Section V- Plug Loads

a.) Summary:
Plug loads are becoming increasingly important as data centers continue to arise across the country. In many office settings, rising energy costs can also be attributed to computer usage. Therefore, it is important to learn about practices and equipment that can decrease the level of these loads.

- Server rooms
  - Server Virtualization
  - Thin Client
  - Economizers
- Computer power management
- General Plug Loads
  - Smart Strips
  - Heaters
  - Fans
- Vending Occupancy Controls
- Process:
  - Equipment efficiency
  - Equipment interaction (i.e. reclaim heat)
- ENERGY STAR equipment

b.) Technical Information:

Server rooms:
Servers generally consume large amounts of energy, but there are several methods for reducing these loads.

- Server Virtualization:
  “Server virtualization offers a way to consolidate servers by allowing you to run multiple different workloads on one physical host server. A “virtual server” is a software implementation that executes programs like a real server. Multiple virtual servers can work simultaneously on one physical host server. Therefore, instead of operating many servers at low utilization, virtualization combines the processing power onto fewer servers that operate at higher total utilization.”
  (http://www.energystar.gov/index.cfm?c=power_mgt.datacenter_efficiency_virtualization)
• **Thin Client:**
Thin clients are computers that are powered independently, but rely on a remote server connection to operate.

• **Economizers:**
Since data centers require constant cooling, air-side economizer may be a good option even in hot climates, where they can take advantage of cooler air temperatures. According to Energy Star, the first data center to earn their label acquired a large portion of their operational savings through air-side economizers. These systems provide cool air to equipment from the outdoors.

**Computer power management (CPM):**
CPM is a relatively simple method that can be easily implemented. Both the central processing unit and the monitor can be set to sleep or hibernation when not in use. Many computers are powered up daily without any standby settings. Enabling screensavers that display images is a common misconception that does not actually save energy. By taking advantage of existing energy management options (features already built into a computer’s operating system), buildings can save a considerable amount of energy. According to Energy Star, libraries can save up to $50 per computer annually by implementing CPM. SEDAC recommends setting computers to enter sleep or hibernation mode after 20 minutes of inactivity; monitors should be set to sleep or hibernate after 5 to 20 minutes of inactivity.

**Table 1: Energy Star PC Energy Consumption**

<table>
<thead>
<tr>
<th>PC Operating Mode</th>
<th>ENERGY STAR-qualified</th>
<th>Standard machines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Monitor (W)</td>
<td>25</td>
<td>32</td>
</tr>
<tr>
<td>Sleeping Monitor (W)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Active Desktop (W)</td>
<td>46</td>
<td>69</td>
</tr>
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<td>Sleeping Desktop (W)</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Active Notebook (W)</td>
<td>14</td>
<td>21</td>
</tr>
<tr>
<td>Sleeping Notebook (W)</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>
“Smart” Power Strips:
ENERGY STAR provides “smart” power strips that can reduce plug loads from various equipment in offices. These power strips prevent vampire loads, which occur when equipment is turned off but continues to consume energy, as it remains plugged in. The following “smart” power strips are available through Energy Star:

- **Timer-equipped**: include outlets controlled by programmable timers. Devices plugged into these strips can be set to automatically turn off and on at specific times.
- **Occupancy-sensing**: include outlets controlled by a motion detector. Devices plugged into these strips turn off and on by responding to physical presence.
- **Current-sensing**: These strips can automatically turn several outlets off or on when they detect that a monitor (plugged into the “master outlet”) enters a low-powered sleep mode, or is turned off/on. ([https://www.energystar.gov/index.cfm?c=power_mgt.pr_power_mgt_more_tips](https://www.energystar.gov/index.cfm?c=power_mgt.pr_power_mgt_more_tips))

Vending Occupancy Controls:
Vending controls can greatly decrease unnecessary run time and plug loads of vending machines. These controls manage power consumption by monitoring both occupancy levels in the space around the vending machine and ambient temperature changes. The vending controls maintain cool product temperatures and reduce lighting that generates heat. It also regulates compressor cycles to run only when necessary. Energy Star claims their product is 50% more efficient than the standard model: [www.energystar.gov/indix.cfm?fuseaction=find_a_productshowProductGroup&pgw_code=VMC](www.energystar.gov/indix.cfm?fuseaction=find_a_productshowProductGroup&pgw_code=VMC)
c.) **Case Study: New School with District Data Center**

This building houses all the servers for the district, so the heat pump system allows the heat of the servers to offset the geothermal field in the winter. They use ENERGY STAR equipment, and they have thin client computers, which greatly increases their efficiency over traditional individual computers. They utilize computer power management, eliminating screen savers and setting computers to sleep mode when they are not being used.

To minimize the use of the elevator, very inviting stairwells were designed. They have also taken advantage of vending energy management, which turns off the lights in vending machines while still cycling the compressor to keep beverages cold.