GPG Outbrief 10

Plug Load Control

GPG Program | U.S. General Services Administration | February 8, 2018

GSA

GPG-003 Advanced Power Strips for Plug Load Control @ gsa.gov

- Infographic
- 4-page Findings
- Full Report
- Additional Resources

Advanced Power Strips

https://www.gsa.gov/governmentwide-initiatives/sustainability/gpg-program/published-findings/energy-management/advanced-power-strips#

GSA

TRAVEL | REAL ESTATE | ACQUISITION | TECHNOLOGY | POLICY & REGULATIONS | ABOUT US

Home > Governmentwide Initiatives > Sustainability > GPG Program > Published Findings > Energy Management > 003. Advanced Power Strips

GPG PROGRAM

Overview
What is GPG?
Published Findings
Building Envelope
Energy Management
  028. Control Optimization for Chillers
  025. Socially Driven HVAC
  003. Advanced Power Strips
  001. Wireless Sensor Networks
HVAC
Lighting
On-Site Power & Renewables
Water
Ongoing Assessments
Request for Information
Outbrief Webinars
Technology Deployments

Advanced Power Strips

GPG-003, September 2012

More than 25% of total energy consumed in US office buildings is used to power plug-in devices, many of which continue to draw power even when turned off. A recent GPG technology assessment found that advanced power strips (APS) that employ pre-programmed timers to de-energize such devices significantly reduce power usage: 26% at workstations and 50% in printer rooms and kitchens. *Click on the infographic below to enlarge.*

READ 4-PAGE FINDINGS
[PDF - 667 KB]

Findings: Plug Load Control > [PDF - 667 KB]

DOWNLOAD FULL REPORT
[PDF - 4 MB]

Plug-Load Control and Behavioral Change Research in GSA Office Buildings > [PDF - 4 MB]

ADDITIONAL RESOURCES

- Guidance: Decision Guides for Plug and Process Load Controls (DOE/Better Buildings, 12-2016)
- Tech Specifications: Advanced Power Strips, Version 1.0 (DOE/Better Buildings, 12-2016)
- Case Study: Reducing Plug Loads in Office Spaces Hawaii and Guam Energy Improvement Technology Demonstration Project (NREL, 12-2016)

GPG FINDINGS

003 SEPTEMBER 2012
ADVANCED POWER STRIPS FOR PLUG LOAD CONTROL

OPPORTUNITY

How much energy is lost to plug loads in U.S. commercial buildings?

25% OF ELECTRICITY IS LOST TO PHANTOM POWER

IN EFFICIENT BUILDINGS THIS CAN INCREASE TO 50%[1]

TECHNOLOGY

Upcoming GPG Outbriefs—Thursdays, 12 PM ET

March 22   LED Downlight Lamps for CFL Fixtures

April 19   Electrochromic Windows

May 10   Honeycomb Solar Thermal Collector

Webinar Recordings

Access all webinars on GSA.gov

GSA.gov/GPG

Continuing Education Credits

GPG webinars offer 1 Continuing Education Learning Unit through the American Institute of Architects

To receive credit:

Complete the post-webinar survey, or contact Michael Hobson,

michael.hobson@gsa.gov

How to Chat Your Questions

Please chat your
questions during the
presentation for the
Q&A segment

Introduction

Michael Lowell
Project Manager, GPG
mike.lowell@gsa.gov
720.641.8891

Webinar Agenda

- ❏ **Overview of GPG (5 minutes)**

- ❏ **Plug Load Control (20 minutes)**
  Rois Langner, National Renewable Energy Laboratory

- ❏ **Advanced Power Strips Evaluation (15 minutes)**
  Dylan Cutler, National Renewable Energy Laboratory

- ❏ **On-the-ground Feedback (5 minutes)**
  John Tegan, GSA Region 3, Building Operations

- ❏ **GSA Deployment (10 minutes)**
  Nasreen Ege, GSA, Office of Facilities Management

- ❏ **Q & A (20 minutes)**

Introduction

Kevin Powell
Program Manager, Emerging Technologies
kevin.powell@gsa.gov
510.423.3384

Emerging Technologies' two programs — GSA Proving Ground (GPG) and Pilot to Portfolio (P2P) — enable GSA to make sound investment decisions in next generation building technologies based on their real world performance

Leading by Example

GSA's Proving Ground accelerates market acceptance by objectively assessing innovative building technologies in real-world environments, and deploying those that deliver. To date, GSA has installed 9 technologies across more than 200 buildings. In aggregate, these technologies are delivering $7.4 Million in annual O&M savings.
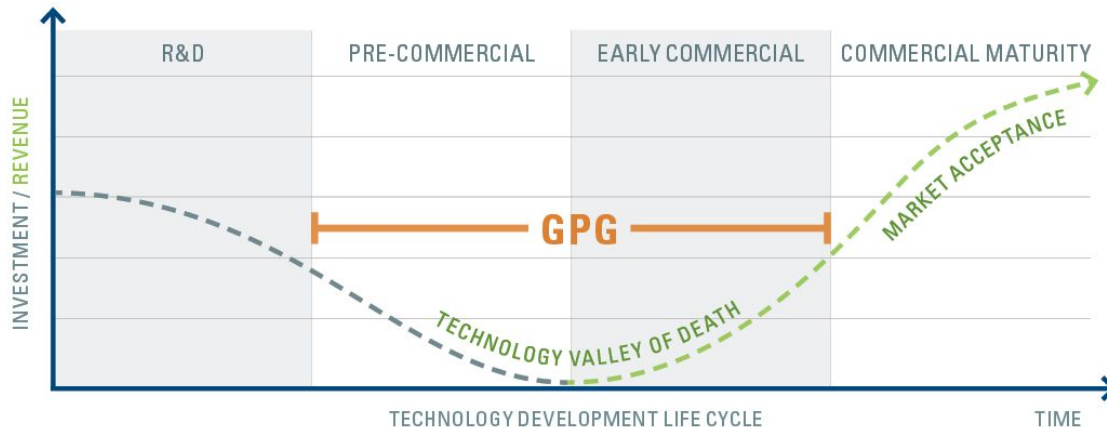
GPG Process

