Extreme Office Makeover

Mira Vowles, Bonneville Power Administration
Colorado Utility Efficiency Exchange Conference
October 22, 2009
Office Energy Use

Based on data from the Department of Energy, Energy Information Administration, Building End-Use Consumption Survey
New York State Energy Research and Development Authority (NYSERDA) Extreme Office Makeover

Plug-load audits for institutional buildings
NYSERDA Extreme Office Makeover

1. Get commitment from the top
2. Audit plug loads
3. Have an IT expert on the team
4. Recommend EE measures and policies
Plug load equipment

- Computers and monitors
- Small power supplies
- Speakers
- Printers
- Copiers and multi-function devices (MFD)
- Faxes
- Scanners and MFDs
- Vending machines
- Task lighting
- Large coffee machines
- Water coolers
- Refrigerators
- Clothes washers
- Space heaters
- Other electronics
Sample Plug Load Energy Use

- Monitors, 26%
- CPU's, 18%
- Task Lights, 6%
- EPS, 5%
- Vending, 4%
- Misc, 18%
- Printers, 13%
- Copiers, 10%
Three “P’s” for Plug-Load Savings

• **Power off**
• **Power management**
• **Policies**
Sample Plug Load Savings

- Vending Machines, 7%
- Misc Equipment, 6%
- Printers, 8%
- CPUs, 16%
- Smart Strips, 18%
- Monitors, 23%
- Copiers, 21%
Personal Computer Opportunities

• Use power management (170 kWh)

• Replace desktops with laptops (185 kWh)

• Replace CRTs with LCDs (115 kWh)
Printer Opportunities

• Turn off “after hours”

• Consolidate printers

• Standardize printer models
Detailed Plug-Load Recommendations with LARGE Potential Savings!

<table>
<thead>
<tr>
<th>Equipment</th>
<th># of Units</th>
<th>Implement Energy Efficiency Measures</th>
<th>% Saved With Implemented Measures</th>
<th>Total Office Savings @ $0.10</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC/Monitors</td>
<td>1600</td>
<td>Shut off PCs &amp; Monitor Power Management</td>
<td>59%</td>
<td>$48,800</td>
</tr>
<tr>
<td>Printers</td>
<td>661</td>
<td>Shut off &amp; Power Management</td>
<td>43%</td>
<td>$11,565</td>
</tr>
<tr>
<td>Copiers</td>
<td>66</td>
<td>Shut off &amp; Power Management</td>
<td>67%</td>
<td>$5,031</td>
</tr>
<tr>
<td>Faxes/Scanners/MFDs</td>
<td>119</td>
<td>Shut off &amp; Power Management</td>
<td>41%</td>
<td>$1,412</td>
</tr>
<tr>
<td>Task Lights</td>
<td>68</td>
<td>Replace Incandescents with CFLs</td>
<td>72%</td>
<td>$167</td>
</tr>
<tr>
<td>Water Coolers</td>
<td>33</td>
<td>Turn off Hot Water Tap</td>
<td>36%</td>
<td>$595</td>
</tr>
<tr>
<td>Refrigerators</td>
<td>73</td>
<td>Replace Old Inefficient Units</td>
<td>32%</td>
<td>$1,964</td>
</tr>
<tr>
<td>Coffee Machines (Lg)</td>
<td>40</td>
<td>Turn off at night/use timers</td>
<td>25%</td>
<td>$1,190</td>
</tr>
<tr>
<td>Vending Machines</td>
<td>7</td>
<td>Replace w/ENERGY STAR machines</td>
<td>62%</td>
<td>$1,178</td>
</tr>
<tr>
<td>Total Equipment Users</td>
<td>1600</td>
<td></td>
<td>53%</td>
<td>$71,901</td>
</tr>
</tbody>
</table>
BPA’s Extreme Office Makeover Team

• Lane Community College Energy Management Program staff and student interns
• Eugene Water and Electric Board EE staff
• Building property manager
• NYSERDA delivery contractor
• BPA EE staff
BPA Extreme Office Makeover of two office buildings

• 60,000 SF
• Three story
• All electric
• 30 years old
• Energy efficient lighting, HVAC and controls
BPA Extreme Office Makeover Pilot

• Analyze lease
• Plug load audits of two office buildings
• Provide sample smart-strip, recommendations, results and incentive information
BPA Extreme Office Makeover
tenant plug-load audits

Equipment Energy Use
Based on Power Management Settings
& Nighttime Shut Off

- Computers
- Monitors
- Printers
- Copiers

kWh/Year

As Found  As Implemented  As Recommended
Plug Load References

- ESource; “Managing Plug Loads; Laptop and Chargers and Fans, Oh My”, Feb 2009
- LBL Study; “After-hours Power Status of Office Equipment and Inventory of Miscellaneous Plug-Load Equipment”, Jan 2004
- BNXS15: Standby power consumption – domestic appliances Version 1.4
- BNXS36: Estimated UK standby electricity consumption in 2006; Version 2.5; updated 24/02/2009.
- A review of the Energy Efficiency Commitment 2005-2008; OFGEM, 1 August 2008
- Carbon Emission Reduction Target (CERT) carbon reduction matrix
BPA Extreme Office Makeover
Lessons Learned

