

PIER Funded Research in Consumer and Office Electronics

A Planning Workshop for a Plug Load
Energy Efficiency Research Center
UC Irvine

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Agenda

- Energy Commission and PIER
- How to Define Plug Loads
- Example Plug Loads
- Why Do Research – Plug Load Energy is Growing
- Research Focus to Date
- Examples of our Past Research and Outcomes
- PIER Feeds Title 20 Standards Process
- Vision for the Future

Energy Commission & Its Functions

Energy policy and information
advisor to the California
Governor and Legislature

- Major functions:

- License power plants
- Assess current and future energy trends
- Advance energy technologies
- Promote energy efficiency and renewable energy
- Administer building & appliance efficiency Standards
- Support public interest energy research to advance science and technology



What is the Public Interest Energy Research Program (PIER)?

- Initiated in 1998 as a part of California electricity deregulation, approximately \$62M/Yr
- Research areas: energy efficiency, demand response, renewable energy, transmission and distribution, climate and environment and transportation
- Natural Gas funding added in 2004, approximately \$24M/Yr
- Conduct public interest energy research to improve the quality of life...by providing environmentally sound, safe, reliable and affordable energy services and products
 - Develop and bring to market technologies
 - Research not addressed by the competitive or regulated markets



Note the dramatic size difference between the inefficient power supply on the left and the switch-mode power supply on the right

PIER Buildings Program

Goals and Outcomes

- More affordable, comfortable, energy efficient buildings from improved designs, construction methods, and operational strategies
- More reliable electricity systems through lowered peak demand
- Healthier, energy efficient indoor environments
- Improved customer choices for affordable, energy efficient technologies

