Oregon Department of Administrative Services & Department of Energy

Executive Order 17-20
Statewide Plug-Load Strategy

January 2019

DAS
DEPARTMENT OF ADMINISTRATIVE SERVICES

OREGON DEPARTMENT OF ENERGY

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I. Background

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 the Department of Administrative Services (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 policies for behavior-based efficiency, which are distinct but complementary to this strategy. The implementation of the Executive Order, including this strategy, is coordinated through the Built Environment Efficiency Working Group (BEEWG), a multi-agency group created by the Executive Order to coordinate implementation efforts.

What Are Plug Loads?

Plug loads are any devices that "plug into" a building's electrical system. In an office environment, they are commonly identified as computers, printers, personal and communal appliances, and audio/visual equipment. Plug loads can also include equipment found in cafeterias, laboratories, medical offices, maintenance facilities, and other specialized facilities. Plug loads commonly consume electricity while in standby power, also known as parasitic, phantom, or vampire loads. This draw can only be stopped by unplugging the device or controlling it a power strip.

Examples of Plug Loads

- *Computers, laptops, and monitors*
- *Copiers, printers, scanners, faxes, and multi-function devices*
- *Televisions, DVD players*
- *Smart boards and projectors*
- *Computer speakers and other peripheral devices like personal space heaters and fans, phone chargers*
- *Work area task lighting*
- *Refrigerators, microwaves, water coolers/dispensers, and coffee machines*
- *Cold beverage and vending machines*
- *Clothes washers/laundry facilities*

Why Address Plug Loads?

Historically, energy efficiency efforts in commercial buildings have targeted lighting; heating, ventilation, and cooling (HVAC) systems; water heaters; and major appliances. While these systems have become more efficient, employees are using an ever-growing assortment of plug load devices. Plug loads can be two to three times larger than lighting loads in offices and approximately 30 percent of commercial building energy use[1]. In office buildings with efficient lights and HVAC systems, plug loads can represent as much as 50 percent of total electricity use[2].

[1] https://aceee.org/files/proceedings/2016/data/papers/8_178.pdf

[2] Metzger, I.; Cutler, D. and M. Sheppy. 2012. Plug-Load Control and Behavioral Change in GSA Office Buildings. National Renewable Energy Laboratory, Golden, CO.

Commercial buildings, on average, are only occupied one-third of the time. Not only are more devices being used, many can continue to run 24/7. As a result, plug load management can offer significant energy and cost saving opportunities. In many cases, controlling plug loads requires little to no up-front capital costs and can be implemented through simple steps such as adjusting power management settings, installing control devices, and engaging users in energy saving behaviors.

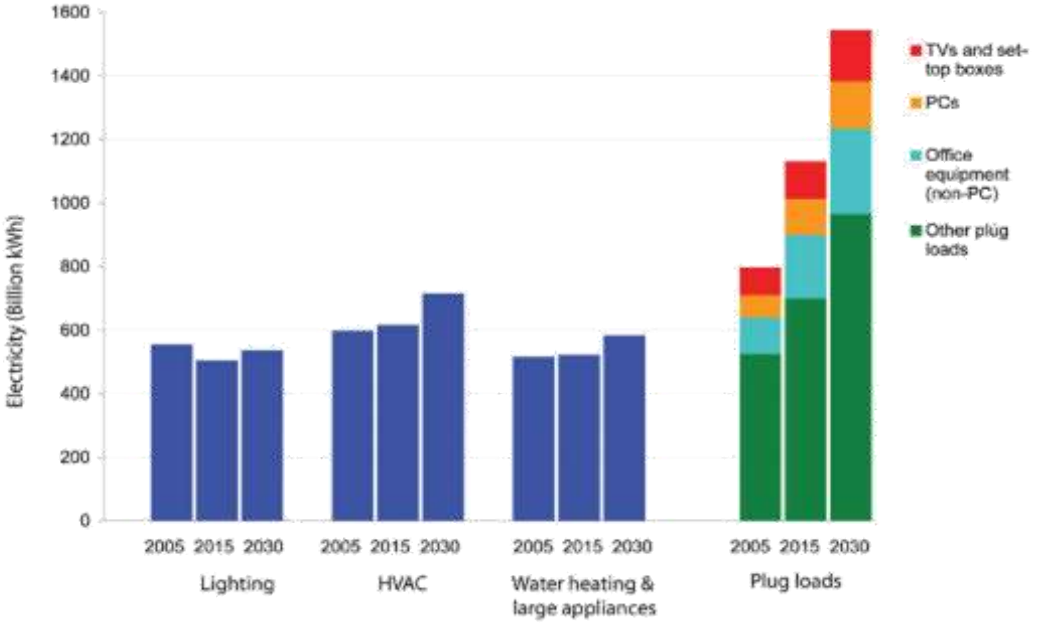


Figure 1. Plug load trends through 2030. New Buildings Institute.

As a state of Oregon example of the effectiveness of plug load management, in April 2018, occupants of the DAS-owned Portland State Office Building conducted an "energy challenge" among floors to reduce plug load-related electricity use. Through largely behavioral changes in plug load use, the challenge resulted in a reduction of approximately 3,100 kilowatt hours (kWh). This was approximately 10 percent of the building's electricity use during the challenge month. Occupants have been encouraged to continue these practices and engage in future challenges.

What's Excluded in Oregon's Statewide Strategy?

While this strategy is written broadly to allow for customization, certain categories of devices and equipment have been identified as not best suited for this strategy. These proposed categories were identified through research and stakeholder input and are excluded due to factors such as intermittency of use, lack of control strategies, their need for essential agency functions, and other related factors. These categories include:

Mobile plug loads: These include devices/equipment that are only plugged in when being used and are unplugged immediately after use (e.g., vacuums, floor cleaners). While not included, it is recommended that agencies evaluate the efficiency of this equipment and consider energy

savings in procurement and operation. To comply with Section 3.D. of Executive Order 17-20, DAS and ODOE are currently developing equipment energy and water efficiency standards for procurement requirements, to be completed in the 2018-2019 fiscal year.

Highly specialized equipment: While this strategy addresses many categories of plug loads – particularly those widely present in office and information technology (IT) operations – some agencies require and operate more specialized plug load equipment. Examples include specialized medical and laboratory equipment, industrial/large data centers, or vehicle maintenance equipment – where the equipment is specifically designed for complex tasks and a limited number of procurement options are available.

Within this strategy, specialized equipment is addressed in the guiding principles, but agencies will decide on more prescriptive strategies. This will allow agencies to adopt strategies when equipment controls are not available or very limited, or when they depend on specific skills to manage. Agencies are encouraged to use this strategy to evaluate specialized plug loads, identify where choices are possible, and provide intervention points to promote energy efficiency and conservation.

