ACEEE
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The American Council for an Energy-Efficient Economy (ACEEE) welcomes the opportunity to provide this assessment of plug load management strategies to advance energy savings across Oregon's state buildings portfolio. ACEEE developed this technical brief in response to the Oregon Department of Administrative Services' (DAS) request to provide information on available technology types and best practices to reduce plug loads.

In November 2017, Governor Kate Brown issued Executive Order 17-20, Accelerating Efficiency in Oregon's Built Environment to Reduce Greenhouse Gas Emissions and Address Climate Change. Item 3.C of the order directs DAS and the Oregon Department of Energy (ODOE) to develop a statewide plug load management strategy. The order also calls on DAS and ODOE to develop strategies for occupant behavior change. Currently, the state does not have a comprehensive plug load management strategy, and common practice varies across agencies.

In this review, ACEEE describes various strategies for addressing plug loads associated with key technology types. We supplement these descriptions with links to further research and guidance. We also describe how other entities, including states and government organizations, have developed comprehensive plug load management strategies and standard operating procedures for public buildings to inform the development of a new policy for state buildings in Oregon.

Managing Key Technologies

COMPUTER POWER MANAGEMENT

Computers account for 10-20% of total energy consumption in commercial buildings.[1] Computer power management (CPM) programs can cut this energy consumption in half by activating sleep mode across an entire network of computers. Typically, IT staff will develop or purchase CPM software for installation on all staff computers. Once installed, the IT department can manage a computer's power profile remotely. While savings from a single computer may seem small, savings aggregated across the network can be substantial. General Electric installed and activated CPM settings on 75,000 computers, resulting in approximately $2.5 million in annual energy cost savings.[2]

Office IT administrators are sometimes hesitant to deploy CPM programs. A primary concern is that sleep mode may interfere with network maintenance and security patches. Administrators can use Windows Server Update Services (WSUS) to overcome this issue. WSUS can detect when a sleeping computer comes online and installs updates to catch the computer up. Administrators may also have concerns about CPM interrupting their

1 ENERGY STAR. 2018. Power Management for Utility-funded Energy Efficiency Programs. www.energystar.gov/products/low_carbon_it_campaign/utility_funded

2 ENERGY STAR. 2010. "General Electric Saves nearly $6.5 M with Computer Management Features". www.energystar.gov/sites/default/files/asset/document/GE_CPM_Case_Study.pdf

employees' productivity, but countless pilots and demonstrations have shown that CPM has little to no negative impact on employees' work.

Offices must incur labor and software costs to implement computer management on a large network of computers. According to ENERGY STAR®, labor costs rarely exceed $5 per computer. Software cost can range from zero to $15 per computer, depending on the computer network and how many features are included in the software.

Additional Resources

- ENERGY STAR provides educational materials for organizations about how to start a CPM program: https://www.energystar.gov/products/reduceitenergycosts
- ENERGY STAR maintains a list of CPM success stories: www.energystar.gov/products/low_carbon_it_campaign/business_case/success_stories
- ENERGY STAR provides free one-on-one consultation for offices that want to pursue a CPM but are unsure what solution best fits their needs: www.energystar.gov/products/low_carbon_it_campaign/contact_energy_star_free_tech_support

ADVANCED POWER STRIPS

Most devices draw standby power when they are inactive. Even if these devices are off, they draw a small amount of power known as a "phantom load" or a "vampire load." Advanced power strips (APS) can avoid these loads by automatically cutting the power to one or multiple outlets. There are five main types of APS controls:

- *Master Controlled*. These power strips have a primary device that triggers the strip to automatically turn off additional devices plugged into the strip. For example, a computer may be the primary device and a desk light is an additional device. When the user shuts the computer down, the desk light automatically shuts off.
- *Timer Power Strip*. Users can program a schedule for these power strips to turn off automatically.
- *Remote Switch Power Strip.* Users can turn these strips off by remote switches and phone applications.
- *Activity Monitor Power Strip.* These power strips can detect activity in the room and turn off the outlet if the room is unoccupied.
- *Masterless Power Strip.* When all devices are turned off, the power strip shuts off power to the outlet completely to eliminate all vampire loads.