Identify promising technologies at the edge of commercialization

Pilot technology installations within GSA's real estate portfolio

Partner with Department of Energy national laboratories to objectively evaluate real-world performance

Identify technologies with broad deployment potential for GSA, coordinate results with broader federal and CRE community.

Introduction to Plug Load Control

Thanks to:

- Region 3 for conceptualizing the study and bringing it to GPG

- NREL for designing a study that tested all the strategies and allowed us to use a technology that had 80% of the value at 20% of the cost

- OFM team for leading a deployment campaign throughout 200 facilities

- FAS for leveraging Federal procurement buying power
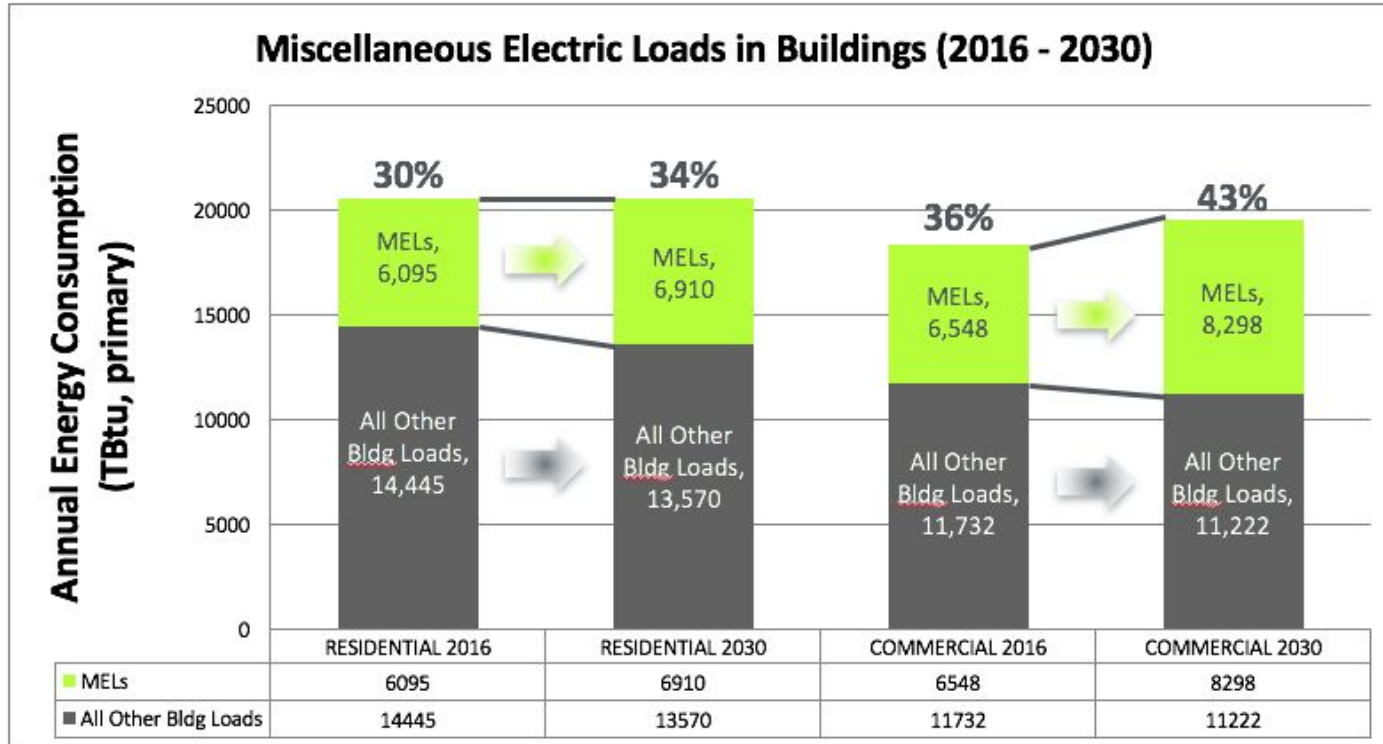
Plug Load Control

Rois Langner
National Renewable Energy Laboratory

What Are Plug Loads?

Plug Load Energy

Miscellaneous Electric Loads in Buildings (2016 - 2030)

	RESIDENTIAL 2016	RESIDENTIAL 2030	COMMERCIAL 2016	COMMERCIAL 2030
MELs	6095	6910	6548	8298
All Other Bldg Loads	14445	13570	11732	11222

Data from: EIA Annual Energy Outlook, 2015.

