California Plug Load Research Center

ETCC Quarterly Public Meeting

December 05, 2012




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California Plug Load Research Center

California Institute for Telecommunications and Information Technology, Irvine

Creating Connections. Powering Innovation

EMERGING TECHNOLOGIES COORDINATING COUNCIL

CalPlug

California Plug Load Research Center

Outline

- CalPlug overview
- Milestones 2011-2012
- CalPlug Applied Research
  - Efficient STB solution
  - PC power savings modes
  - Consumer outreach
- Future plans

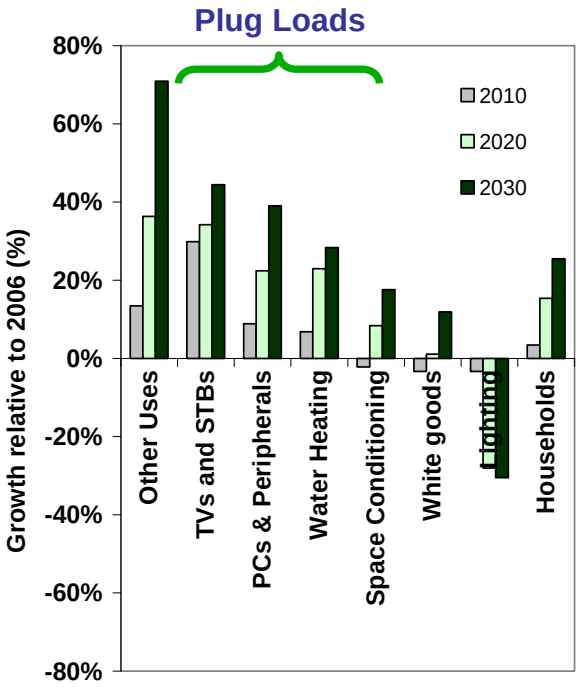
CalPlug Overview

- **Calit2 Irvine**
  - Multidisciplinary research center
  - 100+ industry partners
  - 200+ UCI faculty and researchers

- **CalPlug**
  - 8000 sqft demo/research facility
  - Fourteen advisory members
  - Core faculty
  - 40+ staff and student researchers

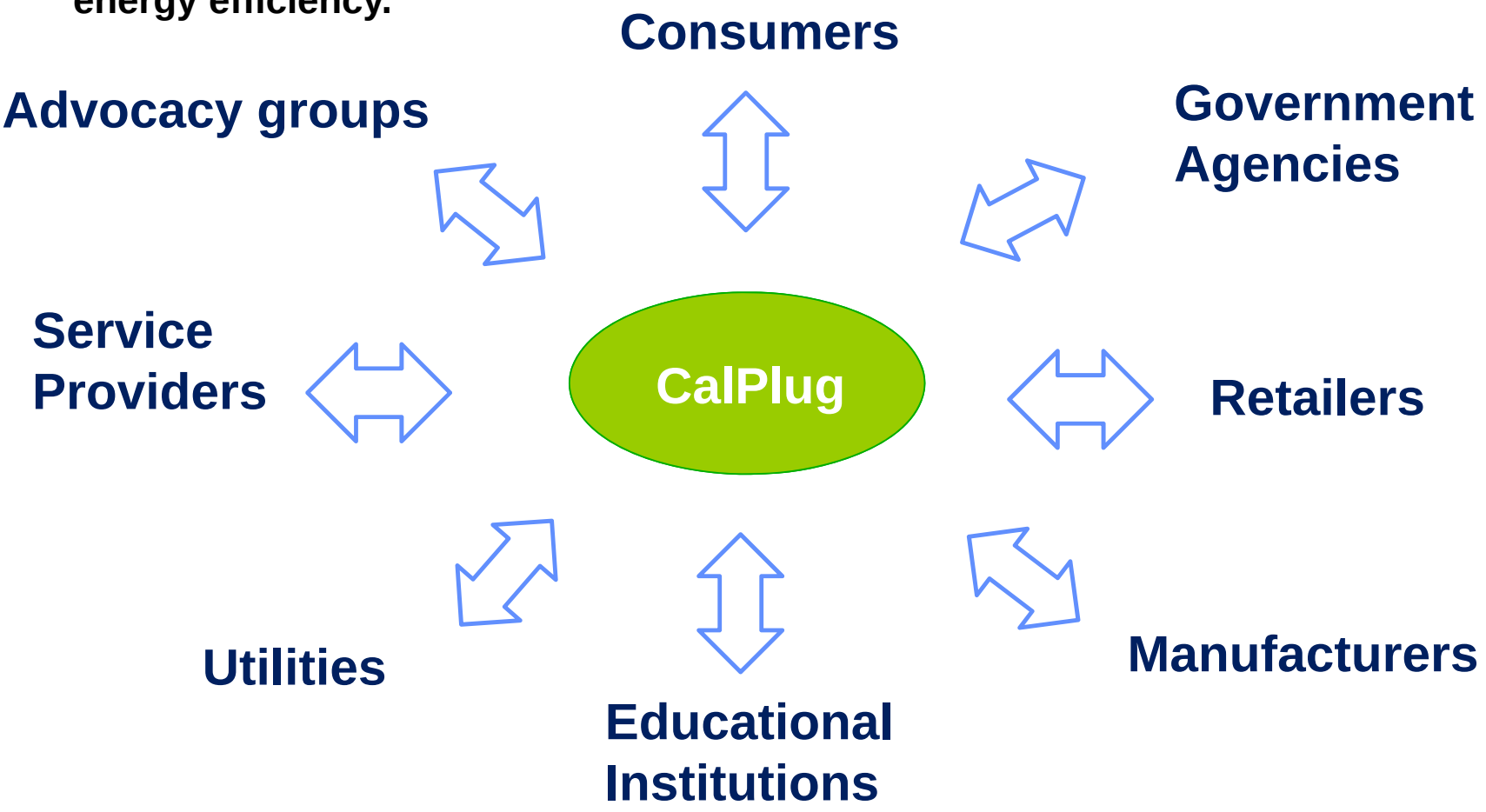
CalPlug Purpose

- **Help California and U.S. improve energy efficiency in appliances and electronic devices**
- **In the residential and commercial sectors**
- **Through research, demonstration, education**
- **About engineering, incentives, codes and standards, and user behavior**



Center Interactions with Key Stakeholders

Neutral playing ground for diverse groups with various challenges and approaches to explore common objectives and goals with the ultimate goal of energy efficiency.