Installing APSs is a cost-effective strategy for reducing plug and process loads (PPLs) in offices. A study commissioned by the Minnesota Department of Commerce found that installing APSs with occupancy sensors at workstations could reduce PPLs by 22%. Additionally, adding a foot pedal switch to an APS makes it more convenient for users to turn off the switch and can reduce PPLs by 19%. APSs with timers in common areas can reduce energy consumption by turning devices off during times the office is typically empty, such as at night and during the weekend. The same Minnesota study found that using timers on an office coffeemaker and water cooler saves approximately 110kWh and 104kWh a year, respectively.

Additional Resources

- The National Renewable Energy Laboratory developed an infographic to help offices determine which power strip meets their needs. See Appendix A.
- The aforementioned Minnesota study quantifies the impacts of multiple office plug load reduction strategies in addition to installing APSs, including computer management and behavioral programs: www.seventhwave.org/commercial-plug-load-study
- The Northeast Energy Efficiency Partnerships maintains a list of research and resources about APSs: www.neep.org/initiatives/high-efficiency-products/advanced-power-strips

PRINTERS, COPIERS, AND SCANNERS

Printers, copiers, and scanners are typically in use only 5% of the time.[3] To avoid wasted energy during periods of inactivity, offices should program imaging equipment to automatically enter sleep mode. ENERGY STAR recommends programming equipment to sleep after 10 minutes of inactivity. Offices can further reduce energy consumption by having multi-functional devices instead of multiple individual pieces of imaging equipment. Offices should also have employees use networked imaging equipment that can serve the needs of many employees instead of individual devices.

COST-EFFECTIVE STAFF ENGAGEMENT AND EDUCATION/FEEDBACK STRATEGIES

Occupant behavior directly influences energy consumption from plug loads. Building owners and management companies can implement education and engagement programs to help occupants understand and reduce their individual energy consumption. ENERGY STAR analyzed various office campaigns and outlined eight strategies for effective tenant engagement, presented in Table 1.

Table 1. Strategies for effective tenant engagement.

Strategy	Description	Example
Transparency	Share the building's current energy use and savings goals to help motivate tenants to meaningfully engage in campaigns	Circulate monthly scorecards for energy consumption and goal progress
Leverage ENERGY STAR	Use ENERGY STAR toolkits, tip sheets, posters, and interactive tools	Post co-branded "Bring Your Green to Work" posters
Educate	Tailor specific messages, steps, and actions for tenants to improve their understanding of their energy use and potential impact on savings	Send out individual or blast emails to tenants with educational materials
Identify opportunities	Help tenants assess their current energy consumption and identify improvements	Develop and distribute checklists and improvement manuals

3 ENERGY STAR. 2017. "Power Management in Your Imaging Equipment". www.energystar.gov/products/ask-the-expert/power-management-in-your-imaging-equipment

Strategy	Description	Example
Form partnerships	Work with tenants to establish performance goals and support energy efficiency champions	Create tenant green committees that establish monthly meetings and goals
Provide incentives	Provide rewards to tenants who meet efficiency goals	Offer catered lunches and tickets to baseball games
Host competition	Make saving into a game to motivate tenants to achieve deeper energy savings	See the ENERGY STAR competition guide
Communicate	Develop tenant communication plan to help maintain regular contact and celebrate success	Host events, develop tenant portal, email blasts, and news letters

Source: ENERGY STAR. 2018. "8 Great Strategies to Engage Tenants on Energy Efficiency". www.energystar.gov/buildings/tools-and-resources/8-great-strategies-engage-tenants-energy-efficiency

A combination of the above strategies can achieve energy savings. For example, Shorenstein, a national real estate investor and manager, developed the "Flip the Switch" program to encourage its tenants to save energy in their leased spaces. The program began as periodic workshops to educate tenants and provide one-on-one assistance to interested tenants. The program has expanded to include other messaging and educational techniques, including its "I Will If You Will" challenge. The challenge tracks office equipment energy use to identify opportunities to save energy. Using this information, the challenge administrators provide tenants technical support and help them implement energy-saving improvements. On average, tenants that participated in the challenge reduced their energy use by 27%. Overall, Shorenstein has seen 20% savings across its portfolio, which its program manager attributes largely to the "Flip the Switch" campaign.[4]