- Owner occupied buildings best application
- Need to know occupants’ motivations
- Audits are labor intensive
- Significant savings from no/low cost measures
- Sub-metering can help
- Smart-strips are a good tool
Commercial Smart Strip Incentives

- Office pilot
- Deem minimum savings
- Incent for all smart-strips?
- Direct install?
BPA Office Pilot

• 165 smart-strips installed
• 700 kWh per year average savings
• Installed if cubicle plug-load was more than 250 watts
• Smart-strip required if cubicle had an electric heater
## Types of available smart strips

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupancy Sensor</td>
<td>A sensor that turns on lights when someone enters the room.</td>
<td>$80 – $95</td>
</tr>
<tr>
<td>Load Sensor</td>
<td>A sensor that automatically controls the load.</td>
<td>$20 – $160</td>
</tr>
<tr>
<td>Timer Plug Strip</td>
<td>A strip with a timer function, allowing for scheduled power usage.</td>
<td>$20 - $50</td>
</tr>
</tbody>
</table>
Smart strips: your savings may vary

<table>
<thead>
<tr>
<th>Smart Strip Type</th>
<th>Savings &amp; Rebates</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Occupancy Sensor</strong></td>
<td></td>
</tr>
<tr>
<td>Barriers:</td>
<td>Savings:</td>
</tr>
<tr>
<td>• False detection</td>
<td>• 700 kWh/yr – BPA</td>
</tr>
<tr>
<td>• Blind spots</td>
<td>• 94 - 295 kWh/yr – PG&amp;E</td>
</tr>
<tr>
<td>Solution:</td>
<td>• 30%– Florida Solar Energy Ctr</td>
</tr>
<tr>
<td>• Adjust sensitivity/sensor position</td>
<td>Rebates:</td>
</tr>
<tr>
<td></td>
<td>• $15 – Rocky Mtn Power</td>
</tr>
<tr>
<td></td>
<td>• $10 – Idaho Power</td>
</tr>
<tr>
<td><strong>Load Sensor</strong></td>
<td></td>
</tr>
<tr>
<td>Barriers:</td>
<td>Savings:</td>
</tr>
<tr>
<td>• Fails to trigger</td>
<td>• 327 kWh/yr – Univ Study</td>
</tr>
<tr>
<td>• Dependent on PC sleep mode</td>
<td>• 41 - 119 kWh/yr – PG&amp;E</td>
</tr>
<tr>
<td>Solution:</td>
<td>• 30%– Florida Solar Energy Ctr</td>
</tr>
<tr>
<td>• Adjust threshold</td>
<td>Rebates:</td>
</tr>
<tr>
<td></td>
<td>• $20 – NYSERDA</td>
</tr>
<tr>
<td></td>
<td>• $7 – BC Hydro</td>
</tr>
<tr>
<td><strong>Timer Plug Strip</strong></td>
<td></td>
</tr>
<tr>
<td>Barrier:</td>
<td>Rebate:</td>
</tr>
<tr>
<td>• Savings depend on time setting</td>
<td>• $7 – BC Hydro</td>
</tr>
<tr>
<td>Solution:</td>
<td></td>
</tr>
<tr>
<td>• Consumer education</td>
<td></td>
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</table>
Are you ready for a Colorado Extreme Office Makeover?
Retro-Commissioning Commercial HVAC Rooftop Units
Rooftop unit problems

- Sensors: 27%
- Thermostat: 58%
- Air Flow: 42%
- Economizer: 64%
- Refrigerant Circuit: 46%

% of units tested with problem

Performance Tested HVAC Pilot

1. Estimate energy savings
2. Retro-commissioning
3. Verify savings estimates
Performance Tested HVAC

Standardized service protocols:

1. Airflow
2. Refrigerant system
3. Economizer
4. Thermostat

Ensure energy savings:

1. Training
2. Quality control
3. Data-logging
Performance Tested HVAC tools

TrueFlow plate

Service assistant
Performance Tested HVAC M&V

• Install data-logging equipment two weeks prior to service
• Remove data-logging equipment two weeks after service
• Analyze savings
Performance Tested HVAC Rooftop Units

• Operational, packaged rooftop units

• Must be over three tons with an economizer

• Operate over 40 hours per week
Performance Tested HVAC Results

- Data for 165 RTUs
- Working group
- Over 300 RTUs
The Future of Performance Tested HVAC

- Data analysis
- Economizer training
- HVAC Trade Allies
- Premium Ventilation
- Deemed savings estimates
Comments?
Questions?