Development Process

Currently, the state does not have a comprehensive plug load management strategy, and practices vary across agencies – although the DAS statewide Resource Conservation Policy (2009) does address aspects of plug loads. Over the course of several months, DAS and ODOE led the strategy development, which included a work plan, literature review, and assessment of best practices. The American Council for an Energy Efficient Economy (ACEEE), with funding provided by the National Renewable Energy Laboratory (NREL), prepared a memorandum on Plug Load Management Strategy and Policy Guidance for DAS (Appendix A). This document summarized plug load best practices and case studies on plug load management implementation to specifically inform Oregon's statewide strategy.

DAS and ODOE staff engaged with multiple stakeholders across Oregon state government to ensure that the plug load strategy was workable and practical, and informed by current agency operations and practices. Specifically, the team collected input from:

- The Chief Information Officer Council
- DAS tenants
- The statewide facility managers group
- The Oregon Health Authority/Department of Human Services Joint Facilities Committee
- The Interagency Sustainability Coordinators Network
- Other interested individuals

DAS and ODOE also held two workshops with a plug load strategy working group, comprised of individuals representing IT, operations and maintenance, facilities, printing and distribution, staff training and behavior change, laboratories, and other interests. Over the course of two 90-

minute workshops in October 2018, participants helped frame the strategy and provided input on major strategy components.

II. Guiding Principles

Provide a Framework, Allow for Customization. Oregon's agencies are diverse in their missions, operations, and the equipment they use. This strategy was developed to provide a framework, guidance, and tools that agencies can adapt to their particular needs and operations. Agencies are asked to inventory, implement, measure, and report on plug load strategies they have implemented. This includes development of actions best suited for their organization that are beyond the prescriptive aspects of the statewide Resource Conservation Policy related to plug loads (e.g., limitation on certain personal appliances in work spaces).

Address the Lifespan of Plug Loads, Identify Intervention Points. While the types and uses of plug loads vary, they follow a similar lifespan from procurement and configuration, to control and user interaction. This strategy provides guidance for managing plug loads throughout this spectrum and identifies specific points of intervention at which a management strategy will be most effective.

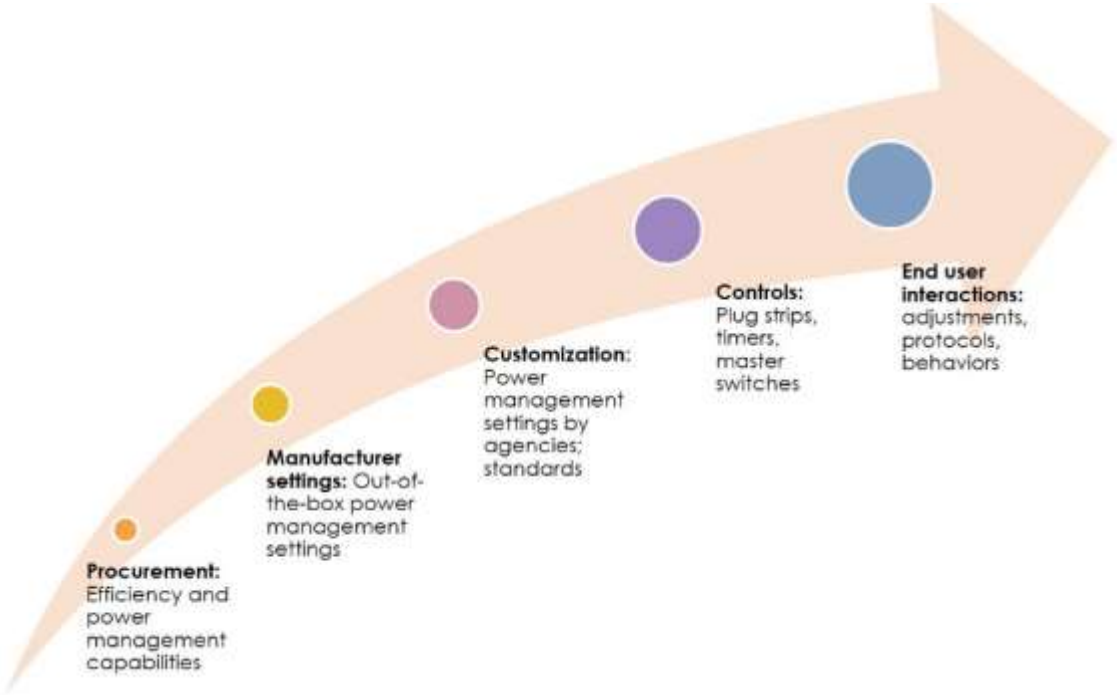


Figure 2. Plug load management intervention points.

III. Plug Load Management Strategy

Portfolio Management

The equipment manager – who could be IT staff, operations and maintenance staff, or facility manager, depending on equipment type – should actively manage the equipment and user controls within their purview. This requires an initial inventory to create an agency baseline. In an office, computers and monitors represent the largest plug loads. The next largest are printers, faxes, multifunction devices, and computer speakers.

Next, conduct equipment and user assessments, which can be done periodically, to identify devices that need new or adjusted plug load management practices. Portfolio management practices can be grouped into three major categories:

- **Control.** Review and adjust internal settings and configuration to "Power Saving" modes. When internal settings cannot achieve the desired outcome, add external controllers that will power down devices that are not in use (strategies discussed below).
- **Replace.** Review and upgrade equipment with models that will allow for the internal power saving configurations (strategy discussed below). Review and install new external controllers to equipment where necessary. ENERGY STAR should be considered a minimum requirement when upgrading.
- **Remove.** Eliminate equipment that is not being used, cannot be optimized, or can be consolidated (strategy discussed below) into central systems. Plug loads that are prohibited by the statewide Resource Conservation Policy can also be removed.

Planning & Specifications in Procurement

The choice not to buy devices or reduce the amount of devices purchased is a guaranteed energy savings. This is most effective when incorporated into a long-term optimization plan to ensure you have the right equipment, right size, and right use.

- **Consolidate and Centralize First.** This is a primary strategy for energy conservation. Consolidated equipment is used more efficiently than individualized equipment, reducing the total number of devices and associated energy use. Start by eliminating and consolidating equipment that is not of high use. This can be also be done by replacing the function of the equipment with a centralized solution and system. For example, you can remove less-efficient personal printers and consolidate to a few, more-efficient centralized printers.

> *In many cases, **DAS Publishing & Distribution** can produce high-volume print jobs faster and more cost-effectively than is possible with standard office multifunction devices. Publishing & Distribution is conducting a pilot project to remotely manage agency multifunction devices using a centralized solution that optimizes use and helps save energy.*

- **Choose the right size and quantity.** When choosing equipment, select devices that match user need and use patterns, working toward "best fit." This includes assessing current use patterns and not buying oversized equipment to meet infrequent peak events or "worst case" scenarios. To meet peak need, consider a "lead-lag" or staged approach where devices exist and operate to meet most of the need, then a few supplemental devices can be brought online to meet additional use as needed. This assessment should also look collectively at individual vs. group needs to minimize the number of single-user devices (e.g., group vs. personal printers) – instead, only provide single-user devices that are in use most of that user's work period (e.g., individual laptop).

