We’ll be starting in just a few minutes….

Tell us…please send your responses to the webinar organizers via the chat window:

1. What topics are you interested in for future webinars?
2. How are you addressing plug load?
Plug into Energy Savings:
Strategies and Resources for Reducing Plug Load Energy Use in Your Buildings

December 1, 2015
3:00-4:00 PM ET
Overview and Agenda

- Welcome & Introductions
- Plug load Overview – National Renewable Energy Laboratory (NREL)
- Case Study – Stanford University
- Case Study – U.S. General Services Administration (GSA)
- Additional Resources
- Question & Answer Session
## Today’s Presenters

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rois Langner</td>
<td>NREL</td>
</tr>
<tr>
<td>Moira Hafer</td>
<td>Stanford University</td>
</tr>
<tr>
<td>Jason Sielcken</td>
<td>GSA</td>
</tr>
</tbody>
</table>
Better Buildings Alliance
Plug and Process Load (PPL) Technical Solutions Team

December 1, 2015
Technical Lead Lab: The National Renewable Energy Laboratory (NREL)
Members work with DOE’s network of research and technical experts to develop and deploy innovative, cost-effective, energy savings solutions.
Why PPLs?

PPLs account for an increasingly large percentage of a building’s energy use.

Reduce PPL energy use by:

- Assessing PPL energy consumption
- Selecting appropriate control strategies
- Exploring efficient PPL design solutions
- Identifying utility incentives
- Institutionalizing policies and procedures for PPL energy reduction

Figure 5. Diagram of an example low-energy workstation. Illustration by Matthew Luckwitz, NREL
Available PPL Resources

- Fact Sheets
- Technical Reports
- Presentations
- Case Studies
- Technical Specifications
- How-To Graphics
- List of Utility Incentives

Featured Publications:
- Assessing and Reducing PPLs in Office and Retail Buildings
- Technical Specification for Advanced Power Strips
- How To Use Advanced Power Strips in an Office Setting
- Utility Incentives for Advanced Power Strips
- Decision Guides for PPL Controls
PPL Solutions

- Messaging, or Turn it Off! Campaigns
- Advanced Power Strips
- Upgrade Equipment with Low-Energy or ENERGY STAR ®-Certified Equipment
- Use Built-In Low Power States for Equipment
- Design Strategies for Consolidating PPLs
- Integrated PPL Controls with Other Building Systems
- Submetering and Control Options
Upcoming Projects & Events

Upcoming Projects:

• Technology & behavioral study comparing thin-client/server-based computing systems to traditional computing systems
  • Technical report
  • Case study

Ongoing PPL Events:

• Bi-Annual BBA PPL Technical Team Calls
• 2016 Better Buildings Summit: May 9-11, DC
• Continually update resources on BBA PPL website
Join the BBA PPL Tech Team

Team Members

Members

- American Society for Healthcare Engineering (ASHE)
- American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)**
- CB Richard Ellis Group, Inc.
- First Potomac Realty Trust
- Glenborough, LLC
- Grand Valley State University
- Gundersen Lutheran Health System
- Health Care Without Harm
- Hines
- IBM
- Legacy Health System
- Newmark Grubb Knight Frank Global Corporate Services
- Parmenter Realty Partners
- PeaceHealth
- Stanford University
- Studley
- The Home Depot, Inc.
- The Tower Companies
- Tishman Speyer
- Ulta Inc.
- University of Maryland Medical Center
- University of Miami
- U.S. General Services Administration
- Wawa, Inc.

* Steering Committee member
** Ex-Officio Steering Committee member

Members in **bold** have taken the Better Buildings Challenge
Moira Hafer

Stanford University
A Data-Driven Approach to Plug Load Energy Reduction Programs

Moira Hafer
Stanford University
Better Buildings Alliance Webinar

December 1, 2015
Goals:

1. Quantify campus plug load energy consumption and understand its composition

2. Identify viable plug load energy reduction opportunities

3. Collect data that supports university partners

Stanford Equipment Inventory Overview

• Comprehensive 220-building equipment inventory
Scope

- Types of equipment included:
  - Standard office equipment
  - Standard lab equipment
  - Common IT equipment
  - Kitchen & break room equipment
  - Gym equipment
  - Other
    - EH&S hazards
    - Water fixtures
    - Occupancy data
- Attributes collected for each type of equipment to provide necessary details for estimating energy consumption
Interns used web application developed at Stanford to collect inventory data.
## Results (A) – Campus-wide Context

