PIER Funded Research in Consumer and Office Electronics

CalPlug Set-Top Box Workshop

UC Irvine

2/1/2012

Bradley Meister and Ken Rider (Title 20)
Energy Efficiency Research Office
Energy Research and Development Division
bmeister@energy.state.ca.gov/916-327-1722

PUBLIC INTEREST ENERGY RESEARCH
"Research Powers the Future"

Agenda

- Energy Commission and PIER
- Funding, Past Research and Future Research
- How to Define Plug Loads
- Why Do Research – Plug Load Energy is Growing
- Cal Plug and First Work Authorization
- Vision for the Future
- Title 20 Briefing

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

PUBLIC INTEREST ENERGY RESEARCH
"Research Powers the Future"

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, industrial, agricultural and water, 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

PUBLIC INTEREST ENERGY RESEARCH
"Research Powers the Future"

STATE OF CALIFORNIA
ENERGY COMMISSION

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

Funding for Plug Load Research

- ~$7.4 Million spent to date
  - $5.3 million in active power research
  - $2.1 million in low power mode and building networks research

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 Standard
- 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

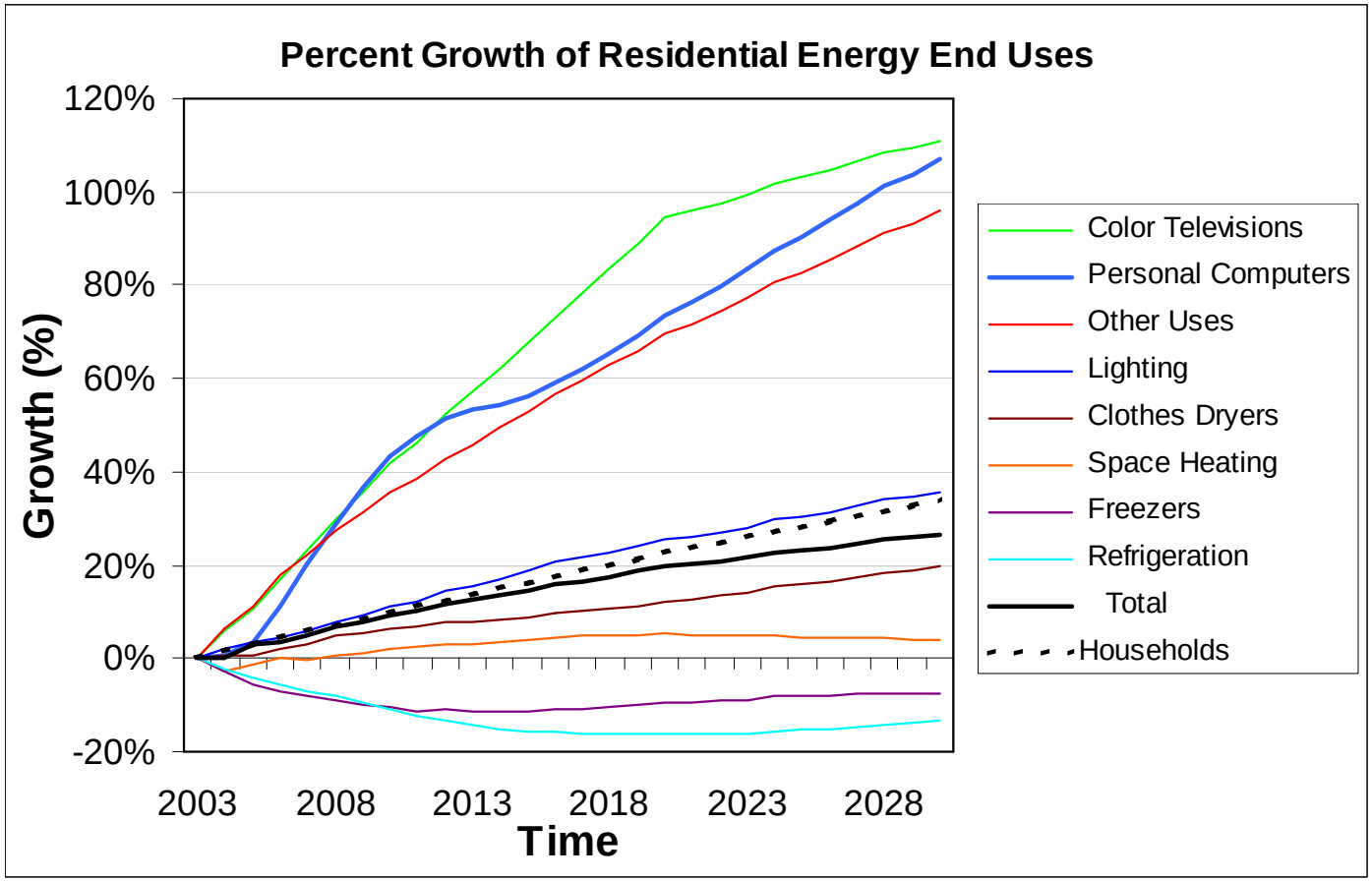
Planned Future Research

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

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

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



PUBLIC INTEREST ENERGY RESEARCH
"Research Powers the Future"

STATE OF CALIFORNIA ENERGY COMMISSION

How much energy do Set Top Boxes Use?

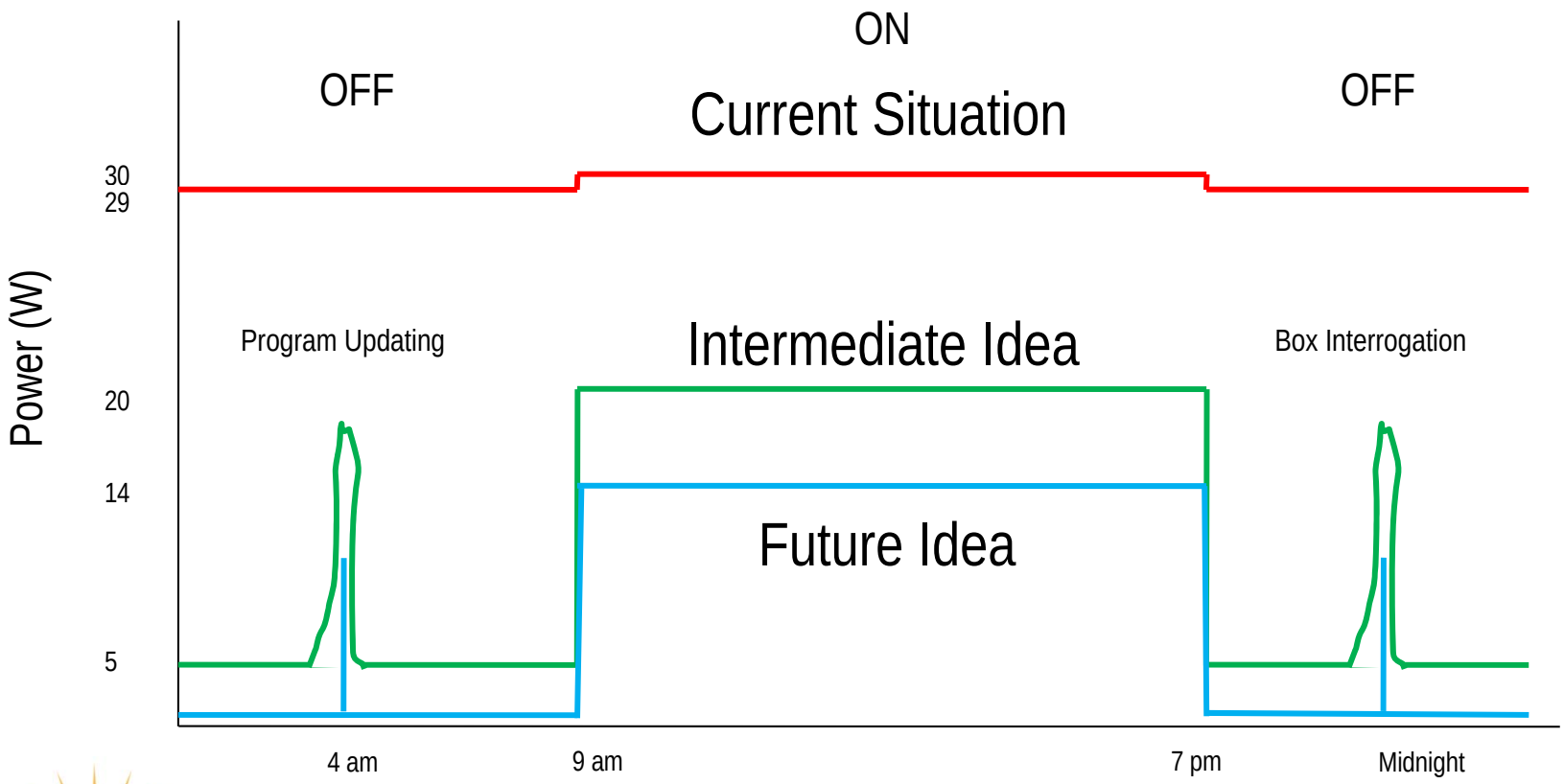
- STBs can use more energy than a new refrigerator
- More than 160 million set-top boxes currently deployed in the United States.
- In 2010, these set-top boxes ate up nearly 27 billion kilowatt-hours of electricity, or 168 kilowatt-hours per set-top device.
- The electricity required to operate all U.S. boxes is equal to the annual household electricity consumption of the entire state of Maryland, costing consumers more than $3 billion annually.
- Two thirds of the power is consumed when boxes are “off”