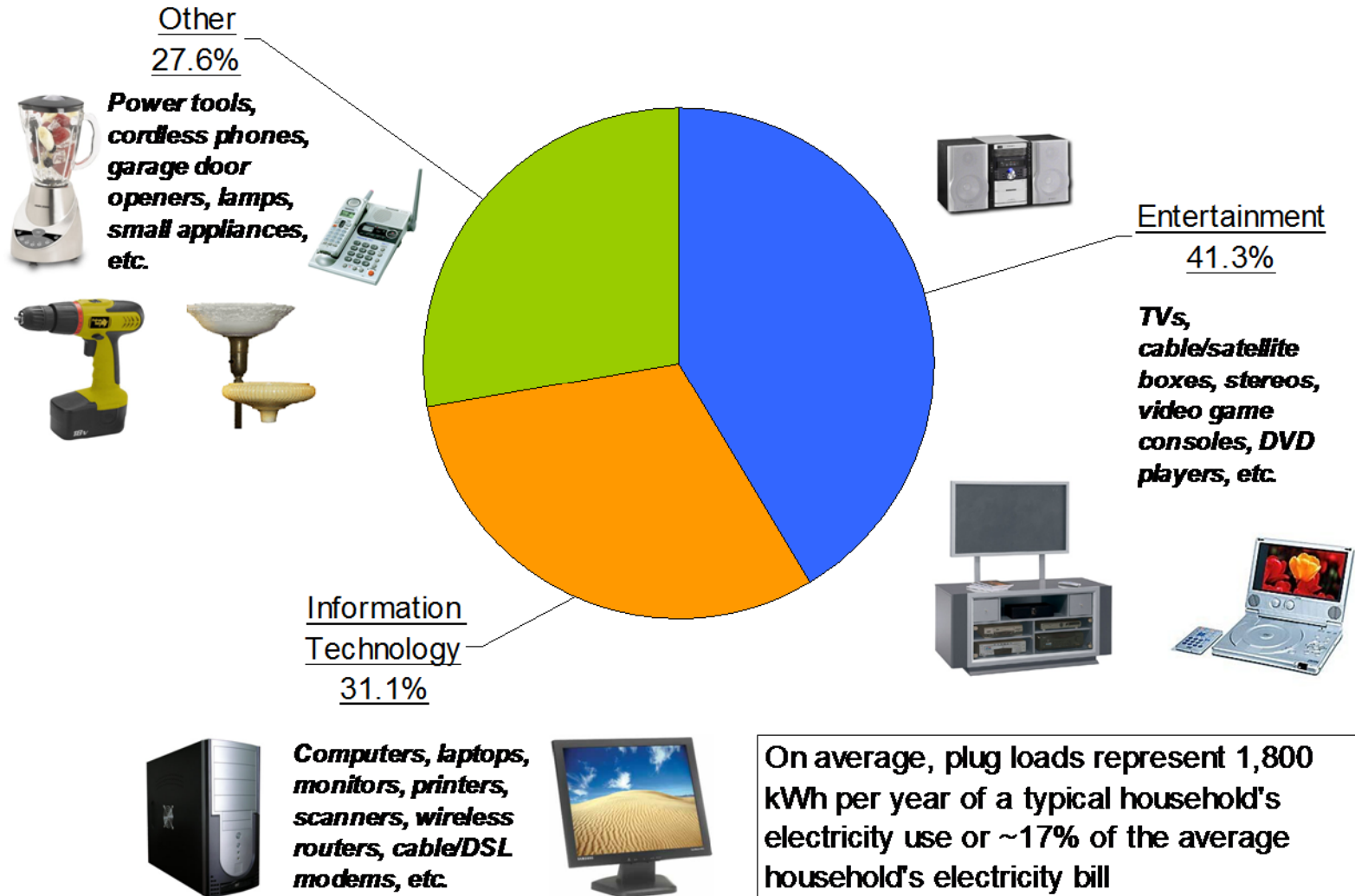
PIER Buildings Program *Scope*

- Primarily focuses on shorter term, applied research in new and existing buildings
- End uses include lighting, HVAC, building envelopes, water heating, appliances, consumer and office electronics and building networks
- Research products include design information/specifications, technologies (hardware), software, data, controls, and others
- Covers the entire building life cycle from component development/design, construction, commissioning, operation

How Do We Define “Plug Loads” and How Much Energy Do They Use?

- Plug loads are devices that plug into electrical outlets (as opposed to being hard-wired)
- They do not fall into other traditional end-use categories (appliances, lighting, HVAC, etc.)
- Can be residential or commercial
- Contain internal or external ac-dc power supplies, some or all of their energy is used in the form of low voltage dc
- Can have digital displays/timers, remote and/or soft touch controls, rechargeable batteries, etc.
- Annual energy use estimates vary: ~15 to 20% of residential and ~10 to 15% of commercial electricity use
- 3 to 4 billion individual devices accounting for about 10% of total U.S. electricity use

Average Share of Residential Plug Load Energy Use by Product Category



On average, plug loads represent 1,800 kWh per year of a typical household's electricity use or ~17% of the average household's electricity bill

John is your typical metropolitan, young, cash-rich, technophile with a penchant for gadgets, music and the latest in technological innovation. He has no idea or care for the size of his energy bills and feels life is too short to 'turn things off'!



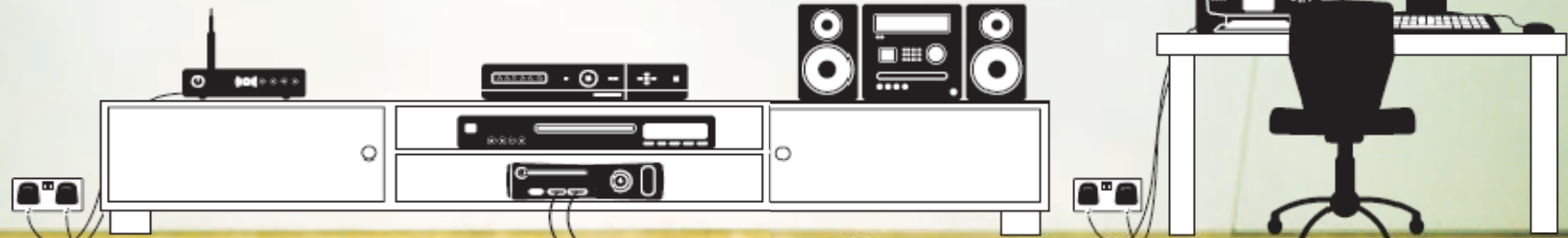
John the technophile

- Xbox
- 42" plasma TV
- 14" CRT in bedroom
- Sky +
- 2 Mobile phones - work and personal
- iPod
- DVD Home Theatre
- WCR
- Digital radio (kitchen and bedroom)
- Personal organiser
- PC & Monitor