Typical Energy Savings

Up to 30%!

Translates to approximately **10%** of whole building energy consumption

Better Buildings Initiative

Better Buildings Initiative

Better Buildings Accelerators

Better Communities Alliance

Better Buildings Challenge

Better Plants Program

Better Buildings Alliance

Better Buildings Workforce

Better Buildings Challenge SWAP

Better Buildings Residential Network

Plug & Process Loads Team

Plug Load Resources

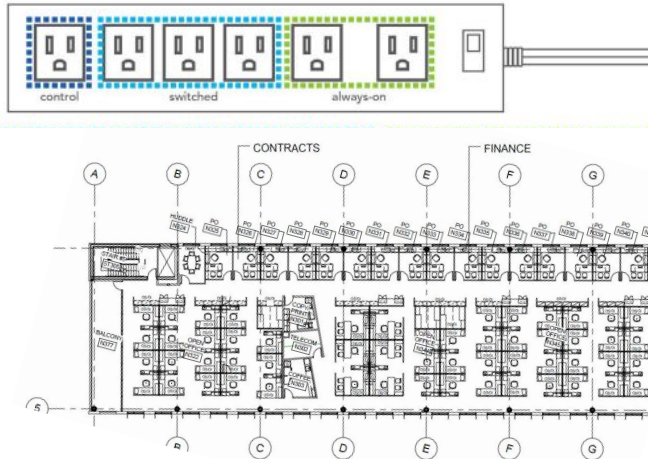# Established PPL Energy Management Solutions

- "Turn It Off!" Campaigns
- Upgrade Equipment, ENERGY STAR
- Built-In Low Power States
- Advanced Power Strips
- Design Strategies for Consolidating PPLs

Plug Load Resources

Advanced Power Strips

Advanced Power Strips

Timer
Power Strip

Master-Controlled
Power Strip

Masterless
Power Strip

Remote Switch
Power Strip

Activity Monitor
Power Strip

- Power strip automatically turns off outlets based on a pre-set schedule

Advanced Power Strips

Timer Power Strip

Master-Controlled Power Strip

Masterless Power Strip

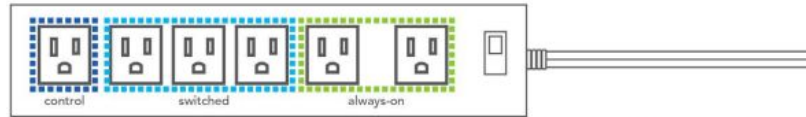Remote Switch Power Strip

Activity Monitor Power Strip

Advanced Power Strips (APS)

control   switched   always-on

Primary Outlet
COMPUTER/LAPTOP

Secondary Outlet
MONITOR, PRINTER, DESK LAMP

Always-On Outlet
LANDLINE TELEPHONE, FAX, MINI FRIDGE

Advanced Power Strips

Timer Power Strip

Master-Controlled Power Strip

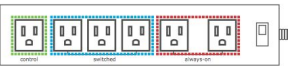Masterless Power Strip

Remote Switch Power Strip

Activity Monitor Power Strip

:::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.

Advanced Power Strips

Timer Power Strip

Master-Controlled Power Strip

Masterless Power Strip

Remote Switch Power Strip

Activity Monitor Power Strip

OFF ON

Many consumer electronics continue to draw power even when they are switched off. This is known as a VAMPIRE LOAD.
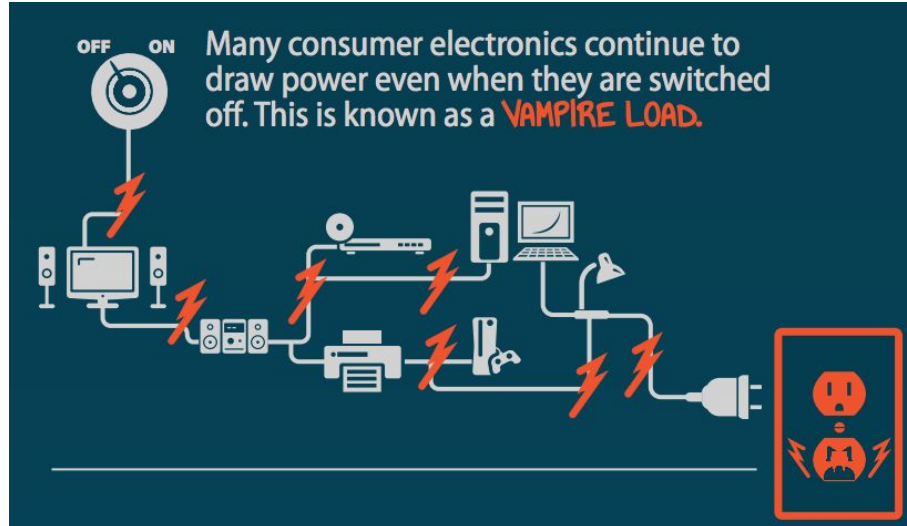
Advanced Power Strips