Additional Resources

- ENERGY STAR has a comprehensive guide to developing energy efficiency competitions for office tenants: www.energystar.gov/sites/default/files/tools/Building%20Competition%20Guide_092514.PDF
- New Buildings Institute created a guide for managing office plug loads, which includes information on behavioral programs: newbuildings.org/sites/default/files/PlugLoadBestPracticesGuide.pdf
- Marta Schantz from Waypoint Building Group and Rois Langer from NREL authored an ACEEE Summer Study paper on engaging tenants to reduce plug load energy use: aceee.org/files/proceedings/2016/data/papers/8_178.pdf

[4] For more information see the US Department of Energy's program description at: betterbuildingsinitiative.energy.gov/implementation-models/%E2%80%9Cflip-switch%E2%80%9D-tenant-engagement-program

DATA CENTERS

Data centers require an incredible amount of energy. Servers operate at high energy intensities 24 hours a day, 365 days a year. This data center energy usage accounts for approximately 2% of total US energy consumption. Research predicts this number will increase more than 9% a year through 2020.[5] Fortunately, DOE has found that efficient data centers can reduce energy consumption by up to 80% through energy efficiency measures.

ENERGY STAR identified three main types of strategies for improving data center energy efficiency: IT solutions, airflow solutions, and cooling solutions. Successful efficiency programs should use a combination of these strategies. We outline each solution type below.

IT Solutions

Currently, the majority of data centers house servers that run below 20% utilization while still drawing full power.[6] This presents a major opportunity for improving data center efficiency. By increasing server utilization rates, offices can reduce the number of servers necessary for performing the same level of output. ENERGY STAR outlined strategies for improving utilization rates, summarized in Table 2.

Table 2. Strategies for improving server utilization rates.

Strategy	Description
Virtualization	Using cloud-computing software, known as a virtual server, to act as multiple servers while requiring only a single physical server.
Decommissioning	Identifying and uninstalling servers that are no longer in use. Research has shown that 8-10% of servers are not in use but still drawing power.
Consolidation	Combining applications from multiple servers onto a single server.
Clustering	Configuring multiple servers to a single back-up server.
Efficient data management	Optimizing how data is organized and stored on servers.
Efficient equipment	Replacing inefficient equipment with more-efficient ENERGY STAR qualified equipment

Source: ENERGY STAR. 2018. "12 Ways to Save Energy in Data Centers and Server Rooms".
www.energystar.gov/products/low_carbon_it_campaign/12_ways_save_energy_data_center

The strategies presented above improve data center efficiency by reducing the number of servers and amount of equipment used to perform the same level of output. This saves energy at the server level, and also reduces energy used for heating and cooling — for every watt saved at the server, HVAC systems save 1.9 watts. Savings from these avoided loads

[5] ENERGY STAR. 2012. "Understanding and Designing Energy-Efficient Programs for Data Centers". www.energystar.gov/sites/default/files/asset/document/ES_Data_Center_Utility_Guide.pdf

[6] US Department of Energy. 2011. "Best Practices Guide for Energy-Efficient Data Center Design". www.energy.gov/sites/prod/files/2013/10/f3/eedatacenterbestpractices.pdf

can be substantial. For example, the University of California, Santa Cruz used the strategies to run 54 virtual servers on 8 physical hosts, saving $22,000 in energy costs annually.

Efficient data management is another key strategy for decreasing the number of servers used. One of the most effective strategies is reducing duplicate copies, which often account for 50% of a company's data. Duplication-detection software can find and eliminate unnecessary copies, ultimately reducing the number of servers necessary. This process alone can achieve 40-50% energy savings.