- **Procurement Specifications**. Identify specifications and standards that include energy efficiency characteristics, while also allowing user controls/configuration for additional energy savings. For example, when possible, choose the most efficient ENERGY STAR rated equipment available.

  > *US Department of Energy's Decision Guides include checklists comparing costs, savings, implementation complexity, and user acceptance rates: https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/Decision_Guides_for_PPL_Controls_0.pdf*

  A separate effort is underway to address Section 3.D of Executive Order 17-20. Specifically, DAS and ODOE will develop high efficiency energy and water use specifications and incorporate standards into procurement requirements. This effort will be completed by the end of Fiscal Year 2018-19, at which time it is envisioned such standards will be integrated into implementation of this strategy.

- **Pick the right time to upgrade.** Review equipment replacement cycles. Consider replacing equipment when new models offers enough improved efficiency to be cost-effective for early or immediate replacement. For example, a monitor may be more efficient and have better power management settings that make sense for early replacement. Note: With efficiencies and available equipment rapidly changing, this may require periodic review of available equipment.

Review and Adjust Settings/Configuration Before Use

- **Review "out of the box" settings.** Many devices offer a low- or no-power state which comes as a default, or can be activated. It is important to review these settings and measure equipment wattage draw in "power saving" mode. Some pre-set power saving settings do not actually turn the equipment off and continue to draw electricity.
- **Review user needs and schedule.** Understand the user's work schedule and use patterns. When completing a large deployment of items or settings, identify outliers in which specific staff, projects, or schedules may require adjustment.

Many of these strategies are applied to commonly-found and consumer-style plug loads, like computers, work stations, and office equipment.

Other categories of equipment may require additional adaptation.

- **Decide whether to allow user control of these settings**. The advantage being that a user can customize settings to ensure proper functionality – the disadvantage being that some users may override settings and eliminate potential savings.
- **Choose power saving settings and match to use case.** Choose the setting that is most closely aligned to the work style and schedule of the user. Some users may be willing to adopt more aggressive power saving schedules, but will need additional engagement to understand the correct use and configuration. Provide a summary of settings and agree on the best option to achieve additional energy savings, when available.
- **Software options.** There are several systems/software programs that allow for adjustment to device configurations and equipment settings. When choosing a system or software not already available on the device, review all possible options. ENERGY STAR provides a list of commercial software packages[3] and offers a free power management program called "EZ Save"[4]. If deciding on a private or customized solution, choose settings that maximize energy savings through a low or no-power mode and allow the equipment manager or user to provide the appropriate amount of customization.

[3] https://www.energystar.gov/products/low_carbon_it_campaign/implementation_resources_enterprises/commercial_software

[4] https://www.energystar.gov/index.cfm?c=power_mgt.pr_pm_easy_save

- **Provide external controller.** There are a variety of external "add-on" controllers that can be used to achieve the desired power management schedule. These controllers can shut off equipment or a group of devices when not in use (load and occupancy sensing), or to match work schedule (timer). These are best used when introduced along with new equipment, when controlling groupings of equipment (workstation or audio/visual stations), or when managing devices that do not come with low-no power settings or configurations. Note: This should be reviewed carefully prior to implementing as some specialized equipment may be harmed from external, manual shutoff. See **Appendix B: Selecting External Controllers** for more details on selecting external controllers.

Optimize Use

As mentioned above, there are a variety of low and no-power modes for equipment that will significantly limit or stop power draw. A successful strategy works to ensure the "equipment works when you're working" and is off when the user does not need it. Start with unoccupied hours at night, on weekends, and during holidays. Once that can been successfully implemented, begin looking at incremental improvement and adjustments.

With the variety of devices, users, and changing work needs, it is important to continually assess and customize settings throughout the life of a device. An **"Optimization Strategy"** maximizes equipment over its lifetime to the best value and use to the organization.

- **Complete periodic assessments – identify trigger events.** Complete an assessment of the devices intended use, current use, and future use – focusing on organizational core needs and use cases for individual users. This can be done with equipment logs, staff surveys, and interviews. Identify trigger points in which uses may change – like changes in staff schedules, department re-configuration, physical moves, equipment upgrades. Instead of defaulting to settings that capture the "worst or highest use" scenario, periodically assessing settings will allow devices to respond to changing user requirements and needs.
- **Continually engage users.** Empower users to turn equipment off at the end of their work day. Require other staff (facilities, custodial, etc.) to turn off equipment if they are onsite after core work hours. These strategies are best accomplished with proactive employee engagement and education.
- **Configuration over time.** If needed, start each user with a basic power saving schedule that can yield sustainable energy savings and still meet user needs. As users become accustomed to these settings, they may be more comfortable with more advanced strategies and configurations. Talk with users to re-confirm and request more aggressive settings – partner with them to "configure over time" so additional savings are incrementally achieved.
- **Add an external controller.** When software/settings are not able to provide the desired control strategy, adding a new external controller can achieve similar outcomes.

Controls may be manually controlled by the user or automatically respond to user occupancy, schedule, or use. This allows the device manager and user to optimize controls when internal settings/configuration is not available. Note: This should be reviewed prior to implementing as some specialized equipment may be harmed from outside manual shutoff. Use the controller that is the simplest, best fit for to achieve the intended outcome (e.g., a simple timer or schedule controller is as or more effective than more complex, remote controllers).

Outreach and Education

All of these strategies depend on education and employee engagement. While devices can be configured and controlled in a variety of ways, plug load management without behavior change is challenging. With these devices being central to the function and performance of employees it is critical to fully understand the user needs and work with staff to implement solutions.

- **Explain benefits, business case, and value of employee action**. Some employees may not be familiar with plug loads or the benefits of plug load management. Provide both general and detailed information on how your organization will directly benefit (e.g., energy and cost savings) from these actions. Discuss the importance of individual action in supporting the overall strategy. Explain that employees may also see personal benefit by having better control over their devices and understanding on how to optimize the equipment they work with.
- **Talk to employees and managers**. Understand minimum required technology needs and engage in conversations on how to meet those needs with adapted settings and controlled devices. Management can provide details on work schedules and use patterns. Proactive and continued conversations will allow employees to understand these changes and gain crucial feedback to ensure that strategies do not interrupt their work.
- **Develop a plug load champion and train the trainers**. Implementing these strategies will require some adjustments by staff. Identifying a champion or staff lead(s) can help with needed transition and staff buy-in. The champion can test configurations and controls, provide messages to and from staff, and engage in problem-solving to those adapting to change or experiencing challenges with new control strategies. With larger agencies, it may also be important to create a group of champions that can train other staff. This will help to refine and customize training materials, along with assisting in broader organizational change. If you have an agency sustainability committee or strategy team, these members may be excellent candidates for plug load champions and trainers.
- **Provide frequent and quick responses to user needs and configurations**. Quickly address user concerns or complications. Making adjustments will help avoid user override or removal of controls. Once addressed, document use cases in which energy

savings were still accomplished while adjusting to user needs – this will create a catalog of user experiences that can be examples of success when future concerns arise.