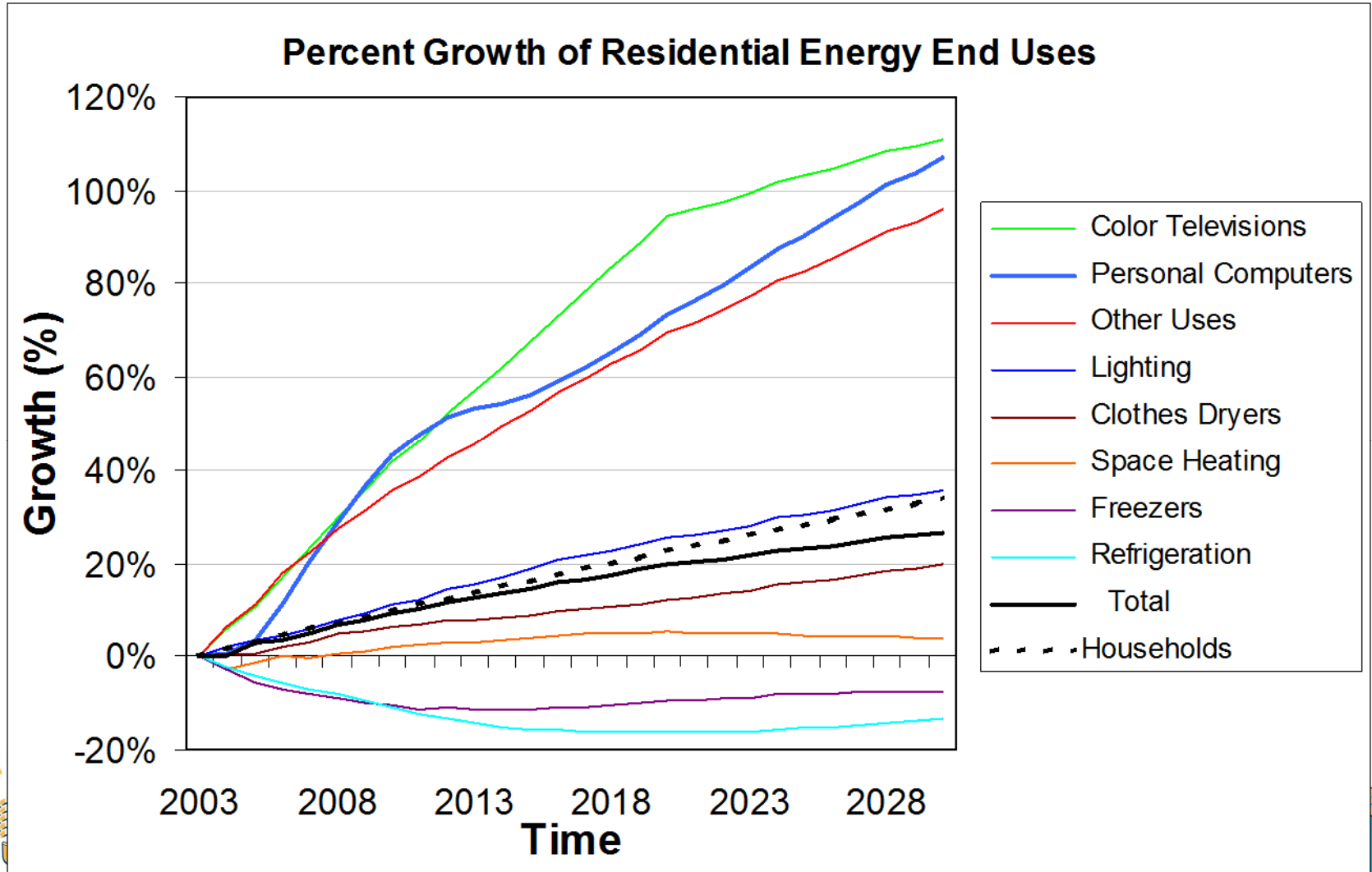
Annual Cost

- £14
- £86.50
- £2
- £16.50
- £1
- £0.50
- £8
- £11
- £9
- £0.50
- £20.50

- Laptop
- Printer
- Fax/Scanner (MFD)
- Broadband router
- PC Speakers
- Total annual running cost: £219**