Beyond reducing the number of severs used, offices can also reduce energy consumption by purchasing efficient equipment — especially servers and uninterruptible power supplies (UPSs). On average, ENERGY STAR qualified servers use 30% less energy to operate than conventional servers. They also require less cooling, which can provide an additional 30-60% energy savings. Replacing old UPSs presents another large savings opportunity. UPSs are necessary for providing energy when the utility power supply is disrupted (even for just seconds). Older UPSs have fixed switching patterns, which often waste energy in the inverter and transformers. Newer UPSs have power management systems that can control and optimize the inverter's switching patterns and significantly reduce wasted energy. On average, ENERGY STAR UPSs can reduce energy waste by 30-55%.

ADDITIONAL RESOURCES

- ENERGY STAR outlines data management strategies on its website: https://www.energystar.gov/products/low_carbon_it_campaign/12_ways_save_energy_data_center/better_management_data_storage

Airflow solutions

Airflow strategies are critical to reducing data center cooling demand. Typically, servers take in cold air through the front and exhaust heat waste through the back. Proper airflow strategies will orient server racks so that one row does not exhaust into another row's cool air intake. Proper airflow not only reduces the temperature of servers and the necessary cooling loads, but also maintains the servers and prolongs their life. ENERGY STAR recommends the following strategies to optimize airflow and reduce energy consumption.

Table 3. Optimizing airflow in data centers.

Strategy	Description
Hot aisle/cold aisle configuration	IT equipment takes cold air in the front and exhausts hot air in the back. Equipment should be configured so that one row of equipment is not exhausting into another row of equipment's cool air intake.
Containment	This strategy is used in tandem with hot aisle/cold aisle configuration. It includes other barriers and structures to further eliminate cold and hot air mixing, such as using flexible strip curtains to contain air flow in cold aisles.
Variable-speed fan drives	Most computer room air conditioning fans are unable to adjust their speed to match the constantly fluctuating server load. This creates a significant amount of energy waste because data centers use multiple fans 24 hours a day. Using variable-speed fans can significantly reduce this waste.
Deployed airflow-management devices	When properly deployed, various devices can help eliminate the mixing and recirculation of hot air from equipment. ENERGY STAR outlines multiple devices and deployment strategies on its website.

Source: ENERGY STAR. 2018. "12 Ways to Save Energy in Data Centers and Server Rooms". www.energystar.gov/products/low_carbon_it_campaign/12_ways_save_energy_data_center

DOE estimates that combining hot and cold aisle configuration with containment can reduce fan energy use by 20-25%. While these strategies are easy to implement in new data centers, retrofitting existing centers can have significant costs, including server downtime, adjusting the HVAC system, new cabling, reconfiguring power distribution, and labor costs. Because these projects are complex, ENERGY STAR provides free phone and email consultations to help offices determine cost-effective solutions for reducing their data center energy consumption.

Installing variable-speed fans and other airflow-management devices can yield deep savings. Reducing fan speed by 20% can reduce electricity consumption by 45%. Data centers that have installed these fans have demonstrated quick payback times, ranging from 0.5 years to 1.7 years. Other cost-effective devices include diffusers, blanking panels, floor grommets, and ventilated tiles.

ADDITIONAL RESOURCES

- Information on setting up a consultation with ENERGY STAR can be found at www.energystar.gov/products/low_carbon_it_campaign/contact_energy_star_free_tech_support
- More information on airflow devices and deployment strategies can be found at www.energystar.gov/products/low_carbon_it_campaign/12_ways_save_energy_data_center/properly_deployed_airflow_management_devices

HVAC solutions

Data center managers tightly control temperature and humidity to protect equipment and prevent equipment failure. Research has shown that data centers are often over-cooled. The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) recommends temperatures at the server inlet of 68°F to 77°F, but most data centers are set below this point. Efficiency programs should encourage data center managers to use the strategies outlined in Table 4.

Table 4. Strategies for heating and cooling data centers.

Strategy	Description
Server inlet temperature and humidity adjustments	Setting higher temperature and humidification levels in data centers can reduce energy consumption while not affecting data center performance. ENERGY STAR cites several server models that can operate up to 90°F.
Air-side economizer	Economizers can direct exhaust air directly outside, reducing the recirculation and mixing of hot and cold air inside the server room.
Water-side economizer	Data centers with water plants can use water-side economizers to reduce energy by using evaporative cooling instead of water chillers in winter months.