Timer
Power Strip

Master-Controlled
Power Strip

Masterless
Power Strip

Remote Switch
Power Strip

Activity Monitor
Power Strip

Advanced Power Strips

Timer
Power Strip

Master-Controlled
Power Strip

Masterless
Power Strip

Remote Switch
Power Strip

Activity Monitor
Power Strip

A Tale of Two Tiers

Tier 1 = Typical APS

Tier 2 = APS with Occupant Sensing

Connected APSs

Hardware + Software + Services

Plug Load Consumption

Energy Consumption Per Device Type

September 8 – September 16, 2013
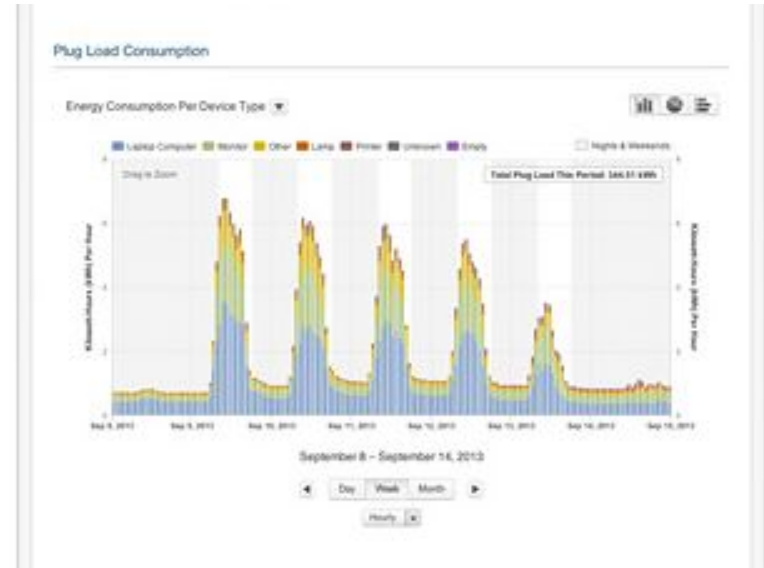
Building Standards & Codes

Standards Require Plug Load Controls (...since 2010!)

- ASHRAE 90.1
- California Title 24
- 50% of outlets in specified spaces must have automatic shut-off control
  - Workstations
  - Private offices
  - Conference rooms
  - Print/copy rooms
  - Break rooms
  - Classrooms
- Plug-in control devices are not allowed
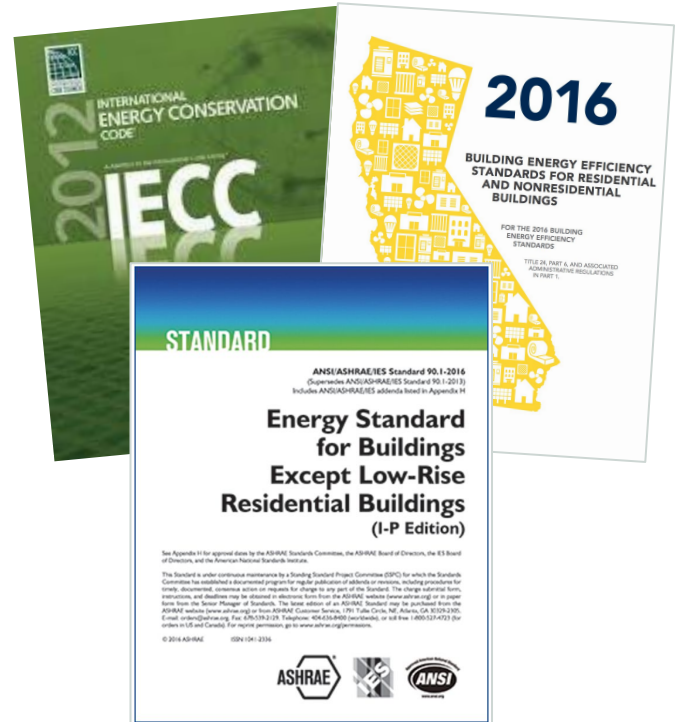
Wireless Meter & Controls —"Smart Outlets"

Better Buildings Initiative

Data analytics = informed decisions

- Set schedules

- Monitor device health for efficiency and failure

- Inform policies

- Control equipment and manage data remotely

- Engage occupants

Measurement & Verification

Dylan Cutler
R&D Staff, National Renewable Energy Laboratory

GPG-003

Advanced Power Strips for Plug Load Control

General Services Administration
Public Buildings Service

GSA

ADVANCED POWER STRIPS

Advanced Power Strips Decrease Energy Consumption

Desk-based technologies and other electronics that plug into office building receptacles draw a considerable amount of power, some of it 24/7. In fact, "plug loads" account for roughly 25% of total electricity consumed within office buildings. GSA currently owns and leases more than 370 million square feet of building space in some 9,600 buildings nationwide. The size of this real estate portfolio alone suggests the possibility of enormous energy savings, if plug loads can be reduced. With this in mind, GSA's GPG program recently assessed the effectiveness of advanced power strips (APS) in managing plug-load energy consumption in eight of its buildings. Three types of plug-load reduction strategies were evaluated: schedule timer control, which allows the user to set the day and time when a circuit will be energized and de-energized; load-sensing control, which monitors a specific device's