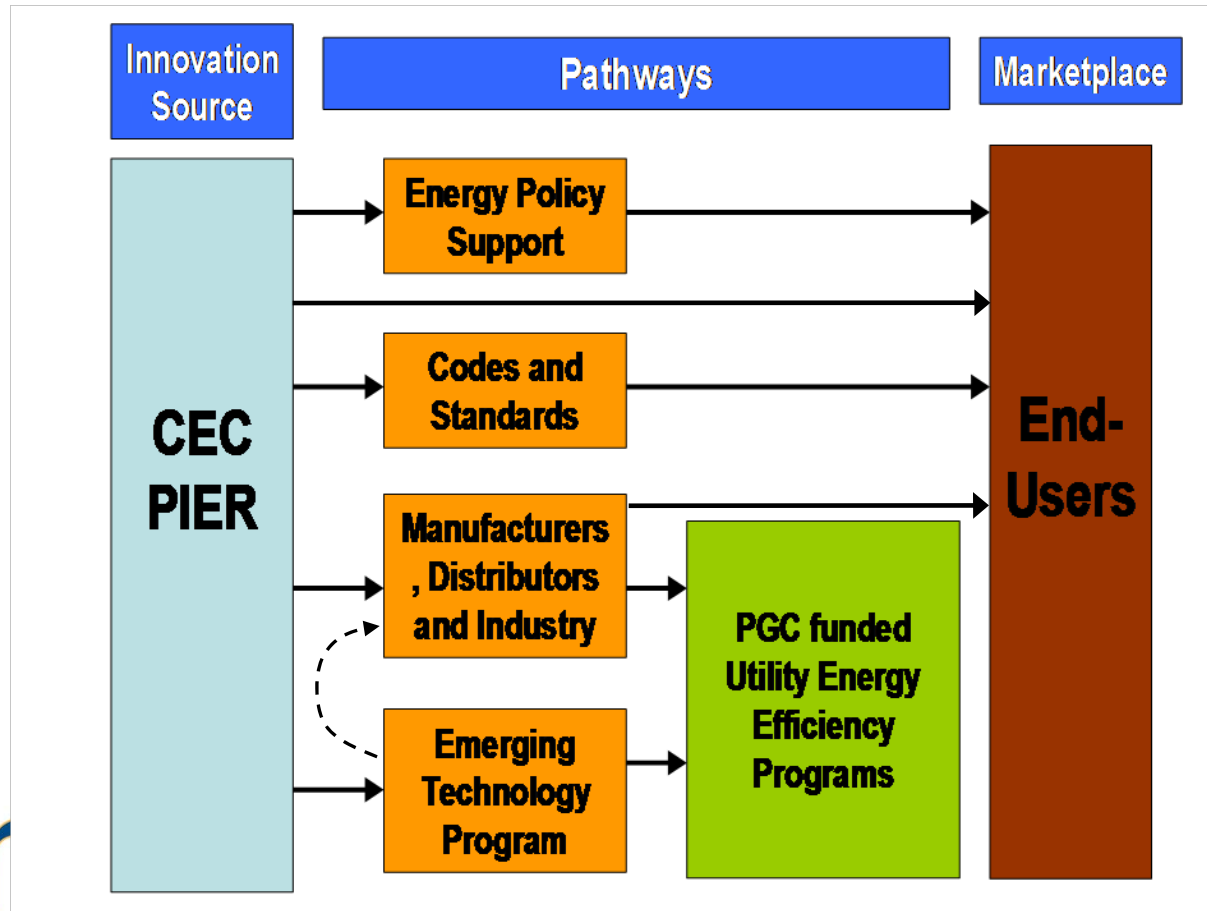
The "Other" Category of Household Energy Use (Plug Loads) Is Growing the Fastest – Estimated to be 29% of Usage in 2030



Funding for Plug Load Research

- ~\$4.5 Million spent to date
 - \$2.3 million in active power research
 - \$2.1 million in low power mode and building networks research
- A new contract for an additional \$2 Million is pending

