Plug Loads in Commercial Buildings

Andrew deCoriolis
Director of Engagement
What are plug loads?

**Behavioral**
- Adapter
- Lamp
- Printer
- Coffee maker
- Lava lamp
- World map

**Institutional**
- Copy machine
- Water cooler
- Server
- Monitor stand
- Elevator
Plug load research overview

- 8 office buildings
- 3 LEED certified
- 15,000 - 500,000 ft$^2$
- SF Bay Area, San Diego, Atlanta, Honolulu, Boulder, Reston
Plug Loads Research Results
Plug loads as a percent of total electricity use

- CEUS 2006
- CBECS 2003
- 50k sf floors
- 23k sf low-rise
- 24k sf low-rise
- 24k sf low-rise
- 500k sf tower
- 15k sf floors
SF office electricity demand (one week)
Results:  Electricity savings by period of day

![Bar chart showing electricity savings by period of day](chart.png)

- **All times**: 
  - Baseline week: 40 kW
  - Competition: 30 kW
  - Reduction: -10.0%

- **Off-peak (wknd + 8p-9a week)**: 
  - Baseline week: 20 kW
  - Competition: 25 kW
  - Reduction: -17.4%

- **Peak (9a-8p week)**: 
  - Baseline week: 60 kW
  - Competition: 60 kW
  - Reduction: -0.9%
Small Power Density

Our office –

Peak Plug loads 18kW
40,000 sqft
= 0.45 w/sqft

Our clients –

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<tbody>
<tr>
<td>General Offices - Enclosed</td>
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<td>General Offices – Open</td>
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<td>Copy Rooms</td>
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Small Power to the People

Which plug loads can we affect?
• Computers
• Monitors
• Phone chargers
• Personal hard drives
• Conference rooms
• Local AC equipment (Eek)

Which plug loads can we **NOT** affect?
• Central copy services
• Kitchen equipment
• Servers and IT
234 occupants

End Use

12:00 AM – 2:52 PM

- SERVER PLUGS: 10 kW
- 6TH FLOOR LIGHTING: 9.6 kW
- 7TH FLOOR HVAC: 8.5 kW
- 6TH FLOOR EAST PLUGS: 6.2 kW
- 7TH FLOOR WEST: 5.9 kW

Floors

12:00 AM – 2:52 PM

- 7TH FLOOR: 24 kW
- 6TH FLOOR: 24 kW
- PLUGS: 21 kW
- LIGHTING: 15 kW
- SERVER ROOM: 15 kW

Kilowatt-hours so far: 767 kW

89 Kilowatts

Total San Francisco Office (kW)
Arup Energy Reduction Competition #1

Nov 15 (Pacific)  Finished  Nov 22 (Pacific)

**ELECTRICITY**

**REAL-TIME**

**FLOOR 7 EAST (PLUGS)**  **COMPETITION**

18.7% reduction

1st

**FLOOR 7 WEST (PLUGS)**  **COMPETITION**

12.5%

2nd

**FLOOR 6 EAST (PLUGS)**  **COMPETITION**

1.8%

3rd

**FLOOR 6 WEST (PLUGS)**  **COMPETITION**

0.9%

4th

Overall percent reduction

Google Confidential and Proprietary
Energy Reduction Competition #1
Plug Loads at Four Quadrants: 6W, 6E, 7W, 7E

Arup SF office is organizing a "plug loads" energy reduction competition. This competition will engage us with the new interactive energy dashboard and help us explore its potential for electricity savings. The competition starts Monday November 15th and ends Monday November 22nd. Your energy usage will be compared to historical usage of late September and all of October.

So... How do you win?

1. Find out what quadrant you’re on.
2. Use less juice!
3. Check the Energy Dashboard frequently to see where your team stands.

Yes, there IS a prize!

Contact Bhing Ayyz, Krunal Ashiya, Sargis Alamsahn or Derek Kim regarding any questions about the dashboard or the competition. Brought to you by OvaGreen, Energy and Resources, ICT, Facilities and IT teams, and more.
Andrew DeCoriolis
Director of Engagement
304 12th Street, Suite 3C
Oakland, California 94607

andrew@luciddg.com