Opportunity
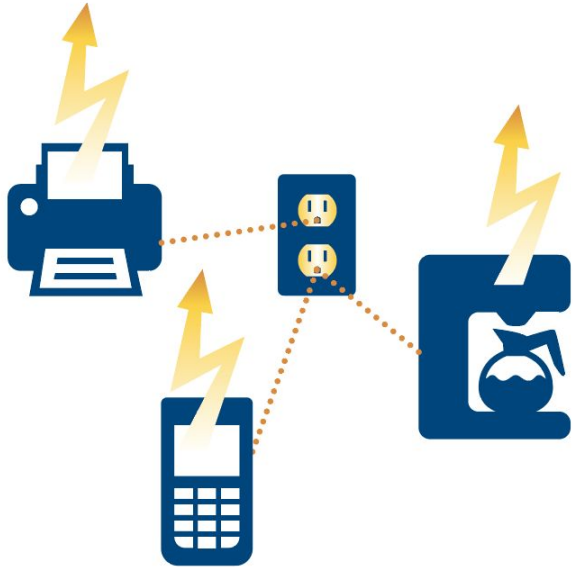
25% of electricity end use

in office buildings goes towards plug loads (in 2012) and this has continued to increase

Advanced Power Strips

De-energize circuits

Based on a timer, load-sensing or both

Measurement & Verification, GSA's Mid-Atlantic Region

Veterans Administration Center Building – Philadelphia, Pennsylvania

William J. Green, Jr. Federal Building – Philadelphia, Pennsylvania

Cohen Complex – Camden, New Jersey

Clarkson S. Fisher Federal Building and U.S. Courthouse – Trenton, New Jersey

Spottswood W. Robinson III and Robert R. Merhige, Jr., U.S. Courthouse – Richmond, Virginia

Edward A. Garmatz U.S. Courthouse – Baltimore, Maryland

William S. Moorhead Federal Building – Pittsburgh, Pennsylvania

Robert C. Byrd Federal Building and U.S. Courthouse – Charleston, West Virginia

NREL assessed Advanced Power Strips throughout GSA's Mid-Atlantic Region

Technology for test-bed measurement and verification provided by Enmetric.

Test Plan

- 3 control strategies: load-sensing, schedule-timer, both

- Different space types: workstations, printer rooms, kitchens
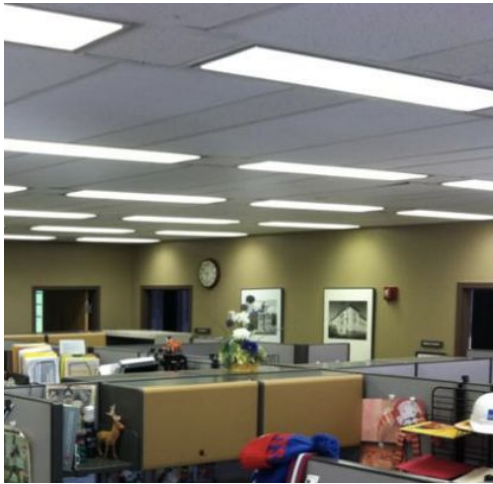
Monitored for 12 weeks
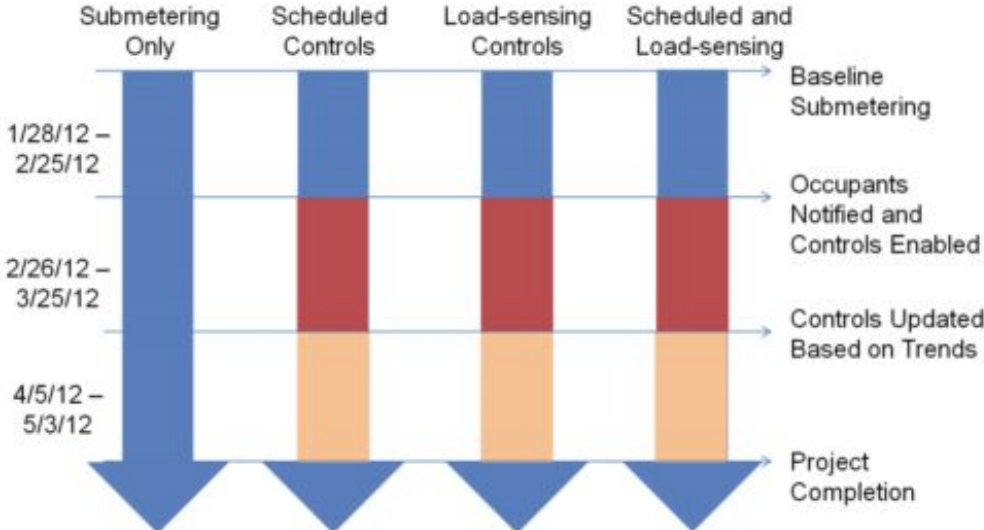
Figure IV-4: Diagram of project timeline

Printers

Laptops

Energy Savings

Monthly Energy Use (kWh)