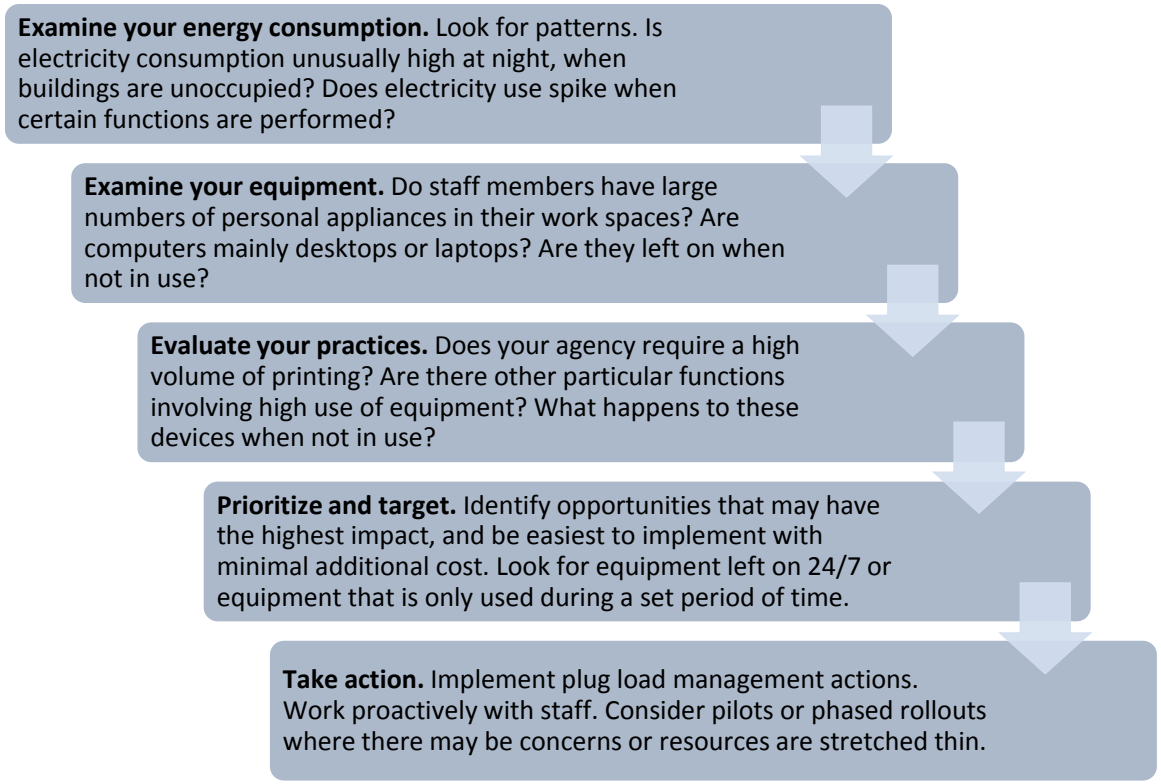
- **Partner with the IT and Central Services Department** early to discuss strategies and employee education. As part of their enterprise services, employee adoption is of high importance – aligning your work to their plans can leverage their expertise and provide credibility to your work. Talk through strategies to make sure they are compatible with ongoing production support and infrastructure maintenance.
- **Run a pilot program or "turn it off' challenge to demonstrate new configurations and controls**. Working with staff leads, office administrative staff, and volunteers is a great way to test and prove out these strategies. Not only will it find any potential issue or needed adjustment, but will also gain champions who can help support rollout. Campaigns or challenges are a great way to encourage users to try new behaviors and rewards users to energy savings.
- **DAS behavior-based policies.** Executive Order 17-20, Section 3.C. directs DAS to update policies for behavior-based efficiency by January 1, 2020. It is anticipated that DAS will utilize the current statewide Resource Conservation Policy as a vehicle for compliance with this section, as well as for aspects of the overall strategy. As previously noted, it is likely that the revised Policy will provide some more prescriptive guidance related to plug loads – specifically the limitation on the use of some personal appliances. Similar to this strategy, DAS will engage affected key stakeholders across the enterprise to update behavior-based efficiency policy.

IV. Implementation Guidance

Implementation is an important step in turning strategy into action. Agencies are provided the flexibility to apply these strategies in a manner most appropriate to their operations, but also have the responsibility to take action and report on progress made.

Appendix C: Best Practices and Resources for Equipment and Devices is a resource to help agencies develop their own action plans, with recommended practices by equipment type as hyperlinks to external research and resources.

While there are no specific, stand-alone goals for plug load energy savings, agencies may be expected to demonstrate ongoing progress in managing plug loads – perhaps as part of a broader agency energy management or sustainability effort – and to comply the statewide Resource Conservation Policy. If specific plug load actions are not already part of an agency's energy or sustainability plan, this strategy recommends considering the following steps:



Periodically – annually or bi-annually is recommended – revisit actions, measure effectiveness, and adapt as needed. Review may also be needed during "change events" – for example, major renovations, additions of new or specialized equipment, or feedback that previous actions did not have the intended effect.

Take Action

Outreach and Engagement. A variety of communication strategies and tactics can build user awareness and buy-in. This includes messaging campaigns, energy challenges or competitions, incentives and rewards, data visualization and benchmarking, reports, and policy or contract requirements. It is important to tailor activities to the specific audience and desired outcome.

- **ENERGY STAR Communications Toolkit**. Provides planning documents, templates, and resources to address behavior of users and customers. https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/communicate-your-success/energy-star-communications-toolkit

https://www.energystar.gov/buildings/tools-and-resources/spotting_energy_waste_plug_load_activity_kit

Estimating Savings. Review the measurement examples below and identify the best way to estimate the baseline or existing energy consumption. Once completed, identify the potential energy consumption by review new equipment specifications or adjustment of existing equipment operation and hours.

- **NREL Calculation worksheet**. Provides hand-on worksheet to inventory plug load, calculate existing and proposed energy savings. https://www.nrel.gov/docs/fy13osti/54175.pdf

Estimating Costs. The cost of implementing this strategy will vary depending on scope, complexity, and timeline of the project. Any purchases should be offset by utility incentives, where provided, and take advantage of any state procurement standards and contracts.