Source: ENERGY STAR. 2018. "12 Ways to Save Energy in Data Centers and Server Rooms". www.energystar.gov/products/low_carbon_it_campaign/12_ways_save_energy_data_center

Simply increasing the temperature of data centers can significantly reduce energy consumption. For every 1°F temperature increase, data centers can save up to 5% in energy costs. Installing additional equipment can yield greater HVAC energy savings.[7] For example, ultrasonic humidifiers can save up to 50% of energy costs by turning off the HVAC humidification controls. Companies that install these devices have seen payback periods of less than two years.

Energy savings from air-side and water-side economizers vary among centers. ENERGY STAR case studies demonstrate air-side economizers reduce energy costs 30-60%.[8] Similarly, research has shown that using water-side economizers can reduce energy costs by up to 70%.[9]

Putting Plug Load Management into Practice

California Standard Operating Procedures for State Buildings

Like Oregon, California's operations are guided by several executive orders that call for leading by example and reducing energy usage in public buildings. The State Administrative Manual includes a chapter on energy and efficiency that highlights opportunities for energy savings across operations, from purchasing practices to recycling to maintenance and operations.[10] The state has developed standard operating procedures for energy management in existing buildings, which focus on several categories including hours of operation, building heating and cooling systems, annual maintenance practices, lighting, plug loads, and demand response. Plug load guidance lays out specific expectations for personal devices used in offices and equipment used in shared spaces like kitchens and lunchrooms. The guidance also requires use of power strips with timers and calls on department directors to send an annual email to educate employees about plug load management strategies. See Appendix B for SOP language on plug load management.

The state does not have enforcement mechanisms in place for plug load management. However, there are several complementary reporting and coordination efforts that reinforce the importance of plug load management and help the Department of General Services track overall energy management progress. For example, California state agencies are required to

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[7] ENERGY STAR. 2018. "Server Inlet Temperature and Humidity Adjustments". www.energystar.gov/products/low_carbon_it_campaign/12_ways_save_energy_data_center/server_inlet_temperature_humidity_adjustments

8 ENERGY STAR. 2018. "Air-Side Economizer". www.energystar.gov/products/low_carbon_it_campaign/12_ways_save_energy_data_center/air_side_economizer

[9] ENERGY STAR. 2018. "Water-Side Economizer". https://www.energystar.gov/products/low_carbon_it_campaign/12_ways_save_energy_data_center/water_side_economizer

[10] The complete manual is available at http://sam.dgs.ca.gov/TOC/1800.aspx.

report every two years on their progress toward meeting the state's lead-by-example targets and requirements for facilities and operations. These Sustainability Roadmap documents include information on energy usage and energy efficiency measures. In its most recent report, the California Public Employees' Retirement System (CalPERS) reported that it had installed plug load devices throughout its facilities, and that it conducts quarterly audits to identify and remove unauthorized personal electronic devices like heaters or fans. The agency also publicizes energy efficiency activities annually to its employees and uses the same format to educate employees on the importance of minimizing plug loads.[11]

The Department of General Services (DGS) has monthly interagency meetings with the various departments that operate state facilities. These meetings offer opportunities to provide training, including providing information on plug load management strategies. While individual departments are responsible for implementing and enforcing plug load management, DGS staff report that tracking activities through the biennial Roadmap reports and having regular forums to engage with building operators have been helpful in encouraging full implementation of the plug load policy.