Baseline
1/28-2/25/12

Initial Controls
2/26-3/25/12

Schedule Controls Refined
4/5-5/3/12

SCHEDULE TIMER LOAD-SENSING SCHEDULE TIMER + LOAD-SENSING
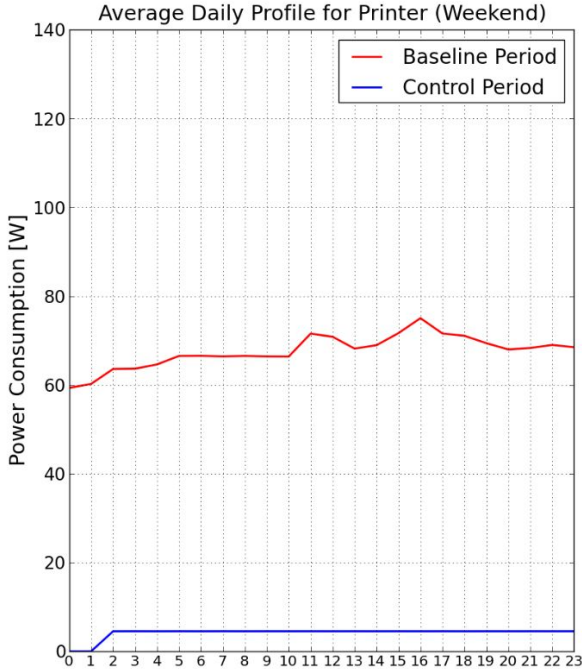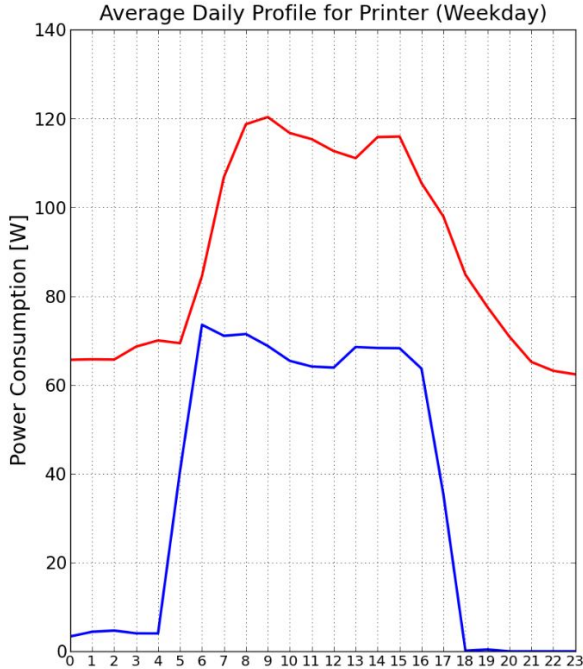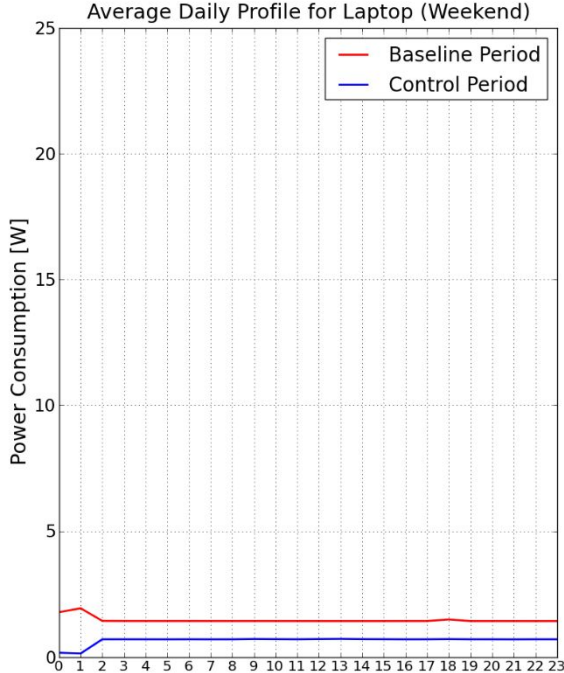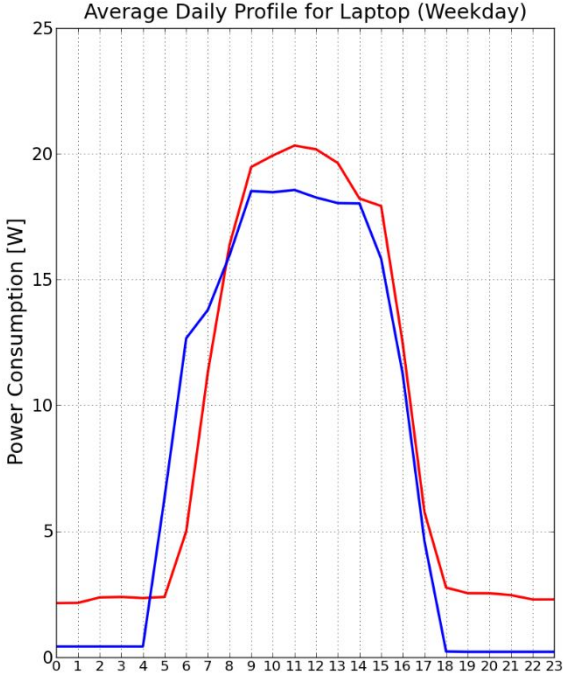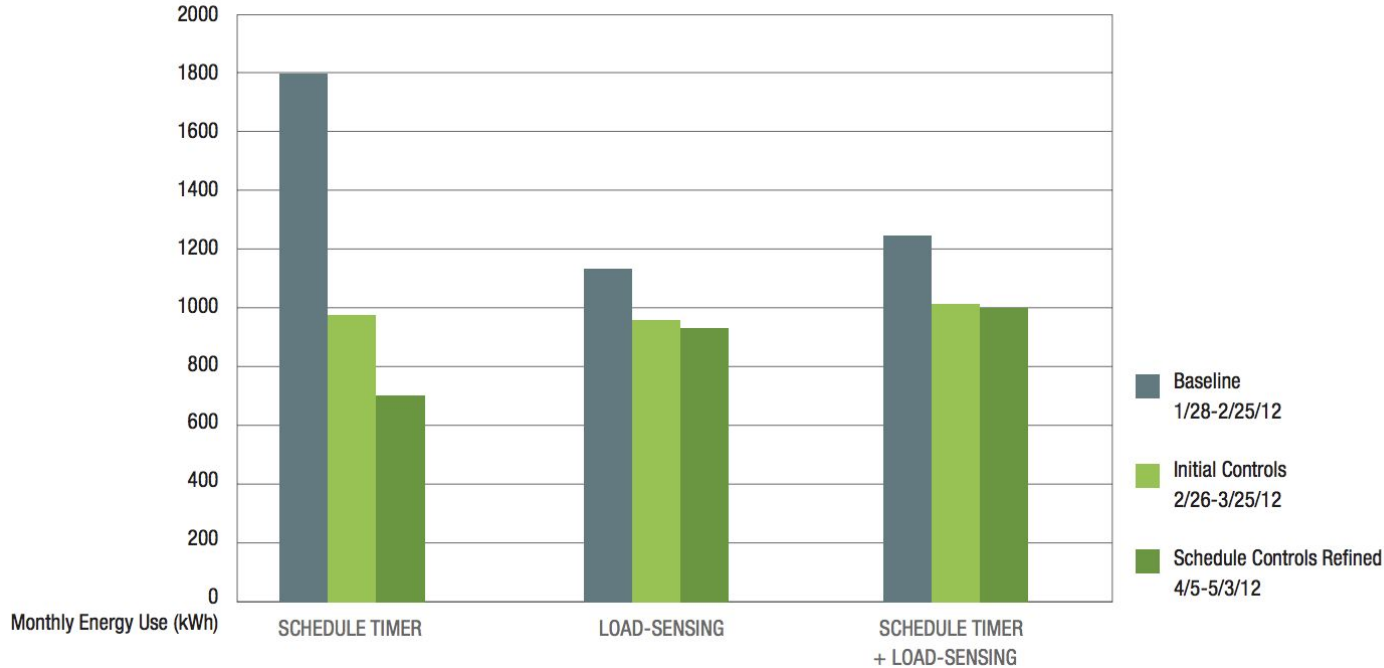
26%
ENERGY SAVINGS
AT WORKSTATIONS
with advanced computer
management in place
48% IN KITCHENS &
PRINTER ROOMS

