becoming a spending concern for anyone running a profitable business. Recent reports indicate that businesses consume more energy than homeowners, and commercial energy usage is increasing rapidly.

According to EnergyStar, "energy represents 30% of the typical office building's costs" and is the single largest operating expense for commercial enterprises. In the United States alone, buildings represent 73% of electricity consumption and the U.S. is estimated to spend $108 billion for commercial buildings and $5 billion to power office devices [Source: Energy Information Administration, http://www.eia.gov].
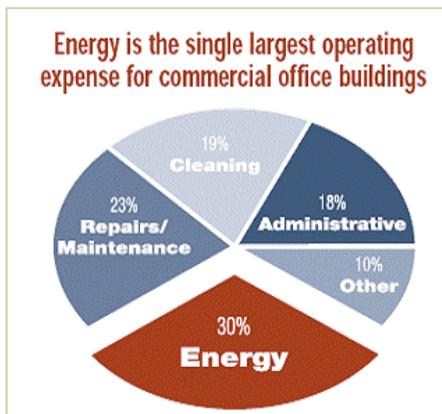
[Source: Georgia Department of Natural Resources/EnergyStar

http://www1.gadnr.org/sustain/toolkit/modules_3_1_2.html#foot]

Commercial Energy Use

- HVAC — 17%
- Lighting — 44%
- Office — 32%
- Ventilation — 8%
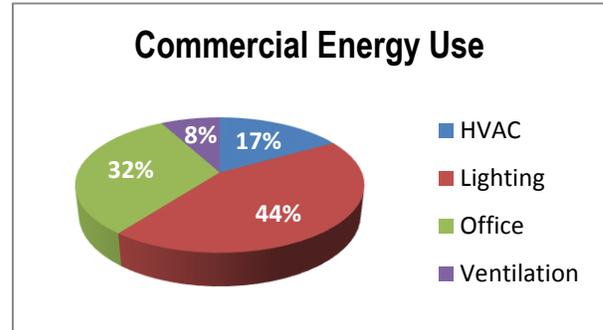
[Source: EIA http://www.eia.gov/emeu/consumptionbriefs/cbecs/pbawebsite/office/office_howuseelec.htm]

Globally, it is estimated that 5-6% of the world's energy is used by IT, and 25-27% is used by imaging. Specifically, office equipment is estimated to account for 25-35% of commercial energy consumption. This includes devices beyond imaging such as computers, servers, printers, vending machines, and refrigerators.

Due to the need to reduce energy consumption and the financial and environmental benefits, an increasing emphasis is being placed on plug load energy management practices.

1. Executives are paying more attention to plug-level use due to financial and environmental benefits.

2. Customers are looking to understand energy use to justify equipment purchases and upgrades, as well as manage usage in geographic locations with volatile energy costs and time-of-use billing.

3. Firms are realizing they can save 30-40% on their office equipment electricity bills when utilizing plug-level energy management.

4. Organizations committed to sustainability practices have discovered that plug-level energy control is an important power-saving practice in conjunction with lighting and HVAC energy management systems.

5. Employees and new hires are looking to work for proactive companies who offer capabilities to improve the environment.

Research from Deloitte, GreenBiz, and others indicate that senior executives are paying attention to plug-level use after focusing on lighting and buildings HVAC. As a result, firms are being asked to respond to societal concerns about energy use, including shareholders, customers, and employees.

Energy responsibility mindset growing

	2011	2012
We view reducing electricity costs as essential to staying competitive from a financial perspective	76%	85%
We view reducing electricity costs as essential to staying competitive from an image perspective	70%	81%
Our environmental efforts are more about doing the right thing than corporate image	66%	79%
We actively promote our green/environmental efforts to our clients and customers - most would know we are doing this	65%	76%
Until the last few years, we never really thought about electricity costs as being something we could focus on or manage	62%	66%
Our customers are demanding that we offer them more environmentally considerate solutions	49%	63%
Our environmental efforts are more about corporate image than cost reductions	44%	54%

Q: Please use the scale below to indicate how much you agree or disagree with the following statements.