CalPlug Milestones

- July 2011 – Hire first dedicated technical professional
- Aug. 2011 – Press release announces center; website launched
- Sept. 2011 – CalPlug99 student team kickoff (80+ students trained to-date)
- Oct. 2011 – Inaugural Advisory Board meeting
- **Oct. 2011 – CalPlug responded/selected to SCE Technology Test Center alliance for plug load testing.**
- Nov. 2011 – CalPlug Engineering Lab Established
- **Jan. 2012 – CalPlug membership agreement finalized**
- **Feb. 2012 – Industry-wide set-top box workshop held at Calit2**

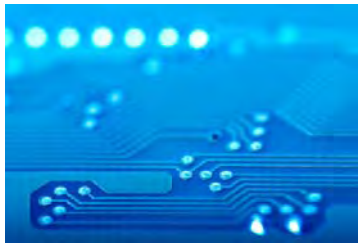
CalPlug Advisory Board 2011-2012

CalPlug Milestones (Cont.)

- **March 2012 – DirecTV joins as first industry member; DirecTV demo setup**
- May 2012 – CalPlug Satellite TV system workshop
- June 2012 – CalPlug RD&D team (Faculty, Staff, Postdoc, Electronics Technician, Ph.D. candidates)
- July 1st 2012 – CalPlug's first conference papers accepted to International Conference of Consumer Electronics (IEEE)
- July 20th 2012 – CEC Commissioner Andrew McAllister visited CalPlug
- **July 24th 2012 – Official date to begin set-top box research for CEC work authorization**
- **August 1st 2012 – CalPlug STB 5W5s roadmap announced**
- **Oct 16th 2012 - Emerging Technology Summit 2012**

CalPlug Applied Research

- **Efficient STB solution**
- **PC power savings modes**
- **Consumer outreach**



Efficient Set-Top Box Solution

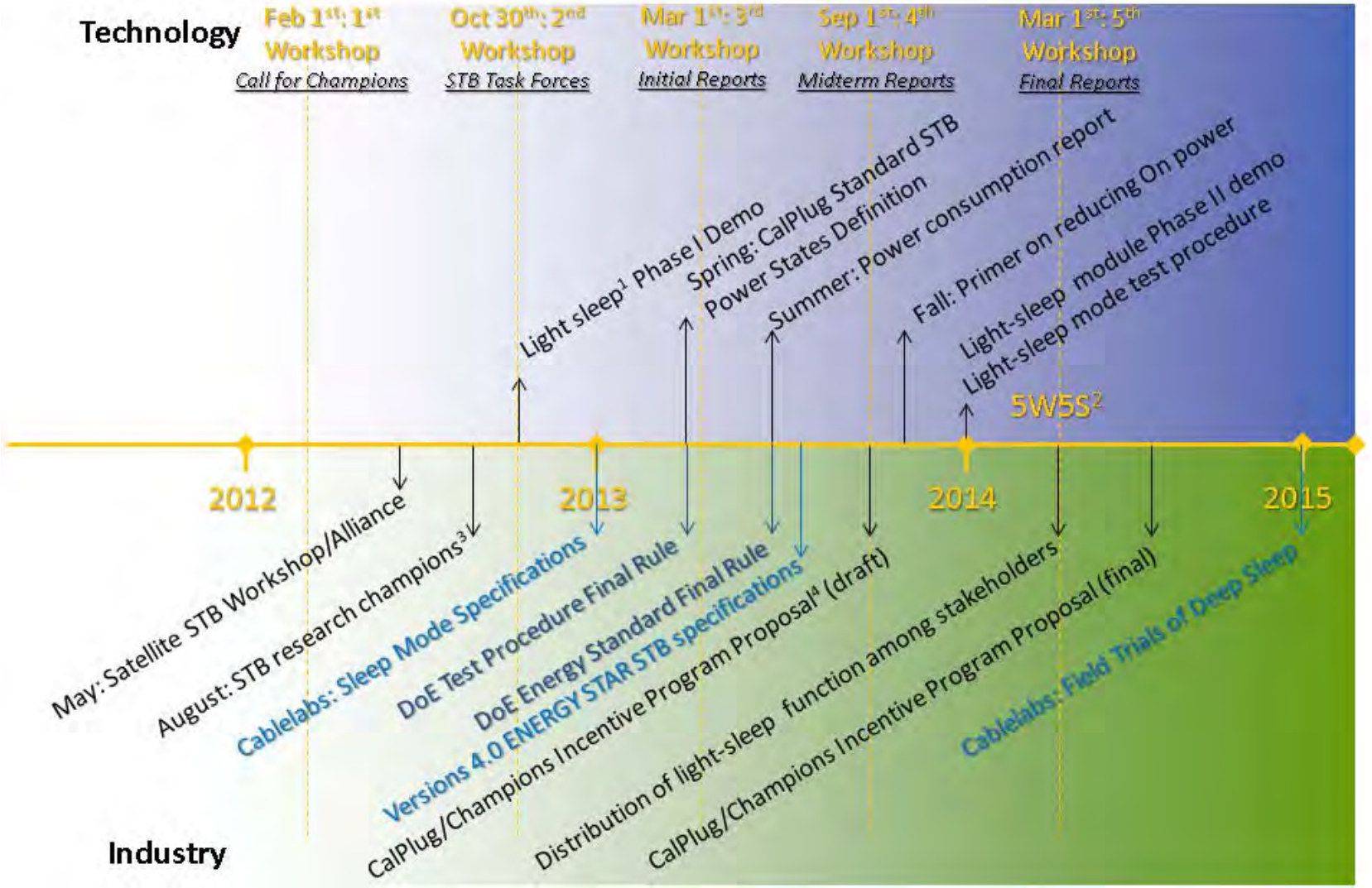
Goal:

To accelerate energy efficiency in STBs (box and network) by innovations in STB hardware and software, codes and standards, and incentives and rebates

Anticipated outcomes:

- **Demonstrate STB energy-saving technology that is feasible to existing and future fleet**
- **An effective working group for strong collaborations among research centers, manufacturers, service/content providers, utilities and government agencies**

CalPlug's 5W5s Roadmap for Efficient STBs



Slide 10

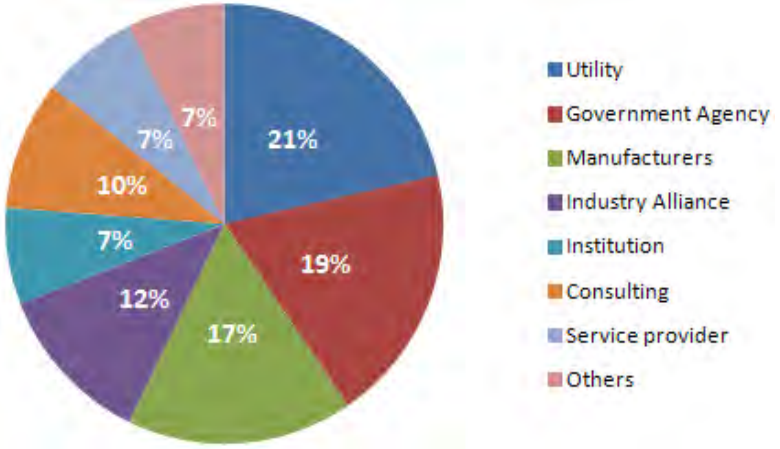
sr14 Remove 'click to add text'
stuross, 10/30/2012

sr15 Should we add the imminent Volujntary Agreement?
stuross, 10/30/2012

sr16 What is or will be the Champions Incentive Proposal? I have heard nothing about it and it hasn't been explained in other slides.
For example:
Why are only our Champions involved?
Why aren't our Champions doing other reports too?
stuross, 10/30/2012

2012 STB Workshop Series

- **Established a collaborative forum for all STB stake-holders to make concerted efforts.**
- **Identified top-priority research areas for STB energy efficiency.**
- **Received wide support from participants and recruited STB research project champions.**
- **Demonstrated research progress and prototypes**



Workshop participants

CalPlug STB Research Focuses

1. **Standard terminologies for STB power modes**

2. **STB power testing and analysis**

3. **Sleep function with fast recovery**

4. **Incentive programs and consumer education**

5. **Beyond STBs: additional functions**

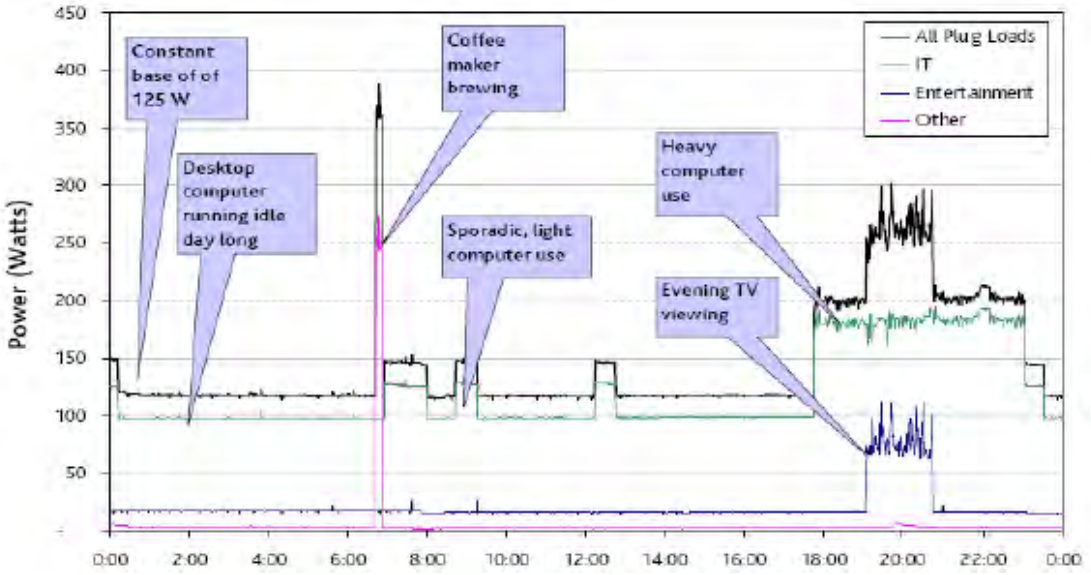
CalPlug STB Project Champions

- **Michael Cook (Comcast), (Beyond STB)**
- **Stephen Dulac (DirecTV), (Energy Efficiency STB)**
- **George Jang (PG&E) , (Incentive program)**
- **Joseph Kuriacose (DirecTV), (Beyond STB)**
- **Gary Langille (Dish Network), (Energy Efficiency STB)**
- **Derek Okada (SCE), (Incentive program)**
- **Kevin Strong (FutureDash), (Beyond STB)**
- **Martin Vu (SCE), (Power testing and evaluation)**
- **Jay Yang (Motorola),**

  (Power mode terminology and testing)