Simpler and Lower-Cost Schedule Timer Most Effective

- Largest savings with devices powered 24/7 such as printers, copiers and kitchen appliances

- Majority of users did not wish to have more control over their individual APSs

- Load-sensing might be worth pursuing for individual workstations when occupants have a variety of desktop appliances and unpredictable schedules

Payback

GSA Estimated Energy Savings

77.23 kWh/yr for Workstations
Annual savings of $8.50

466.2 kWh/yr for Common Areas
Annual savings of $51.29

3
YEARS
PAYBACK

for workstations
@$22 per device
.5 years for
common areas

Recommended Broad Deployment

Best suited for all locations

- Energy savings and low payback support deployment throughout GSA's portfolio

On-The-Ground Feedback

John Tegan, C.E.M.
GSA Region 3 Building Operations

Test-Bed Experience

Timer tested was powerful

- Each plug programmed separately, wifi accessible, logged plug electricity use

- IT security issues prevented connecting to GSA's network

- Savings weren't as high as initially expected because most offices had already gone from desktop to laptop computers

Test-Bed Experience

User experience

- Users didn't like big brother aspect of logging when electricity was being used

- Users had issues with printers being turned off when they needed them

- Override switch wasn't easy to use, users had to get on hands and knees to access

Current APS

Decided on a much dumber timer-controlled APS

- Most of these are still being used

- At first, the thought was that it would be hard to give these away but then everyone wanted one
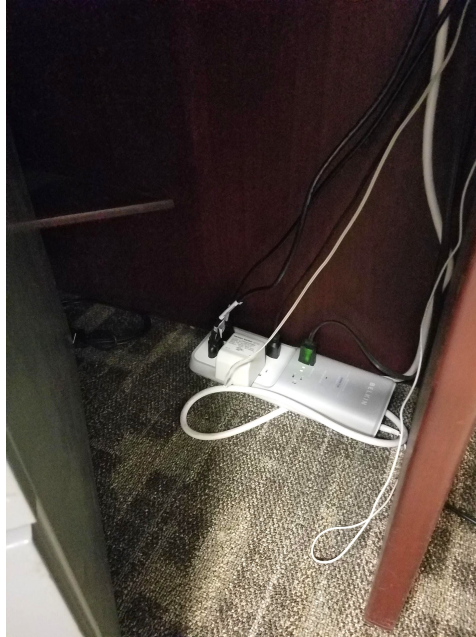
Deployment Campaign
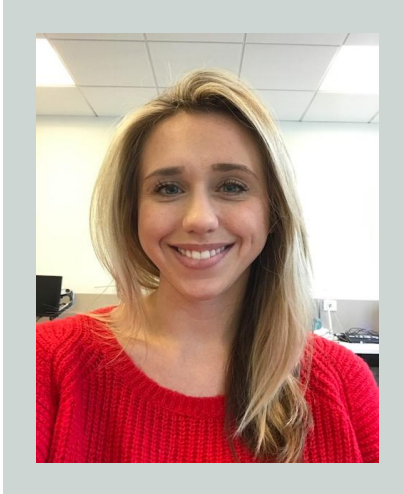
Nasreen Ege
Office of Facilities Management
Public Building Service