- **Department of Energy Decision Guide**. Provides a range of costs and savings, with tailored control strategies and solutions. https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/Decision_Guides_for_PPL_Controls_0.pdf

Office Solutions	Strategy Considerations				Project Types				
Strategy	Total Cost	Potential Savings	Implementation Complexity	User Acceptance of Change	Do it Now	Staged Retrofit	Whole-Building Retrofit	New Construction	Landlord Tenant Solutions
Turn it Off Campaigns	$	$	○	👍	✔	✔	✔	✔	✔
Advanced Power Strips (APSs)*	$	$$	◎	👍	✔	✔	✔	✔	✔
Upgrade Equipment with Low-Energy or ENERGY STAR Certified Equipment**	$$	$$	○	👍	✔	✔	✔	✔	✔
Use Built-In Low Power States	$	$	○	👍	✔	✔	✔	✔	✔
Design Strategies for Consolidating Plug and Process Loads (PPLs)***	$$	$$	◎	👍		✔	✔	✔	
Integrate PPL Controls with Other Building Systems	$$$	$$$	◎	👍			✔	✔	
Additional Submetering and Control Options****	$$	$$	◎	👍		✔	✔	✔	✔+

Measurement & Reporting

Measuring specific energy and/or cost savings from plug load management can be challenging. While plug loads can consume one-third of an entire building's energy use, it can be hard to separate the specific energy use attributed to only plug loads. Few agencies have metering capabilities that would allow them to specifically separate out plug loads. What's more, their decentralized nature makes plug load progress measurement even more difficult.

When documenting outcomes from their plug load management efforts, agencies are encouraged to consider the following:

Progress measurement. This type of measurement is a summation of actions taken. For example, on how many computers did the agency change power management settings? Or how many break room appliances were controlled by timers or advanced power strips?

Performance measurement. This measurement documents the outcomes of the actions taken in terms of energy and cost savings. Where agencies do not have plug loads separately metered (which will be virtually all agencies), the following actions can be considered, from simplest to most difficult:

Assumed savings	Spot measure and extrapolate	Sub-meter
Using this methodology, agencies would use projected savings from literature or other case studies to estimate savings. No direct measurement would be performed.	Take simpler direct measurement by using data loggers on pieces of equipment, over-the-outlet meters, or circuit-level meter. Measure individual or groups of devices as a sample, then extrapolate results to provide representative measurement.	Agencies may choose to separately sub-meter plug loads on a floor, a section or in a building. This could be a temporary measurement using devices such as clamp meters, or a more permanent in-line solution.

ODOE provides assistance to agencies interested in measuring and improving energy use in buildings. The DAS Sustainability Program also offers assistance to DAS buildings and tenants interested in energy management.

Enforcement. Provide consistent enforcement on all devices and behaviors that are strictly prohibited – guidance will be provided on certain aspects of plug loads by the statewide Resource Conservation Policy, but agencies may wish to take further steps beyond policy direction. For these items, make sure to use clear messaging, address misconceptions, and provide employees an opportunity to understand and comply.

For all other strategies, agencies should use proactive education, on-on-one communication, and outreach to reduce or eliminate the need for enforcement. Work directly with the management team, IT, and facilities staff to address any outstanding issues.

One option is to perform periodic walkthroughs with safety and/or sustainability committees or staff. You can identify items that are not compliant and work to remove them. This will also allow you to identify equipment that is not functioning well or behaviors that need to be adjusted. Walkthrough reports/action plans are also a simple way to document baseline conditions and results of changes made to implement this strategy.

Documentation. In support of Executive Order 17-20, the Built Environment Efficiency Working Group (BEEWG) recommends tracking activities and progress made related to the Statewide Plug-Load Strategy. Documentation could include:

1) Plug Load Reporting Checklist. Example provided in **Appendix D: Example Plug Load Reporting Checklist**.
2) Narrative in an existing agency plan or report, including energy, sustainability, or facility management plans.
3) Summary memo that discusses how agency is implementing this strategy.

DAS, ODOE, and other members of the BEEWG may conduct additional outreach and support for implementation of this plug-load strategy, in conjunction with the Resource Conservation Policy. This will include discussions regarding meaningful and appropriate methods for agency actions and reporting.

V. Appendix A: ACEEE/NREL Memorandum on Plug Load Management Strategy and Policy Guidance for DAS

[Includes selection from memo – Full copy available upon request]

ACEEE
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TO: David Wortman, Statewide Sustainability Officer, Department of Administrative Services, State of Oregon

FROM: American Council for an Energy-Efficient Economy

DATE: June 1, 2018

SUBJECT: Plug Load Management Strategies and Policy Guidance

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.

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

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 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.

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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

- *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%. 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.

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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
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
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

--End of Selection--

VI. Appendix B: Selecting External Controllers

Type	Attributes	Best Use & Application
Schedule	Applies schedule to match use pattern. Comes in two primary forms: • Basic electrical outlet timer (manual and automatic) that can control single or multiple outlets • Centralized scheduler that controls devices, such as wireless plug and play or through a building management/energy management system (BMS/EMS)	**Best Use:** Predictable use profile, set work schedule. Conference room, break room, printer room. **Pro:** Generally simple to install and reliable to maintain ***Important to make sure schedule is accurate and periodically reviewed
Load-Sensing	Relies on primary device to turn on/off other associated equipment. Comes in two primary forms: • Power strip with primary device plugged into a "master" controller • Centralized controller, such as wireless plug and play devices or BMS system	**Best Use:** When a primary device can control auxiliary devices. Office desk area, computer lab, entertainment center. **Pro:** May save more energy than a set scheduled controller ***Requires correct setting or user operation
Occupancy	User occupancy triggers devices to turn on/off. Sensor scans for vacancy and de-energizes devices when user is not occupying the space. • Some variations include manual on, and automatic off for vacancy – commonly seen in lighting controls. Best applied when equipment ONLY needs to be on when the user is there.	**Best Use:** Users with frequent departures throughout day. Office desk, conference room, break room. **Pro:** Can save a lot of energy by turning off equipment when not in use ***Challenging to configure and operate correctly
Manual On/Off	User manually controls power to the equipment, on and off. • This can be done with a built-in power switch, power strip, or wireless controller • May require user to understand start up or shut down procedures	**Best Use:** When no other controller is available and when user education is thorough. **Pro:** Can be very effective method with low user complaints ***Requires user engagement and consistent behavior

In 2012, GSA coordinated with NREL to test the effectiveness of schedule, load-sensing, and a combination of the two controllers. Schedule-based control was found to be most effective. The program estimated savings of 26 percent energy reduction at workstations with advanced computer management already in place, 50 percent energy reduction in kitchens and printer rooms, and a two-year payback (GSA 2012)[5].