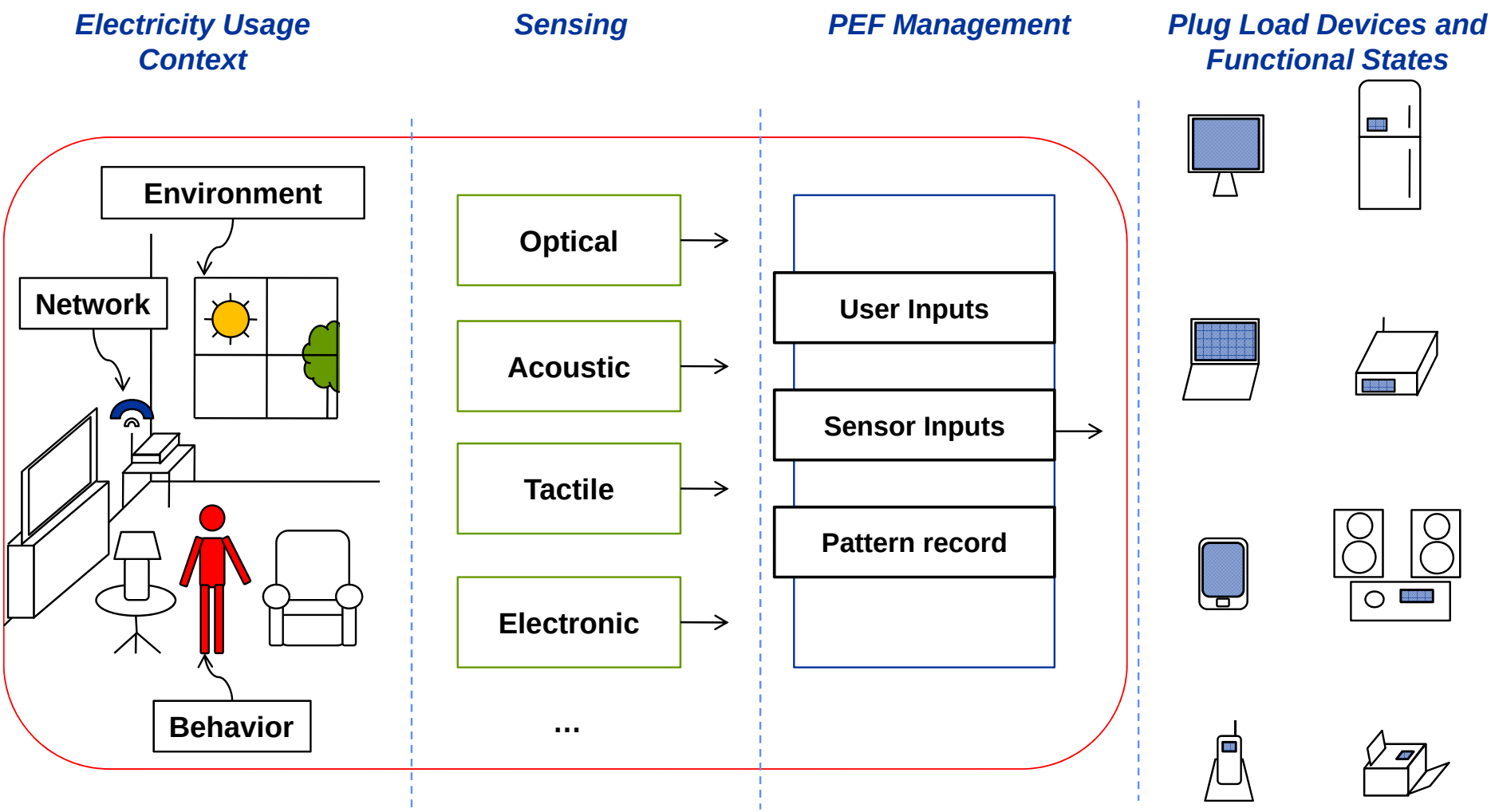
Research Methodology: Energy efficient plug load devices

- **Define efficiency**
- **Duty-cycle, sleep modes, and deemed savings**
- **Personal energy footprint (PEF) management**