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[Source: Deloitte Global Services, http://www.deloitte.com]

BENEFITS AND CHALLENGES OF ENERGY MANAGEMENT

Energy efficiency and sustainability programs have tangible benefits in both hard and soft dollars. A typical office building with 50,000 square feet can reduce operating costs by $40,000 per year through no-cost and low-cost actions [Source: http://www.fypower.org/com/]. In regards to soft dollars, research indicates that 65% of global warming pollution is estimated to come from energy consumption [Source: World Resources Institute, http://www.wri.org/tools/cait/]. Therefore, reducing energy use has been proven to be a key sustainability practice.

Helping the environment is not the only benefit businesses received by reducing energy waste. Research has proven that the less energy you use, the more money you generate or can invest in other areas, and the more profitable you become. Data shows that companies with sustainability programs are managed better, have greater shareholder return, and have better employee engagement. It has been shown that organizations implementing energy-efficient measures outperform their competitors by 10-15% [Source: http://www.fypower.org/com/].

There are, however, concerns associated with energy management:

- Time of Use Billing: One challenge businesses face comes from the fact that utility companies are changing their pricing model in high-cost areas. Due to time of use billing, companies will soon need to manage energy use more effectively in order to avoid cost hikes. Time of use billing means at certain times of the day, utility rates can rise exponentially and during those periods it may make sense to turn select office equipment off. Additionally, due to the fact that U.S. utility companies track energy usage at the meter and not at the plug level, accurate real-time usage data is not available.

- Estimated Measurements: Most alternative building energy systems utilize algorithms or "guesstimates of device usage" and are enormously expensive. These algorithms track usage at the meter and make assumptions on device usage. Therefore, they are not real-time plug-level measurement solutions and cannot identify those devices that are inefficient or being used improperly at the branch circuit level.

- EnergyStar: Although equipment manufacturers have incorporated EnergyStar power savings technology, studies indicate that devices with EnergyStar capabilities are deactivated a considerable amount of the time by employees for perceived efficiency reasons. Research from Lawrence Berkeley labs indicates that as much as half of devices are left in full power mode ALL the time [Source: LBNL, http://enduse.lbl.gov/Projects/OffEqpt.html].

To get an accurate, real-time measurement of actual energy usage, plug load measurement is required to understand and control a business's energy consumption. For most companies, it is difficult to independently track misused energy costs, measure vampire power, and identify specific employees, equipment, and locations within a facility that are energy hogs. Rather than making decisions based on estimations taken from a meter or holistic software algorithm, businesses should control, manage, and monitor every plug at a company's facility and make smarter, greener business decisions. ESP's eCommandCenter can help businesses fulfill these goals.

THE IMPACT OF PLUG LOADS

Plugged-in devices represent the fastest growing electricity loads in the commercial sector. A recent study indicates that devices with power cords consume up to 30-40% of office electricity–a much higher percentage than what prior studies suggested a few years ago. The assumption is that lighting and HVAC are now being managed more efficiently via sophisticated control platforms, increasing the percent usage at the plug, which can increase up to 50% depending on the environment.
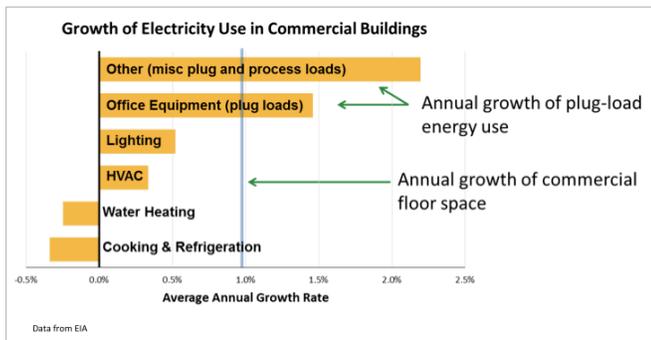
EIA 2012 Study

The Energy Information Administration (EIA) 2012 Annual Energy Outlook reports that, per square foot of office space, only plug and process loads are growing, whereas lighting and HVAC (heating, ventilation, and air conditioning) loads are decreasing. For example, the number of printers, servers, vending machines, water coolers, localized heating, mini-refrigerators, and coffee makers in offices increases over time as new devices join the circuit, but older ones remain plugged in.