Federal Government Programs and Policies

The federal government has several initiatives that target plug load energy usage. Executive Order 13693 sets out guidelines for a variety of sustainability initiatives, including energy savings goals for existing buildings and data centers.[12] It includes specifics regarding a few technology types. For example, it requires that data centers incorporate energy efficiency by installing energy meters and establishing power usage effectiveness targets. For new buildings, the order requires improved efficiency through compliance with the Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings.[13] For existing buildings, the order calls for the development of energy savings targets. It also lays out specific expectations for leasing and procurement. Products must be energy and water efficient, and agencies are given a variety of ways to ensure compliance, including ENERGY STAR certified appliances and Federal Energy Management Program (FEMP)-certified

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[11] California Public Employees' Retirement System. 2017. *Sustainability Roadmap 2018-2019.*

[12] EO 13693 was superseded by E 13834, issued on May 17, 2018. The new executive order calls for a review of policies and programs, but reinforces elements of EO 13693 including calling on agencies to save energy and requiring the publication of energy scorecards. See https://sftool.gov/learn/annotation/447/executive-order-13693-planning-federal-sustainability-decade-archived for an archived version of EO 13693. Additional guidance on the order from EPA is available here: https://www.fedcenter.gov/_kd/Items/actions.cfm?action=Show&item_id=30816&destination=ShowItem.

[13] The Federal Energy Management Program maintains a variety of resources to help agencies use the Guiding Principles. Checklists for new and existing buildings are available here: https://www.energy.gov/eere/femp/downloads/guiding-principles-checklists-new-construction-and-modernization-and-existing.

products. FEMP and the GSA have developed a wide variety of tools to help agencies comply with purchasing and leasing guidelines. For example, GSA publishes lists of key products for custodial and construction services.[14]

Federal agency compliance with sustainability guidelines, including procurement practices and energy savings in existing buildings, is assessed through high-level annual benchmarking. The Office of Management and Budget (OMB) is required to publish these scorecards and make them available to Congress, federal agencies, and the public. Scorecards for 2016 rated agencies on a red-yellow-green scale across a variety of metrics, including reduction in energy intensity compared to the previous year.[15] The scorecards do not include plug load energy consumption, but adhering to plug load management strategies helps agencies meet energy savings targets.

GSA's Green Proving Ground devotes resources to developing best practice information on plug load energy usage reduction. For example, GSA has tested and published the results of several plug load energy management strategies using its own portfolio of buildings. In 2013, the agency developed a project to test two plug load reduction strategies that relied on advanced power strips. The first was using schedule timers to turn appliances on and off according to the time of day. The second was using load-sensing controls that monitor a master device's power state and de-energize auxiliary devices when the master device goes into a low-power state. They found that timers were more effective. The study also recommended a variety of other best practices, including giving building occupants the ability to customize control settings, developing conservative schedules for control systems to minimize complaints, and ensuring that large devices have their own power strips.[16]

Additional Resources

- Lawrence Berkeley National Laboratory prepared a contracting guide for energy-efficient product procurement for the US Department of Energy's Federal Energy Management Program. The guide includes specific language to include in contracts, including those for product purchasing and buildings operation and maintenance. It is available here: https://www.energy.gov/sites/prod/files/2016/10/f33/femp_best_practices_guide_for_procurement.pdf
- The US Department of Energy's Better Buildings program issued a set of Decision Guides for Plug and Process Load Controls in 2015. These include simple checklists comparing costs, savings, implementation complexity, and user acceptance rates. The Decision Guides are available here: https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/Decision_Guides_for_PPL_Controls_0.pdf

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[14] See https://sftool.gov/greenprocurement/pbs

[15] See https://www.sustainability.gov/scorecards.html.

[16] See https://buildingdata.energy.gov/cbrd/resource/1099

- A searchable database of products requiring FEMP certification is available here: https://sftool.gov/GPCSearch?Query=FEMP

Further Research

ACEEE is available to provide additional resources, research, and analysis of options for plug load management, efficient buildings policy, and strategies for leading by example.

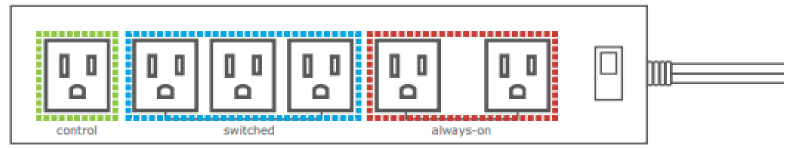
For more information on the material covered in this memo, please contact ACEEE Research Analyst Hannah Bastian (hbastian@aceee.org). For more information on technical assistance opportunities, please contact Senior Manager for State Policy Annie Gilleo (agilleo@aceee.org).