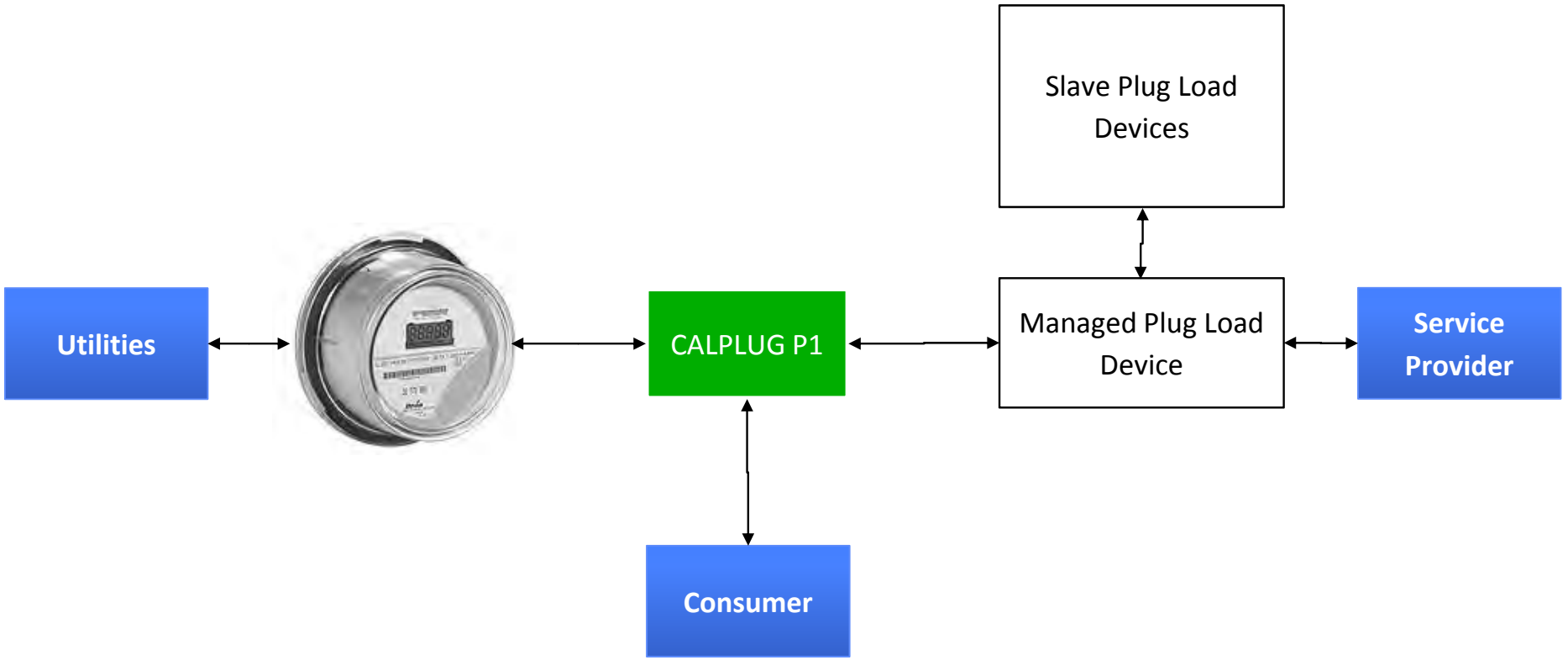


Source: Porter et al. 2006

Personal Energy Footprint Management

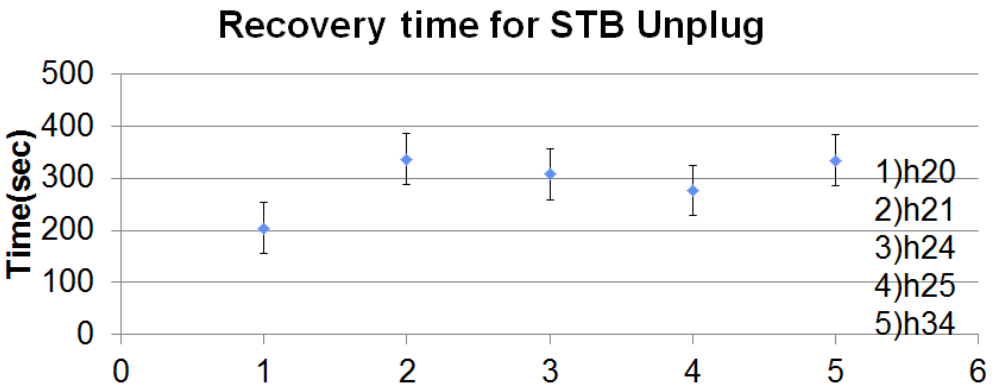


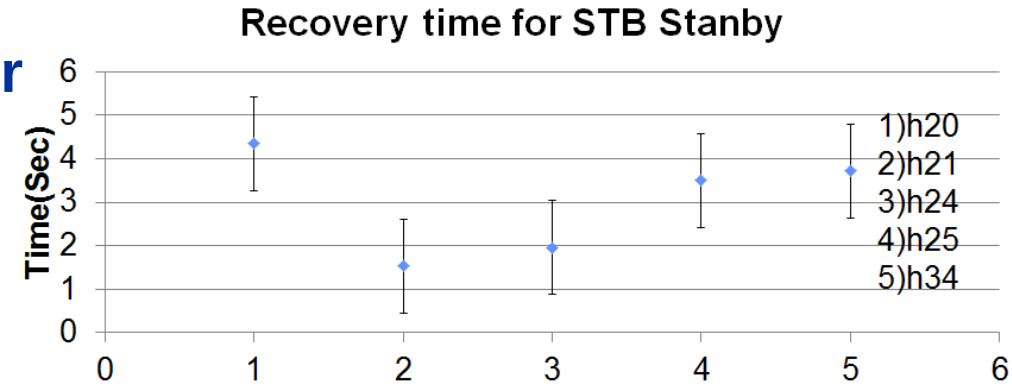
CalPlug STB Phase I solution



Consumer Tradeoffs in Efficiency Designs

- **Efficient, on-demand designs always have tradeoffs in system response time**
- **“Frustration threshold” study**
- **How to reduce consumer perceived “Delay”?**





Slide 17

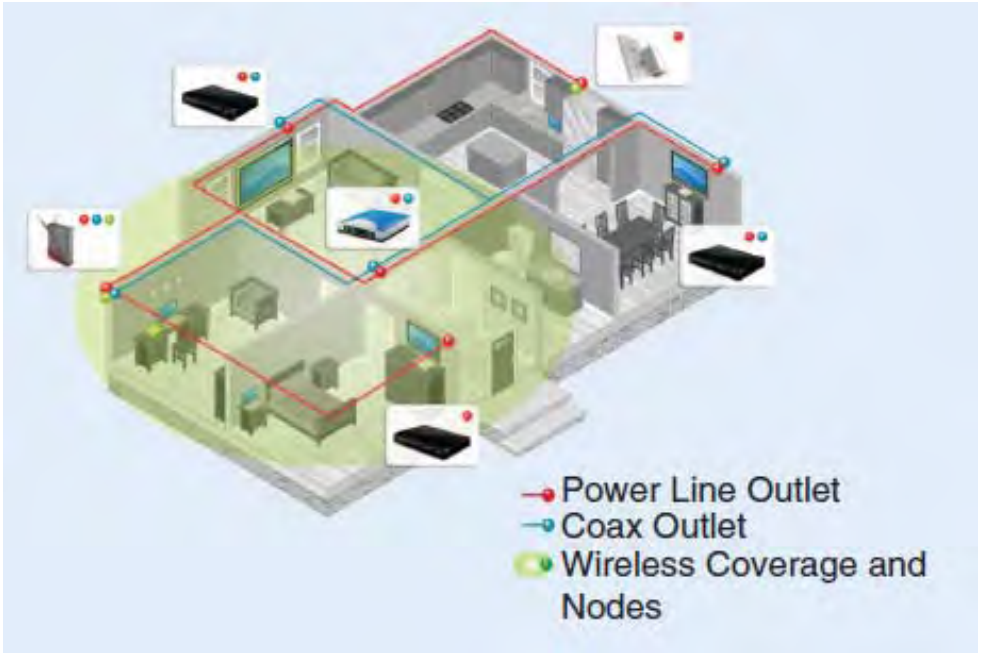
sr12 Skip the photo to expand the charts for readability.