Source: NRDC

UCI Plug Load Center

- The California Energy Commission awarded the UC Irvine division of the California Institute for Telecommunications and Information Technology $1 million in 2011
- Provide research on plug-load devices, including creating more energy efficient plug load devices and providing data to support future Title 20 Appliance Efficiency Standards.
- First Work Authorization will be to support Set Top Box Research. Likely scope of work will be to complete the following:
  - Test and limited tear down of a variety of STBs
  - Determine ways to reduce “On” power
  - Investigate Light Sleep options. Determine how to get “off” power less than 5 watts with instant recovery

Conceptual Roadmap



PUBLIC INTEREST ENERGY RESEARCH
"Research Powers the Future"

Vision for the Future

1. **Convert** power efficiently (power supply)
2. **Store and retrieve** energy efficiently (battery charging)
3. **Scale** power consumption to the level of service provided
4. **Auto-power down** automatically when not in use
5. Be shipped with power-saving features **enabled by default**
6. Clearly **communicate** operating state to users and network
7. Bear clear, comparative energy use and efficiency **label**

Product Efficiency Standards

- Voluntary standards: ENERGY STAR
  - Version 3.0 effective since September 2011
  - Version 4.0 effective July 2013
- Mandatory standards: U.S. Department of Energy
  - Request for Information (RFI) released December 2011.

Energy Commission and Set Top Box Standards

- First received proposal for STB regulation in January of 2008
- Updated proposal for STB regulations submitted September 2011
  - Consume approximately 4,000 GWh/yr
  - Saving opportunity of 3,000 GWh/yr

Scoping Workshop

- August 31, 2011 the Commission held a workshop to discuss potential future product energy efficiency standards
- Set top boxes were identified by the Investor Owned Utilities (IOUs) and NRDC as a significant opportunity
- Workshop included participation by STB industry

Next Steps

- Staff will draft an order instituting rulemaking (OIR) which will include a list of products for consideration in standards development
- The OIR will then be considered for adoption through a Commission business meeting