[5] https://aceee.org/files/proceedings/2016/data/papers/8_178.pdf

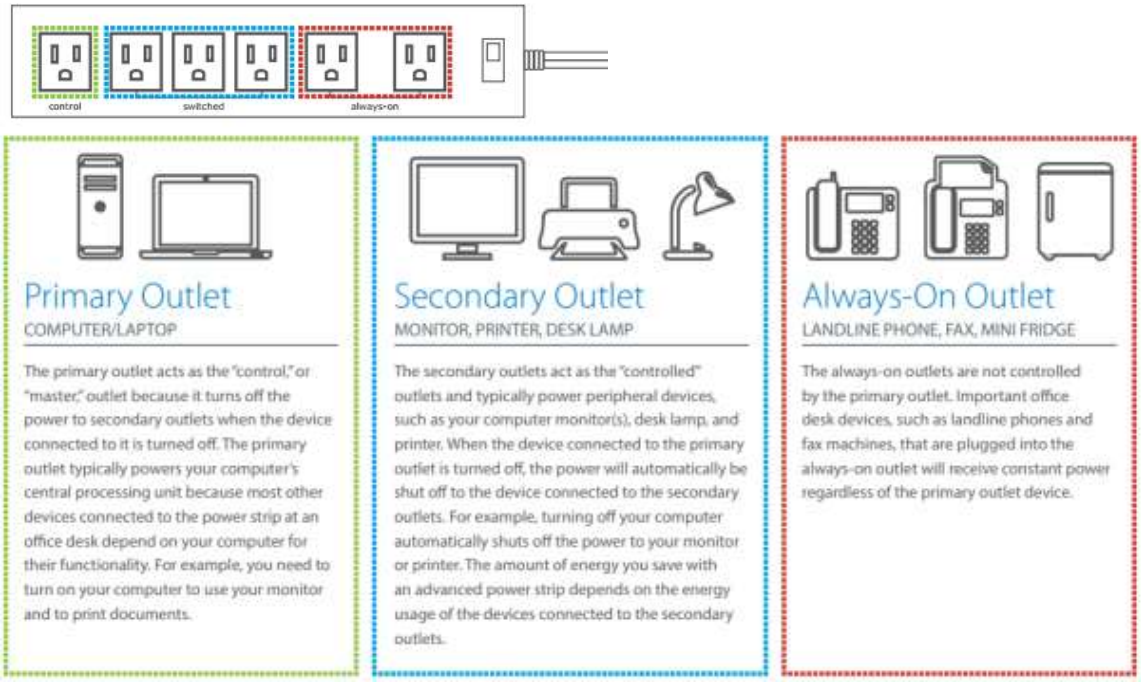
NREL performed extensive research[6] on recommended control strategies for a range of commercial building devices. The table illustrates the NREL recommended strategies for each device type.

Table 2–2 Recommended Controls for Typical PPLs

Device	Built-in Automatic Low-Power State	Scheduling	Load Sensing	Occupancy	Manual On, Vacancy Off	Manual Control	No Control
Audio equipment		X	X	X	X		
Battery chargers		X					
Cash registers		X		X	X		
Computer monitors	X		X				
Credit card machines	X		X				
Decorative lighting			X		X		
Desktop computers	X						
Digital photo frames			X		X		
Dishwashers		X					
Drinking fountains		X		X	X		
Electric hole punchers		X	X		X		
Electric information displays	X	X		X	X		
Electric pencil sharpeners		X	X		X		
Electric staplers		X	X		X		
Fans		X		X	X		
Floor cleaners		X			X	X	
Floor polishers		X			X	X	
Freezers							X
Gym equipment		X			X		
Heaters		X			X		
Label makers/printers		X	X		X		
Laptop computers	X		X				
Ovens/stoves/ranges		X					
Paper shredders		X	X		X		
Peripherals			X				
Personal print/copy equipment			X				
Phones	X						X
Projectors	X	X	X		X		
Refrigerators							X
Shared print/copy equipment	X	X					
Small kitchen appliances		X			X		
Smart boards		X			X		
Task lighting			X		X		
Televisions	X	X		X	X		
UPS units		X	X				
Vacuums					X	X	
Vending machine – nonrefrigerated		X		X			
Vending machine – refrigerated (parishable items)		X		X			X
Vending machine – refrigerated (non-parishble items)		X		X			
Water coolers		X		X	X		
Water filters		X		X	X		
Water heaters		X		X	X		

[6] https://www.nrel.gov/docs/fy12osti/51708.pdf

NREL also developed a how-to guide[7] on properly installing an Advanced Power Strips in an office setting.



Recommended Practices

- Provide workspaces with power strips with a master on/off switch to shut off workspace devices. Computers and monitors that are programmed for sleep mode may be plugged in separately.
- Agencies are encouraged to pilot advanced power strips (timer or occupancy based) in personal workspaces to automatically power off controlled devices.
- Advanced power strips (timer based) or timers are encouraged for coffee pots, shredders, shared printers/copiers and other related equipment without sleep/standby settings.

Resources

- Advanced power strips for plug load control: https://www.gsa.gov/governmentwide-initiatives/sustainability/emerging-building-technologies/published-findings/energy-management/advanced-power-strips-for-plug-load-control.
- State of Minnesota study quantifying the impacts of multiple office plug load reduction strategies, including Advanced Power Strips: (https://www.mncee.org/getattachment/Resources/Resource-Center/Technical-Reports/Impacts-of-office-Plug-Load-Reduction-Strategies/Impacts-of-office-plug-load-reduc-strategies.pdf.aspx).

[7] https://www.nrel.gov/docs/gen/fy15/63800.pdf

- Northeast Energy Efficiency Partnerships list of research and resources about advanced power strips: https://neep.org/initiatives/high-efficiency-products/advanced-power-strips.
- The Better Buildings Technical Specification (https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/Advanced_Technical_Power_Strips_FINAL%20040915_508.pdf) offers guidance on the procurement process and selecting effective APS models for commercial buildings.

VIII. Appendix C: Best Practices and Resources for Equipment and Device Categories

The following compilations of recommended plug load management practices were drawn from literature reviews on best practices and input from the core working group assembled to develop this strategy. Agencies are encouraged to review these practices and supporting resources as they develop their own plug load action plans. Some of these practices will be incorporated into the statewide Resource Conservation Policy; others will be left to the discretion of particular agencies to apply as appropriate in their plug load management efforts.

Computers and IT

Recommended practices

- Use central, automated power management solutions (Windows enterprise software or other solutions) to apply sleep mode or off mode as a default when a device remains idle.
    - Require users/groups to "opt out" of sleep or off mode only if essential to their job duties. Discourage use of hibernation mode, as it adversely affects memory.
    - Ensure IT department enables appropriate settings and use newly-available updating techniques (such as wake-on-LAN (local area network) or remote desktop manager) to update software and maintain effective business operations.
    - Note: Centralized solutions can be tricky as users can't change settings on their own. This may require changes in group policy.
- Where agencies do not have centralized power management, deploy sleep settings on individual staff computers, requiring the same opt out procedures.
- Make "balanced" mode the default power plan for computers, unless users/groups demonstrate a need for higher performance settings.
- Allow users to completely power off computers and monitors as part of a work space "power off" strategy (e.g., using load sensing plug strips or master switches), where security risks and patching disruption can be minimized. Notify users when to leave computers on for necessary updates
- Deploy laptop computers, small form factor PCs and LED monitor solutions unless user has a functional need for more robust technologies (e.g., desktop computer).
- Eliminate use of screen savers. Set monitors to enter sleep when not in use and standby state in tandem with associated computers when they enter sleep or are powered off.
- Program projectors, smart boards and wall displays to enter sleep mode when not in use during operating hours.
- Power off projectors, smart boards and wall displays after normal operating hours.