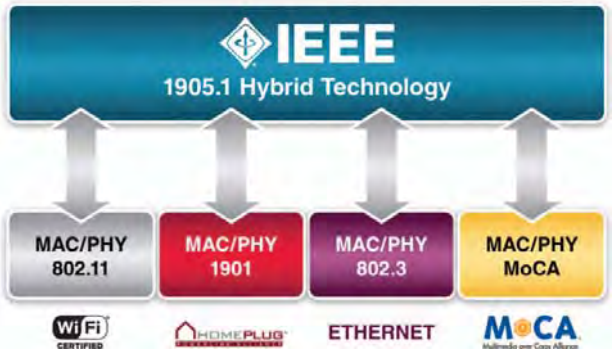
Use left justification
stuross, 10/30/2012

sr13 What are the 'tradeoffs'?
Customer satisfaction vs. energy saved?
stuross, 10/30/2012

STBs and Whole Home Networks

- **STBs are connected devices**
- **Server STB and multiple clients**





Stephen Palm, ICCE Magazine, 2012

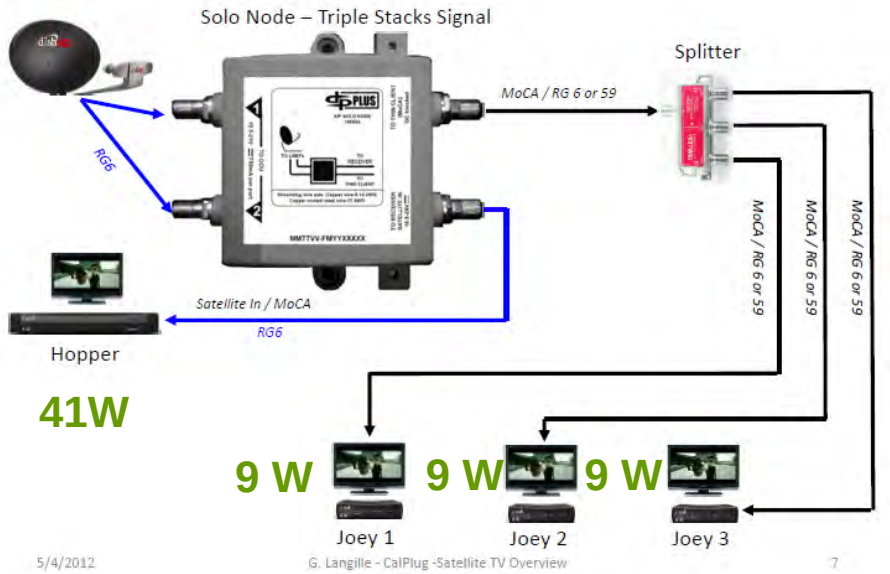
Slide 18

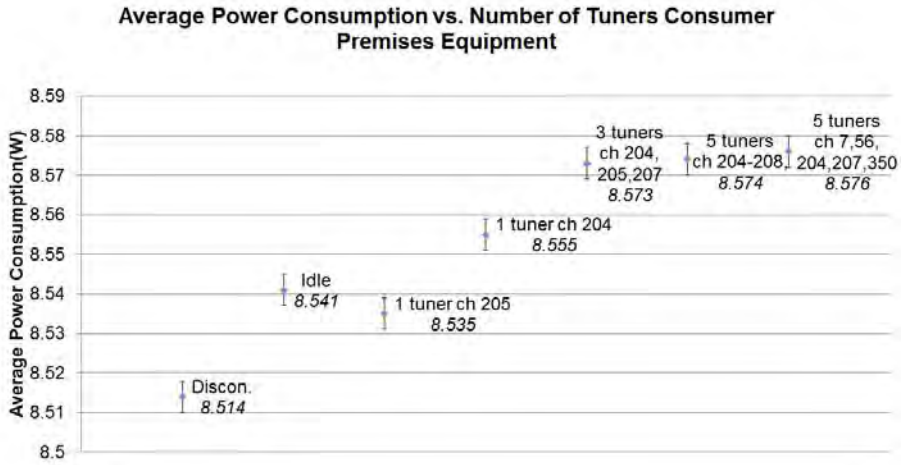
sr9 This probably should be split into two slides, for intellectual and visual clarity.
1) STBs connect to lots of things already
[We need to see those lines more clearly]

2) There are many different alliances, protocols, agreements for maintaining the connections
[that stuff needs to be more readable too]
stuross, 10/30/2012

Multi-room Architecture and Power Savings

- **Average 2.5 TV sets each household**
- **Thin-clients, compatible TV/tablets**
- **Share the fixed cost of energy on consumer-premise equipment**





CalPlug Engineering Lab August 2012

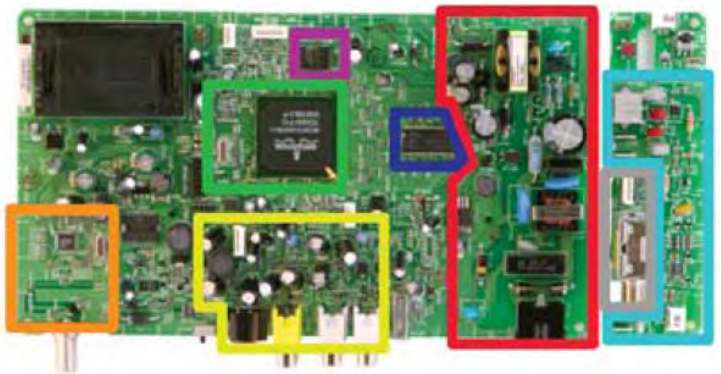
Slide 19

sr10 The reference to 'transmit' is not clear. I think you mean the fixed cost of getting the signal to the house, but this could also be read as the cost of transmitting from server to clients. And it isn't just 'transmitting' that uses power -- also security, recording, etc. etc.