Nearly all electrical products use power when sitting idle. A typical office is only occupied about one third of the year because of nights, weekends, and holidays. Even when no one is working at their desks, printing documents, or making coffee, energy is still being consumed by electric equipment, putting an unnecessary strain on a company's plug load. The energy consumed can result in a significant loss of profits.

Due to energy waste from connected equipment, plug load energy can be a huge problem unless managed. Consider printers, for example. The majority of office printers are laser desktop models, which consume between 3 and 42 watts in sleep mode. For large, free-standing printers, the sleep mode can vary from as low as just a few watts, to more than 60 watts. The size and functionality of the printer does not indicate the power used in sleep mode. Research has also indicated that the energy savings modes are deactivated in many cases.

Printers generally have four possible modes: active, ready, sleep, and off. In active mode, the printer is carrying out a print job. For several seconds, the power spikes very high. Following a print job, the printer will remain in ready mode so subsequent print jobs commence quickly. After being unused for a period of time (20-90 minutes on most printers) the printer enters an energy-saving sleep mode. To go completely off, someone needs to push the power button on the printer–a rare occurrence on a shared resource.

Energy-saving sleep modes are not enough to eliminate stand-by electricity waste. The amount of energy wasted by idle printers depends on many factors, including how long they sit in ready mode before entering sleep mode, if they become stuck in ready mode for hours or days, and if the user turns them off. Another trend is that energy-savings and EnergyStar modes are not being efficiently utilized. Research from Lawrence Livermore Labs indicates that up to half of all devices are constantly left in full power mode because businesses are disabling energy savings mode settings. Data suggests that devices wake up and do not power down in the middle of the night.

Desktop computers can also consume unnecessary amounts of energy. Less than 25% of desktop computers are turned off or put into hibernation when unused. These products are one of the biggest energy-waste offenders in the office space. They are constantly left running, and they continue to work while in sleep mode, drawing 2-3 watts—almost as much power as when they are in active use. It should be noted, however, that different computers differ in their power requirements.

Plug load burdens can also extend to the office kitchen. Many companies provide a vending machine in the kitchen for the convenience of their employees, without considering how much they are paying to power the machine. Beverage vending machines generally contain sodas and water that are kept constantly cold. While this is appreciated by the buyer, the beverage does not need to be cool 24 hours a day, 7 days a week. Soda vending machines run a compressor cyclically, several time an hour, to cool the beverages. Averaging over these cycles, vending machines constantly use 128-350 watts, even when no one is around to purchase the beverages. The less energy-intensive snack vending machines are at room temperature, and they use a constant amount of energy (about 40 watts) to keep the interior lit.

There is a need to track real-time, plug-level data from any standard device in a building. Businesses are looking for a tangible solution to identify specific energy consumption data, analyze employee behavior, and reduce operational costs. Insuring that office devices are turned off during non-business hours is a simple and powerful step toward energy efficiency. To save money on electricity, plug load energy management must be implemented to insure idle equipment is not using power.

THE SOLUTION: eCommandCenter

ESP now offers tangible hardware and software solution packages that feature minute-by-minute insights into device use at the plug level. The eCommandCenter protects and tracks energy consumption for multiple types of equipment and helps businesses measure, control, and report plug-level energy consumption to implement sustainability programs. This innovative solution enables companies to identify specific areas of energy waste and control what devices are turned off during non-business hours (after-hours and weekends).

ESP's eCommandCenter can be used to measure the energy used by any equipment that plugs into a standard wall outlet. It can generate savings by automatically cutting the electricity to connected equipment after work hours and restoring power before employees arrive. Using the eCommandCenter on shared devices will give insight into the frequency of equipment energy usage.