Resources

- ENERGY STAR provides educational materials for organizations about how to start a computer power management program: https://www.energystar.gov/products/reduceitenergycosts
- ENERGY STAR maintains a list of computer power management success stories: www.energystar.gov/products/low_carbon_it_campaign/business_case/success_stories
- ENERGY STAR provides a list of commercial software packages (https://www.energystar.gov/products/low_carbon_it_campaign/implementation_resources_enterprises/commercial_software) and offers a free power management program called "EZ Save" (https://www.energystar.gov/index.cfm?c=power_mgt.pr_pm_easy_save)

Server Rooms and Data Centers

Server rooms are large energy users and should be included in comprehensive energy management strategies.

Recommended practices

- Server Virtualization. This practice consolidates the total number of servers by allowing you to run multiple servers on one physical host server. Instead many servers at low utilization (6-12 percent on average), virtualization allows for one server to operate at a higher total utilization rate. Virtual servers restart more rapidly, are easier to move, and decrease energy consumption and waste heat. Virtualization can also help with re-purposing and re-configuration for your organization – and reduce energy costs by 10-40 percent. Along with this strategy, instead of running test environment 24/7, only run equipment for testing windows that are needed.
- Review and upgrade equipment. More energy efficient servers, UPSs, and PDUs are available today. Servers are now more efficient, have better regulators, consume less power and have better cooling technology. New uninterruptible power supplies (UPS) are 92-95 percent efficient and can cut energy losses by 30-55 percent. New power distribution units (PUD) use high-efficiency transformers and are 2-3 percent more efficient.
- Manage the HVAC and space. While not a plug load, efficiently managing the climate settings and configuration of these spaces and significantly impact the operation and energy impact of data centers and servers. Adjust configuration to hot aisle/cold aisle and enclose server racks. Use ASHRAE recommended temperature and humidity settings – included a temperature range of 65-85°F which can save 4-5 percent in energy costs for every 1°F increased. Installing an air-side or water-side economizer can save 60-70 percent on cooling.

Resources

- ENERGY STAR, 12 Ways to Save Energy in Data Centers and Server Rooms: https://www.energystar.gov/sites/default/files/asset/document/DataCenter-Top12-Brochure-Final.pdf
- ENERGY STAR provides resources specific to saving energy in data centers and server rooms: https://www.energystar.gov/products/low_carbon_it_campaign/12_ways_save_energy_data_center
- US Department of Energy, Best Practices Guide for Energy-Efficient Data Center Design: www.energy.gov/sites/prod/files/2013/10/f3/eedatacenterbestpractices.pdf
- ENERGY STAR, Data management strategies: https://www.energystar.gov/products/low_carbon_it_campaign/12_ways_save_energy_data_center/better_management_data_storage

Personal Devices

Recommended practices

- Minimize all unnecessary devices at individual work stations. Prohibit personal appliances in work spaces, including items like microwaves, coffee makers, refrigerators, coffee warmers, crock pots, toasters, and warming plates.
- Mobile device chargers (e.g., cell phone chargers) should be limited to a maximum of one charger per workspace. Chargers should not be left plugged in when not in use.
- Consolidate less frequently used work station items into centralized, shared use work areas (e.g., electronic staplers, pencil sharpeners, paper shredders, label printers).
- Personal appliances for thermal comfort: personal desk fans up to 15 watts are permitted. Higher watt fans and radiant heating mats may be permitted in areas where the HVAC system does not provide sufficient comfort as measured to approved temperature setbacks, or where staff have special needs, and all other reasonable energy-free options have been exhausted.
- All personal task lighting should be LED. Ensure task lights are controlled to shut off during non-work hours.

Communal Appliances

Recommended practices

- Set equipment to low-power mode and to shut off (or sleep) when not in use. If this is not available, add an external controller so they are off during non-business hours. Remove equipment that does not automatically shut off or cannot be controlled.

- Underutilized appliances should be removed or re-deployed to higher use areas.
- Appliances that are not used daily should be unplugged when not in use.
- Replace outdated equipment with more efficient, ENERGY STAR models. For example, refrigerators before 2000 and non-ENERGY STAR models should be replaced.
- Vending machines should utilize low power modes or be retrofitted with Vending Misers.
- Refrigerators should be set for no less than 40°F.
- Dishwashers should only be run when full.

Multi-Function Devices and Printers

Recommended practices

- Limit individual printers and copiers for only those who require frequently and use them as a part of their essential job functions.
- Deploy multifunction devices to reduce the need for individual copiers, printers and scanners. Multifunction devices have added benefits like Secure Print with reduce paper misprints, are easier to administer and supply, provide added security, and reduce energy costs.
- Avoid printing non-critical documents. Print multi-page documents in two-sided (duplex) mode, rather than one-sided mode. Encourage printing of larger jobs through DAS Printing & Distribution.
- Program shared printers, copiers, and scanners to enter sleep/standby mode after a period of non-activity during operating hours. Best Practice: Program to enter sleep after 10 minutes of inactivity

Resources

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

User Engagement

Recommended practices

- Designate a plug load champion in each building, also engage with the agency's green team, sustainability committee, or strategy and IT teams, if applicable.
- Develop and distribute periodic (annual is suggested) energy scorecards or other communications to managers of buildings, along with communications with steps that

https://www.geappliances.com/ge/energy-star-appliances/refrigerator.htm

users can do to save energy through plug loads.

- Conduct periodic (1-2 times per year is suggested) night audits of buildings and provide feedback to users on energy saving opportunities.
- Develop and implement "power down" campaigns to raise awareness and encourage energy saving actions among tenants and employees.
- Recognize users, divisions, and/or buildings that achieve energy savings through incentives, events, and other means.
- Issue periodic messages to staff from agency leadership on the energy and cost savings from plug load management, as well as agency-wide energy savings reports. For example, address why individual printers are costly and the benefits of a shared solution.
- Collect user feedback on successes and challenges of plug load management and adjust strategies based on this feedback.
- Provide staff training for optimal use of smartboards and other video devices.

Resources

- 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
- 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
- ACEEE Summer Study paper on engaging tenants to reduce plug load energy use: aceee.org/files/proceedings/2016/data/papers/8_178.pdf
- US Department of Energy's "Flip the Switch" tenant engagement program: https://betterbuildingsinitiative.energy.gov/implementation-models/%E2%80%9Cflip-switch%E2%80%9D-tenant-engagement-program

Additional Resources on Plug Load Best Practices

- NREL, Assessing and Reducing Plug and Process Loads in Office Buildings: https://www.nrel.gov/docs/fy13osti/54175.pdf
- DGS, Standard Operating Procedures for Energy Management in State Buildings: https://www.documents.dgs.ca.gov/sam/SamPrint/new/sam_master/sam_master_file/chap1800/1805.3.pdf
- New Buildings Institute created a guide for managing office plug loads, which includes information on behavioral programs: https://newbuildings.org/sites/default/files/PlugLoadBestPracticesGuide.pdf

IX. Appendix D: Example Plug Load Reporting Checklist

Plug loads are big energy users, consuming approximately 30 percent of electricity used in offices. In an office, computers, monitors, printers, and multifunction devices represent the largest plug loads. Other plug loads include portable lighting, telephones, battery chargers, vending machines, and coffee makers.