Appendix A. NREL Guidance for Advanced Power Strip Usage

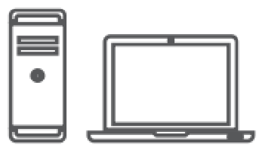
NREL
NATIONAL RENEWABLE ENERGY LABORATORY

ADVANCED POWER STRIPS (APS)

HOW TO USE IN AN **OFFICE SETTING**



Each APS has three outlet types for equipment with various electricity needs:



Primary Outlet

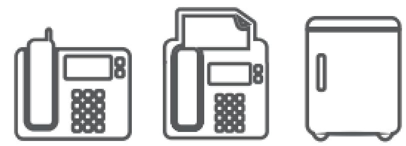
COMPUTER/LAPTOP

The primary outlet acts as the "control," or "master," outlet because it turns off the power to secondary outlets when the device connected to it is turned off. The primary outlet typically powers your computer's central processing unit because most other devices connected to the power strip at an office desk depend on your computer for their functionality. For example, you need to turn on your computer to use your monitor and to print documents.

Secondary Outlet

MONITOR, PRINTER, DESK LAMP

The secondary outlets act as the "controlled" outlets and typically power peripheral devices, such as your computer monitor(s), desk lamp, and printer. When the device connected to the primary outlet is turned off, the power will automatically be shut off to the device connected to the secondary outlets. For example, turning off your computer automatically shuts off the power to your monitor or printer. The amount of energy you save with an advanced power strip depends on the energy usage of the devices connected to the secondary outlets.



Always-On Outlet

LANDLINE PHONE, FAX, MINI FRIDGE

The always-on outlets are not controlled by the primary outlet. Important office desk devices, such as landline phones and fax machines, that are plugged into the always-on outlet will receive constant power regardless of the primary outlet device.

Learn more about plug and process loads: www4.eere.energy.gov/alliance/activities/technology-solutions-teams/plug-process-loads.

NREL is a national laboratory of the U.S. Department of Energy,
Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

NREL/PO-5500-63800 • March 2015

Source: https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/how_to_use_advanced_power_strips.pdf

Appendix B. California Standard Operating Efficiency Procedures: Plug Loads

The section below is excerpted from California's Standard Operating Efficiency Procedures for Public Buildings, referencing Management Memo 14-07.

- State employees shall not plug in any personal devices, including but not limited to coffee pots, microwaves, refrigerators, and heaters, in workspaces.
  Exception: the following may be allowed if the facility manager determines that the circuit can safely accommodate the electrical load:
    - Cell phones and tablets;
    - Task lighting that is UL approved and does not use incandescent or halogen bulbs.

- Facility managers shall work with employees and vendors to ensure that all equipment in employee kitchens, lunch rooms, and other shared spaces complies with the following:
    - Additions of new equipment must have a current ENERGY STAR rating, when available;
    - As practical, strive to replace refrigerators and equipment manufactured prior to 2000 with more efficient models;
    - Refrigerated beverage vending machines and hot/cold water dispensers that are purchased, leased, or supplied by an outside vendor must be ENERGY STAR rated to the current version, when available;
    - All vending machines with non-perishable items must comply with one of the following:
        - Have built-in low power modes for lighting and refrigeration, as applicable and described in ENERGY STAR program requirements for refrigerated beverage machines, version 3.0, section 3(B); or
        - The facility manager has installed an after-market occupancy sensor.
    - Coffee makers must shut off automatically;
    - Equipment must be regularly cleaned and maintained to optimize efficiency.

- Facility managers shall install power strips with timer settings and/or inexpensive, energy-efficient timers to turn off equipment during non-work hours (including paper shredders, lighted ambient snack vending machines, and hot/cold water dispensers). In implementation of this section, facility managers shall follow any applicable procurement guidelines established for such equipment.

- Department directors or their designees shall distribute an annual email to educate all employees about the importance of minimizing electrical plug loads and to review relevant state policies and guidelines.