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Equipment Count</td>
<td>110,000</td>
</tr>
<tr>
<td>Total Energy Consumption (kWh/yr)</td>
<td>48,200,000</td>
</tr>
<tr>
<td>Total annual cost</td>
<td>$6.7 million</td>
</tr>
<tr>
<td>Plug Load as % of Total Campus Electricity Use</td>
<td>22%</td>
</tr>
<tr>
<td>Plug Load as % of Electricity Use of 220 Bldgs</td>
<td>32%</td>
</tr>
</tbody>
</table>

**Diagram: Equipment Count**

- **Personal Computer:** 18%
- **LCD Monitor:** 17%
- **Desk Lamp:** 12%
- **Other:** 28%
- **Small Networked Printer:** 2%
- **Server:** 2%
- **Hot Plate:** 2%
- **Speakers:** 2%
- **Network Switch:** 2%
- **Centrifuge:** 3%
- **Phone:** 9%
- **Personal Printer:** 3%
Results (B) - Energy Consumption by Equipment Type

Key:
- IT Equipment
- Lab Equipment
- Office Building Equipment
Results (C) – Energy Consumption by Building Type

Average Plug Load Energy Use Intensity by Building Type

Energy Use Intensity (kWh/SqFt/Yr)

- Hi Intensity Lab
- Low Intensity Lab
- Office
- Shops
- Commons
- Classroom
- Recreation Facility
- Auditoriums
- Library/Museum
## Plug Load Energy Savings Programs

Estimated to save a total of $260,000 - $1.8 million annually

<table>
<thead>
<tr>
<th>Program</th>
<th>Expected Annual Savings</th>
<th>Average ROI</th>
<th>% Plug Load Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment Retrofits</td>
<td>$261,000</td>
<td>2.7 years</td>
<td>3.9%</td>
</tr>
<tr>
<td>Space Heating</td>
<td>$40,000</td>
<td>1.7 years</td>
<td>0.6%</td>
</tr>
<tr>
<td>Sustainable IT</td>
<td>$728,000(^1)</td>
<td>4.4 years</td>
<td>10.6%</td>
</tr>
<tr>
<td>Green Labs</td>
<td>$703,000</td>
<td>11 years</td>
<td>10.3%</td>
</tr>
<tr>
<td>Procurement Strategy</td>
<td>$85,000</td>
<td>N/A</td>
<td>1.2%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$1,800,000</strong></td>
<td><strong>3.6 years</strong></td>
<td><strong>27%</strong></td>
</tr>
</tbody>
</table>

\(^1\)The additional savings from reduced power needs and cooling costs from server consolidation and virtualization could equal over 990,000 per year, bringing energy reduction from Sustainable IT plug load measures to the equivalent of 25% of total plug loads.
Thank you!

MOIRA HAFER

MBHAFER@STANFORD.EDU

FOR MORE INFORMATION, VISIT US AT HTTP://SUSTAINABLE.STANFORD.EDU
Jason Sielcken

U.S. General Services Administration (GSA)
WAYNE N. ASPINALL FEDERAL BUILDING &
US COURTHOUSE

PPL ENERGY INCENTIVE DATA REVIEW
& LESSONS LEARNED

December 2015
PROJECT OVERVIEW:

- Building Constructed in 1918 with a major addition in 1938
- Listed on the Nation Register of Historic Places Required SHPO & ACHP Review / Comment
- Project Focus: Major preservation and rehabilitation effort balanced with a deep energy retrofit and capability for energy production within the footprint to achieve net zero
- Houses 8 federal agencies + the US Courts
PROJECT OVERVIEW:

- Design Build Procurement
- Target of LEED Platinum & Class A Net Zero
- SHPO & GSA reviews required a substantial reduction to the visibility of the renewable energy resource post award
- Challenge: Reduce the PV : Maintain ZNE
PROJECT OVERVIEW:

- Optimize Building Envelope
- Reduce Internal Loads
- Design High Efficiency System
- Match Building Load with On-site Renewable Energy
ENERGY USE BREAKDOWN:
SEPTEMBER 2013 – AUGUST 2014

- VRF: 35%
- Misc: 31%
- Light: 13%
- DOAS: 4%
- Pumps: 6%
- Fans: 2%
- Other: 4%
- DHW: 1%

Elev: 2%
PPL CONTROL STRATEGIES:

- 40,000 kWh/yr. – Cumulative target for all 51 employees for PPL (not including vertical transport).
- Sub-Metering to the Circuit Level
- Energy Information Displayed in the Lobby, with Access via Occupant Workstation
- Load Shedding Circuits Installed
- Utilized Load Shedding Plug Strips for Every Occupant
FINANCIAL INCENTIVE:

Take a portion of the RSF fee GSA collects for utilities and offer it back to the agency if they meet their energy target. **Reward Occupant Awareness & Response**

Agency target was based on their RSF, FTE Count, and Mission.
FINANCIAL INCENTIVE:

ACOE: 4,217 kWh/yr. Target  
8 FTE | 4,724 RSF | Open Office, Typ. Office Equipment  
VS.  
US Marshals Service: 4,600 kWh/yr Target  
2 FTE | 1,732 RSF | Open Office, Holding Cells, Typ. Equip., Security Equipment

$0.55/ kWh (rounded up to $18,000) vs. $0.10 kWh Utility  
32,250 kWh Total Annual Plug Load Allowance for all Participating Agencies

IRS Annual Target = 14,000 kWh x 43.41% of total kWh available = $7,813.95

Additional $0.25/kWh if agency improves on their target.
RESULTS:

**US ARMY CORP OF ENGINEERS:**
- 8 FTE: 339 kWh/FTE ANNUALLY
- 0.6 kWh/RSF ANNUALLY

**INTERNAL REVENUE SERVICE:**
- 23 FTE: 609 kWh/FTE ANNUALLY
- 1.4 kWh/RSF ANNUALLY

**US SENATE:**
- 2 FTE: 628 kWh/FTE ANNUALLY
- 1.37 kWh/RSF ANNUALLY

**US PROBATION:**
- 2 FTE: 1,010 kWh/FTE ANNUALLY
- 0.9 kWh/RSF ANNUALLY

**FEDERAL BUREAU OF INVESTIGATION:**
- 3 FTE: 12,734 kWh/FTE ANNUALLY
- 11.49 kWh/RSF ANNUALLY

**US DISTRICT COURTS:**
- 2 PTE: 4,197 kWh/PTE ANNUALLY
- 1.34 kWh/RSF ANNUALLY

**US MARSHALS SERVICE:**
- 2 FTE: 3,223 kWh/FTE ANNUALLY
- 3.72 kWh/RSF ANNUALLY

**US ATTORNEYS:**
- 0 FTE: 0 kWh/FTE ANNUALLY
- 0.0 kWh/RSF ANNUALLY
NEXT STEPS:

1. I.T. SUPPORT & INVOLVEMENT IS CRITICAL

2. INCENTIVIZE MORE THAN JUST PLUG LOAD

3. CONSIDER THE INCENTIVE DURATION

4. CONSIDER WHERE THE INCENTIVE GOES – WHAT IS THE LOCAL RECOGNITION?

5. IS THE REWARD ENOUGH TO DRIVE CHANGE
2014 ELECTRIC DEMAND:
JANUARY 2014 – DECEMBER 2014
NEXT STEPS:

1. I.T. SUPPORT & INVOLVEMENT IS CRITICAL
2. INCENTIVIZE MORE THAN JUST PLUG LOAD
3. CONSIDER THE INCENTIVE DURATION
4. CONSIDER WHERE THE INCENTIVE GOES – WHAT IS THE LOCAL RECOGNITION?
5. IS THE REWARD ENOUGH TO DRIVE CHANGE
DISCUSSION

CONTACT: JASON S. SIELCKEN, PMP, LEED AP BD+C
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303.236.2972
Additional Resources
For More Information

NREL

- Better Buildings Alliance Plug & Process Loads

Stanford University

- Publication of Plug Load Inventory Results
- Guide for Installing Timers on Lab Equipment
- Guide for Installing Timers on Office Equipment
- Plug Load Inventory & Results Summary
- Sustainable Stanford Annual Report

GSA

- Wayne N. Aspinall Federal Building and US Courthouse
Join us for the next Better Buildings Webinar

Registration is now open!

Cutting Edge Building Technologies – Join the Fun!

January 12, 3:00 – 4:00 PM ET

Presenters:
U.S. Department of Energy
New York Presbyterian Hospital
QM Power

Register [here].
**Additional Questions? Please Contact Us**

**betterbuildingswebinars@ee.doe.gov**

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