California's office plug loads consume more than 3,000 gigawatt hours annually, costing more than $400 million each year. This is the equivalent to the carbon dioxide emissions of 140,000 cars (700,000 metric tons) per year. Yet even with these costs, plug loads are not high priorities and can be hard to manage.

This checklist assists agencies in developing and implementing a plug load strategy. It was compiled from research on plug load programs addressing energy impacts in government, private, and institutional facilities. The full checklist is available at U.S. General Services Administration: https://www.gsa.gov/cdnstatic/PlugLoad_Checklist_Form_Fields_508.pdf. It can function as a "to do" tool, as well as a tracking tool – describing a general sequence of activities that may also happen concurrently. In addition, it provides a framework for continual optimization and assessment. Information developed or progress made in one activity is likely to affect work in other activities.

TASK: Establish a plug load champion. Plug loads are essentially "orphans" and need a leader and an integrated team that understand the importance of "adopting" plug load management.				
Activity	**In Progress**	**Achieved**	**N/A**	**Activity Comments**
Select a leader who understands plug load opportunities and strategies.	☐	☐	☐	
Select a leader who has the ability to independently and objectively apply business model cost justifications.	☐	☐	☐	
Select a leader that has the authority to make changes.	☐	☐	☐	
Select a leader who can facilitate an integrated team, and is enthused with rallying people to this work	☐	☐	☐	
Other Notes:				

TASK: Develop a business case to address plug loads. To gain buy-in from stakeholders, especially the building owner, the team must develop economic justifications for addressing plug loads.				
Activity	**In Progress**	**Achieved**	**N/A**	**Activity Comments**
Identify the best set of plug load management strategies.	☐	☐	☐	
Quantify the energy reduction and energy cost savings associated with each strategy. See benchmark below.	☐	☐	☐	

Select/prioritize strategies for a plug load management program.	☐	☐	☐	
Other Notes:				

TASK: Benchmark the efficiency of current equipment and operations. In order to have cost effective solutions, the team must identify the sources of plug load problems.				
Activity	**In Progress**	**Achieved**	**N/A**	**Activity Comments**
Perform an assessment to establish a baseline.	☐	☐	☐	
Collect data to understand how equipment is used.	☐	☐	☐	
Determine when equipment is not in use, and can be turned off.	☐	☐	☐	
Other Notes:				

TASK: Identify user needs. In order to have cost effective solutions, the team must identify the users' needs and compare those to the users' activities.				
Activity	**In Progress**	**Achieved**	**N/A**	**Activity Comments**
Determine if the user's allocated office equipment is optimal in terms of energy efficiency and productivity.	☐	☐	☐	
Determine if there is a need to upgrade or replace this equipment.	☐	☐	☐	
Determine a power management program that will not negatively impact user.	☐	☐	☐	
Other Notes:				

TASK: Meet needs efficiently. The key strategy in an effective plug load program is to use more efficient equipment in a more efficient manner.				
Activity	**In Progress**	**Achieved**	**N/A**	**Activity Comments**
Determine if user has access to equipment that is energy efficient.	☐	☐	☐	
Determine if power management is installed AND active on the user's equipment.	☐	☐	☐	
Determine if the user's power management functions work properly.	☐	☐	☐	
Determine if user has changed the power management settings and if the settings are appropriate for user.	☐	☐	☐	
Other Notes:				

TASK: Turn equipment off. Office buildings are unoccupied on average for two-thirds of the year. A key strategy in any plug load program is to reduce wasted energy during non-business hours.

Activity	In Progress	Achieved	N/A	Activity Comments
Determine if the user can turn equipment off at night.	☐	☐	☐	
Determine if user routinely turns equipment off at night.	☐	☐	☐	
Consider whether centralized solutions are in place to switch non-essential systems on and off.	☐	☐	☐	
Determine if the user has plug strips or other controllers that manage equipment.	☐	☐	☐	
Determine if the user has been educated about the different kinds of plug load management settings and controllers.	☐	☐	☐	
Other Notes:				

TASK: Institutionalize plug load management though procurement decisions and policies. Another key strategy for a plug load program is to adopt enforceable plug load policies for procurement and operations. These policies should be designed to promote desirable user behavior.

Activity	In Progress	Achieved	N/A	Activity Comments
Share the plug load strategy and procurement practices with staff.	☐	☐	☐	
Customize the plug load strategy into an action plan with targeted equipment and measures to be taken.	☐	☐	☐	
Other Notes:				

TASK: Promote user awareness. Because user behavior greatly impacts energy use, users should be educated about plug load policies and enlisted to support their implementation.

Activity	In Progress	Achieved	N/A	Activity Comments
Create a process for educating users on plug load management practices.	☐	☐	☐	
Educate the user regarding their role and responsibility to reduce plug loads.	☐	☐	☐	
Train the user to use equipment efficiently.	☐	☐	☐	
Educate the user about "parasitic loads" and how to reduce these loads.	☐	☐	☐	
Create a "suggestion box" to address plug loads.	☐	☐	☐	

Use optimization strategy for continual improvement. Collect user feedback and use it to improve practices.	☐	☐	☐	
Other Notes:				

TASK: Address unique miscellaneous plug loads. Some equipment is not purchased by the building owner or user, these plug loads must be addressed on a case-by-case basis. Manufacturers may be able to recommend alternatives.

Activity	In Progress	Achieved	N/A	Activity Comments
Determine if contractor/vendors are engaged to understand goals and provide capable equipment.	☐	☐	☐	
Ensure contractor/vendors provide energy efficient equipment; and, include energy efficiency requirements in the request for proposal (RFP) and contract language.	☐	☐	☐	
Determine if devices in common areas (e.g. kitchens, break rooms, and fitness rooms) are energy efficient.	☐	☐	☐	
Identify other miscellaneous plug loads, if any. Customize plug load management practices to address these items.	☐	☐	☐	
Other Notes:				

TASK: Address plug loads in building design/retrofits (Design Team). New construction and retrofit projects bring additional plug load reduction opportunities that the design team should address. The team should review standard specifications, operations, and design standards that may limit energy savings opportunities.

Activity	In Progress	Achieved	N/A	Activity Comments
Determine if there are policies or practices in place that limit effective plug load management.	☐	☐	☐	
Consider options for space efficiency and consolidation to reduce loads.	☐	☐	☐	
Consider upgrades to the facility's electrical system to control outlets at work stations and common areas.	☐	☐	☐	
Other Notes:				