To automatically save energy, using the eCommandCenter to preset schedules is encouraged. A typical office savings plan will shut down equipment after the business day has ended and restore power on weekday mornings before employees begin arriving to the office. Likewise, equipment will be turned off automatically on weekends and holidays, when no one is in the Additionally, companies will be provided with a summary of energy asset utilization. ESP's energy management platform enables companies to change employee behaviors to meet their sustainability initiatives and monitor their energy consumption costs.

Furthermore, the eCommandCenter delivers significant benefits in reporting actual usage for a multitude of business needs. The platform can be used as a tool in understanding plug-level energy use to justify equipment purchases and upgrades. For businesses under internal or external pressure for their environmental footprint, using the eCommandCenter's reporting, monitoring and control features can help alleviate these pressure points.

FEATURES

- Innovative plug-level energy consumption platform
- Tracks and protects plug-level office equipment
- Provides real-time data
- Adaptable for a facility, department, or building floor
- Independent wireless mesh network, outside of firewalls
- Easy to use web interface and dashboard
- Employee engagement programs available

ROI METHODOLOGY

The table below summarizes the one to two year ROI over that the eCommandCenter can provide on typical devices found in offices, given common North American energy rates.

Energy Intensive Office Equipment Providing a Solid 1-2 Year Return on Investment (ROI)

Equipment Type	Energy Wasted	Energy Rate $0.10/kWh	Energy Rate $0.15/kWh	Energy Rate $0.20/kWh
	Watt Hours	Potential Annual Savings Per Device		
Industrial Coffee Maker	64	$37	$55	$74
Soda Vending Machine	260	$149	$224	$299
Snack Vending Machine	37	$21	$32	$43
Water Dispenser (hot/cold)	107	$62	$92	$123
Water Dispenser (cold)	51	$29	$44	$59
Plotter Printers	35	$20	$30	$40
Large Network Printers 30+ ppm (pages per minute)	28	$16	$24	$32
MFP 20-30 ppm	25	$14	$22	$29
MFP 31-40 ppm	47	$27	$41	$54
MFP 41-50 ppm	84	$48	$72	$97
MFP 51-60 ppm	142	$82	$122	$163
> 24" TV	99	$57	$85	$114
>24" Plasma TV	205	$118	$177	$236

Source: ThinkEco, Inc. plug load data base, April 2013

For each of these devices, the "Average Wasted Power" is calculated to illustrate potential savings through use of the eCommandCenter device. Average Wasted Power is the average power consumed between 7:00PM and 7:00AM for all days before an energy savings plan is implemented. To find the cost of energy wasted annually by a typical device in each category, it is assumed that the devices are unnecessarily consuming electricity at the rate given by the Average Wasted Power for 12 hours each business day and 24 hours each weekend day or holiday, equaling 251 business days and 114 weekends and holidays each year. Average Wasted Power gives the average rate at which devices consume energy during non-business hours. Each device may have several different power states during the course of a typical day. For instance, a printer may be off (though this is rare), in sleep mode, ready mode, or active mode. At night, most printers enter sleep mode, but some events, such as a paper jam, prevent a printer from entering sleep mode. The Average Wasted Power for such a printer would be an average of the sleep mode and the error mode, weighted by the amount of time spent in each. So the "Average Wasted Power" is the rate of energy wasted, averaged over real-world conditions.

Due to the real-world conditions captured as Average Wasted Power, the distribution tends to be very broad within a

category. Network interferences, energy surges, and user behaviors all play a factor. We expect these numbers to change over time as the database size increases and the current inherent bias towards energy-conscious sites becomes less apparent. There is not yet enough data to determine if the devices in our database, many from companies with strong energy initiatives, are any greener than devices from other companies.

To automatically save energy, the use of preset schedules is encouraged. A typical office savings plan will shut down equipment after the business day has ended and restore power on weekday mornings before employees begin arriving in the office. Likewise, equipment will be turned off automatically on weekends and holidays, when no one is in the office. Insuring that office devices are turned off during non-business hours (after-hours and weekends) is a simple and powerful step toward obtaining a ROI.

CONCLUSION

The eCommandCenter can help companies reduce their energy costs. This product enables organizations to identify and eliminate energy waste by plugged-in appliances and is recommended for a wide range of electronic devices.

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