Multiple market pathways for products developed through RD&D

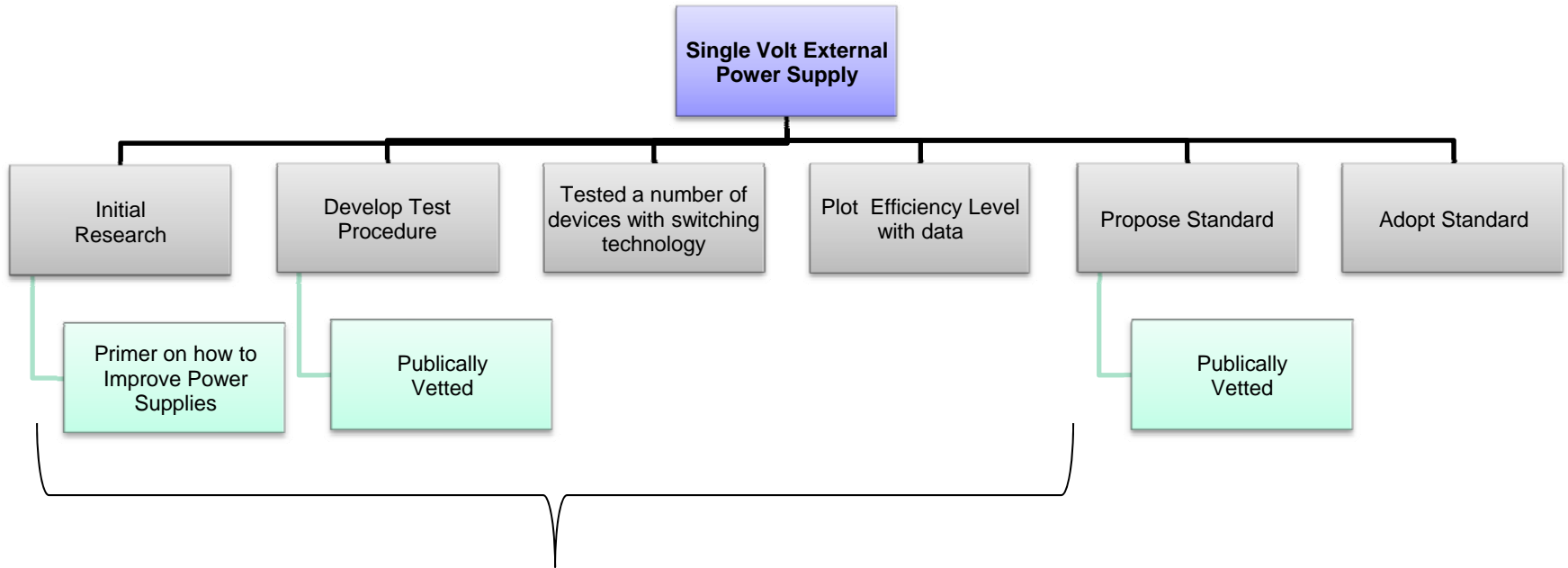


Research Process for Plug Loads

- Research largely based on census of consumer and office electronic products across a broad spectrum
- Census reflects the typical duty cycle and volume of devices – how much total energy is used. How much power and for how many hours per day
- Program targets the highest energy using devices
- Program also targets low power mode and building networks
- Program, in some cases, develops a new, well-vetted test procedure to evaluate product types and develop a Title 20 appliance standard
- Program develops and evaluates data to support Title 20 appliance standards

Title 20 Standard Process

Example: External Single Volt Power Supply



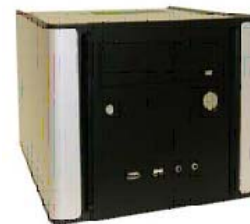
PIER Feeds T20 Standards

Examples of Past Research and Outcomes

- External Single Volt Power Supply Test Procedure
- External Single Volt Power Supply Title 20 Standard
- Influenced a revised Energy Star specification for computers that included power factor correction
- Battery Charger Test Procedure
- Battery Charger Title 20 Standards under consideration
- PIER built a low and ultra low energy computers – these computers stimulated manufactures to build computers that use less energy
- Influenced TV Title 20 Standard Test Procedure
- TV Title 20 Standard
- Largely Influenced Energy Efficiency Ethernet IEEE 802.3AZ
- Influencing work on a protocol to communicate with an external proxy

New Energy Efficient Computer Designs Drive Industry Towards More Efficient Models

- PIER developed efficient computer prototypes and demonstrated cost-effective, market ready efficiency opportunities that greatly exceed ENERGY STAR requirements
- The market has made dramatic advances since we completed our research because this project demonstrated what was possible with commercially available components



Office Plug Load Field Study and Smart Plug Strips



California Pioneers Office Plug Load Field Research Study

- 47 offices with inventory of all plug load devices
- Plug load meters on a subset of devices in 25 offices
- Inventoried nearly 7,000 plug load devices and collected meter data from 470 plug loads
- Computers and monitors accounted for the largest share of energy in the office plug loads study—66 percent
- Estimated that California's office plug loads consume more than 3,000 GWh annually, costing business owners over \$400 million/year



Smart Plug Strips

Modeling findings showed potential savings of between 80 and 115 kWh per year in a home entertainment center, and approximately 40 kWh per year in a standard home office. This study produced some of the first product testing results and savings estimates for smart plug strips.

Planned Future Research

- Set Top Boxes – use significant energy when “off”
- Computer and Other Displays – displays consume about 20% of plug loads in California businesses
- Low-end kiosks and point-of-sale terminals
- High-end gaming systems – energy use associated with graphics
- Develop home audio test procedures
- Power Factor: How much savings can be achieved by Power Factor Correction (for electronics) in buildings

Vision for the Future

- All external and internal power supplies are highly efficient and properly sized
- All electronic devices scale power use closely with work load
- Improved smart plug strips control legacy loads
- One highly efficient computer remains on continuously (low idle power) to download and display content, monitor status of other devices, and control them
- Separate set top boxes, DVRs, DVD recorders, game consoles, and video players mostly displaced by simpler, highly capable computers
- To address the growing energy use of Plug Loads, establish a research center dedicated to long term collaboration with market stakeholders that would develop and demonstrate energy efficient electronic technologies and appliances and improve public education