APS National Deployment

16,000 timer-controlled devices in over 80 facilities across GSA

Region 10
1,000 **APS**
3 locations

Region 5
120 **APS**
5 locations

Region 1
761 **APS**
5 locations

Region 3
2,700 **APS**
6 locations

Region 9
987 **APS**
20 locations

Region 8
31 **APS**
7 locations

Region 6

Region 2
5,000 **APS**
25 locations

Region 11 (NCR)
4,560 **APS**
16 locations

Region 7

Region 4
1,200 **APS**
11 locations
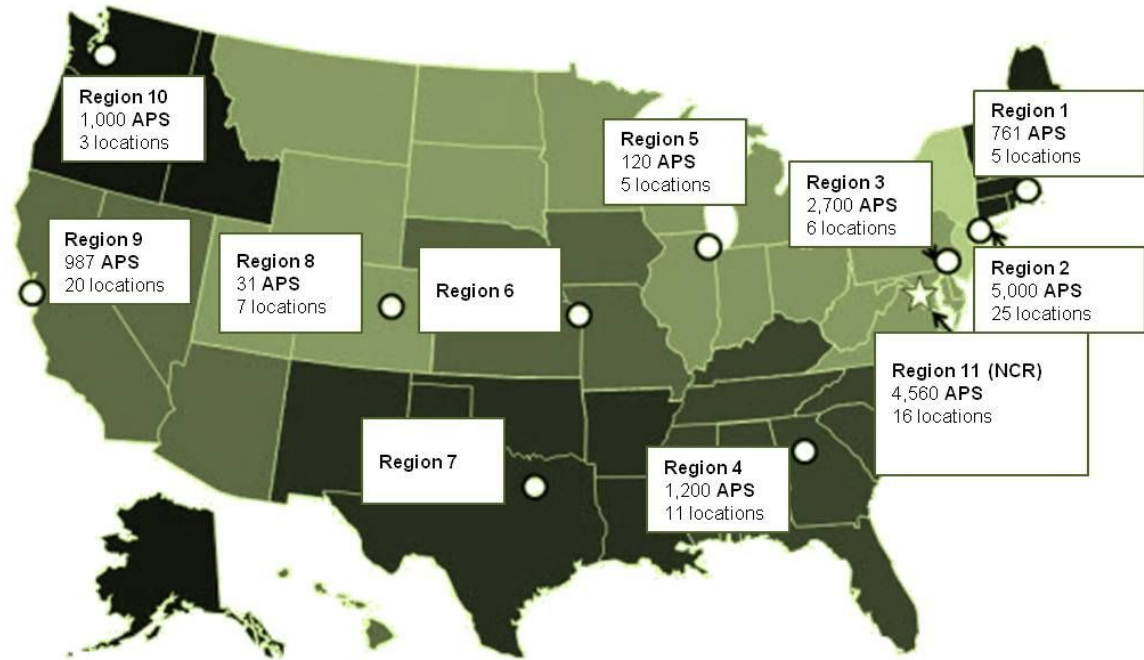
Deployment Details

Bulk Purchase of APS

- Off the shelf, no customization, Belkin, Conserve Surge with Timer

- On GSA Schedule & TAA compliant

- 35% discount from GSA Schedule

Deployment

- 90% workstation
  10% kitchen/print room

- 80 facilities over 9 regions

Cost Effective

- Over $200,000 savings annually

- 1.7 year overall payback

  - Workstations
    2.6 years

  - Common Areas
    0.4 years

Timer-Controlled APS Functionality

One-Touch Desktop Button

Use the Desktop Button to turn your Timed Outlets on and off. These outlets automatically turn off after 11 hours to save power. The blinking LED status indicator notifies you when your outlets are about to be turned off. Press the button to keep outlets on for another 11 hours.

6 Auto-Off Timed Outlets

Timed outlets automatically turn off after 11 hours. Use these outlets for devices that don't require constant power (24/7), such as laptop computers*, monitors, phone chargers, printers, and desk lights.

2 Always-On Outlets

Use these outlets for devices that require power at all times, such as desktop computers, phones and clocks.

Q & A

Survey and Continuing Education Credit

GPG webinars offer 1 Continuing Education Learning Unit through the American Institute of Architects

To receive credit:

Complete the post-webinar survey, or contact Michael Hobson,

michael.hobson@gsa.gov

GPG Outbrief 10: Plug Load Control

* Required

Email address *

Your email

Continuing Education Credit

☐ Check here to request a certificate for 1 CE unit.

AIA Number

Your answer

First Name and Last Name

Your answer

The information presented in the Outbrief webinar was helpful.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

I am interested in installing Advanced Power Strips or Smart Outlets

○ Yes, in the next 2 years.

○ Yes, in the next 5 years.

○ Maybe

○ No

Thank you!

For more information: gsa.gov/GPG

Kevin Powell, Program Manager kevin.powell@gsa.gov 510.423.3384
Michael Lowell, Project Manager mike.lowell@gsa.gov 720.641.8891