stuross, 10/30/2012

STB Device-Level Power Saving Potentials

- Power scaling system-on-a-chip CPUs
- Improved switching power supplies
- More efficient recording memory (Hard-drive-less, Hybrid, spin-down on-demand)
- Software, middleware updates
- Light-sleep/Deep-sleep bus system design to selectively de/activate components



MPEG Decoder + Transport + Modem + Control CPU + NTSC Encoder
AC-DC Power Supply
Volatile RAM
EMPROM (Flash) Non-Volatile Memory
Modem Analog Front End
Satellite Tuner
Analog Video and Audio Output
RF Modulator

STEPHEN DULAC, PROCEEDINGS OF THE IEEE, VOL. 94, NO. 1, JANUARY 2006

Slide 20

sr11 use left justification

stuross, 10/30/2012

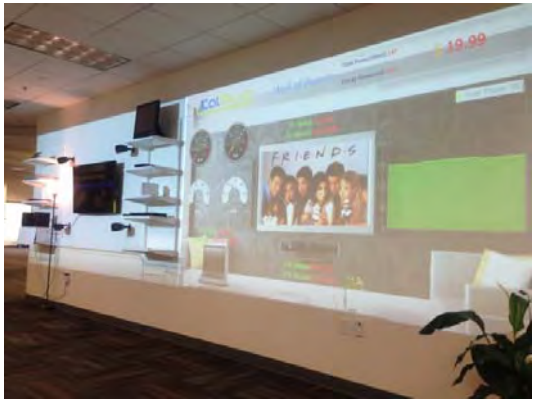
PC Power Saving Modes

- **Are PCs really going to sleep at night?**
- **Major PC industry players in participation**

Consumer Outreach

- **1 kWhr Challenge**

- **The “Wall of Power”**



Partner with CalPlug

- **Friends**
  - ✓ Newsletters, announcements and event discount
- **Affiliates**
  - ✓ Above plus corporate recognition, exhibit opportunities, networking opportunities with partners
- **Partners**
  - ✓ Above plus use of meeting facilities, student mentoring opportunities and seat on external technical committee
- **Core sponsors**
  - ✓ Above plus consultation with technical staff researchers, access to company liaison office, identify and organize workshops with staff assistance

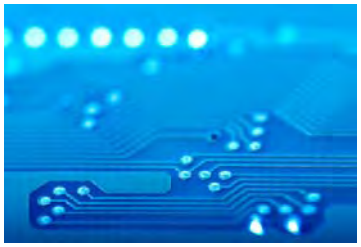
Future plans

- **Projects:**
  - **STB project (August 1st 2012 to Feb 2014)**
  - **PC power saving project (Winter 2013 to Winter 2014)**
  - **Personal energy footprint management system (Spring 2013 to Spring 2014)**
- **Partners:**
  - **Testing alliance, Plug load devices**
  - **CalPlug conference**
  - **EPIC program**

We welcome opportunities for collaboration.

Thank you!

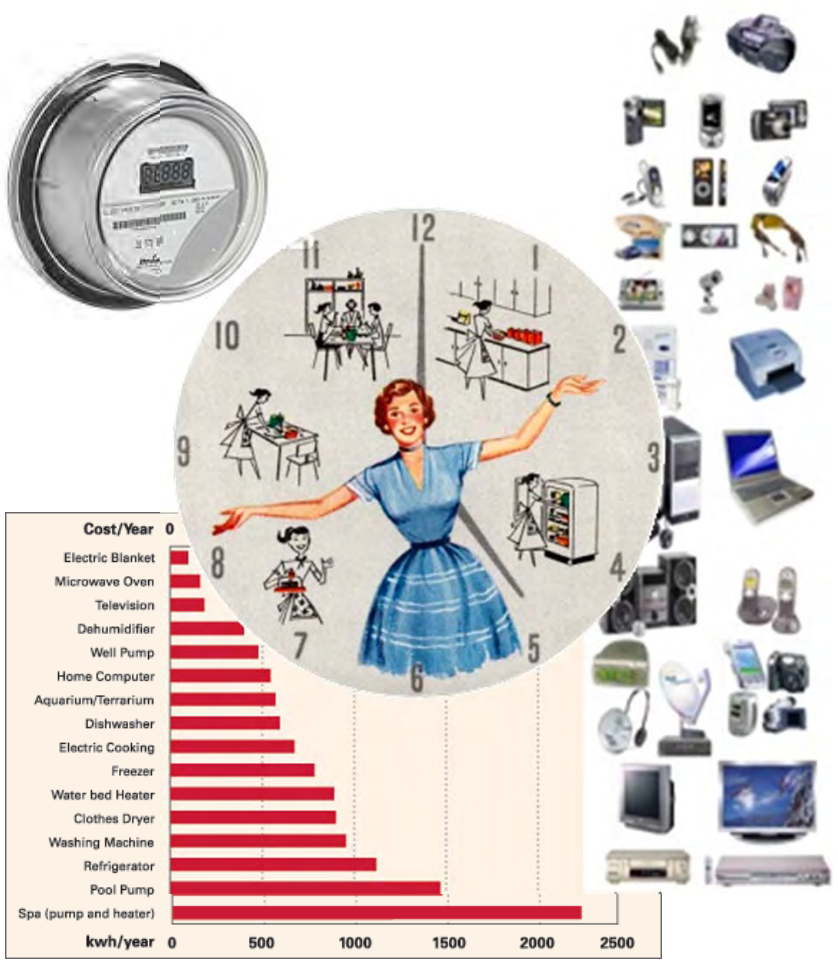
Engineering Research:



Applied research, including the physical sciences

- **developing test standards**
- **lab testing of appliances & equipment**
- **circuit design**
- **adding intelligence and remote control**
- **computer modeling and simulation**
- **mechanical engineering design**
- **construction of prototypes**
- **demonstration projects**

Behavioral & Marketing Research:



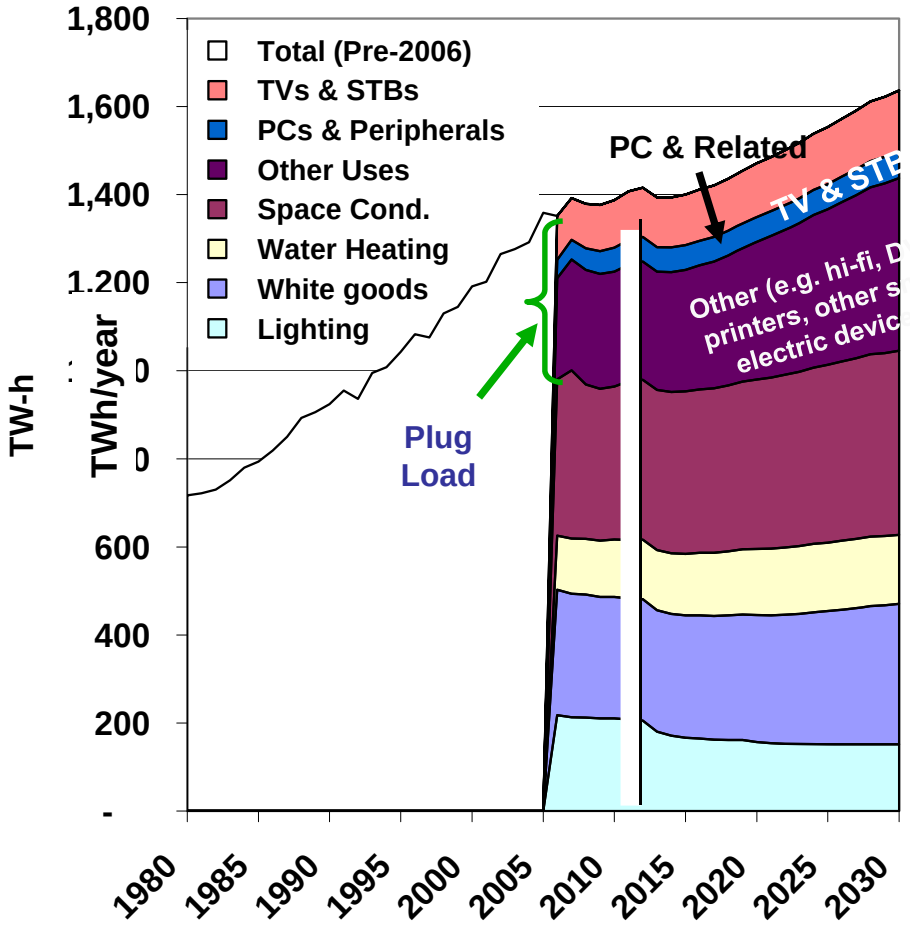
- **Some behavioral issues are specific to a particular device**
- **Others apply to all**
  - **responsiveness to price**
  - **attitudes toward new technology**
  - **adoption of energy-efficient solutions**
  - **awareness of energy usage**
- **Recognize behavioral studies as a unique category**

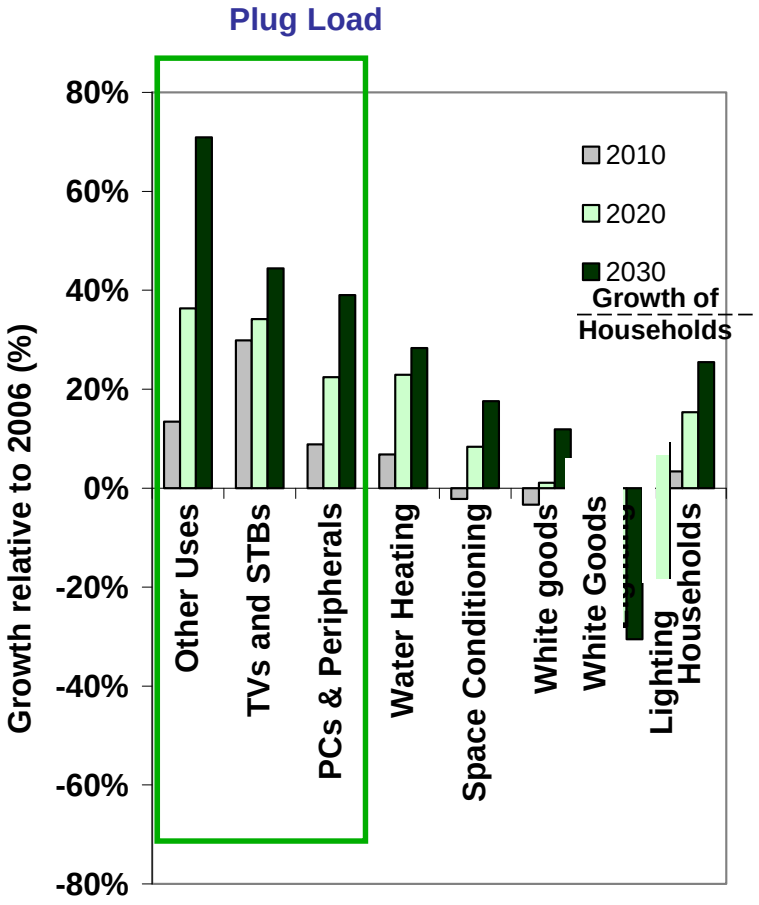
Organizational Coordination:

- Bridging organizational boundaries to define and achieve common objectives
- Negotiations and agreements may originate from managers or with field personnel
- Possible efforts include:
  - drafting of codes and standards
  - development of incentives and rebates
  - achieving more efficient products by informal negotiation

Education Outreach:

- Giving presentations to community groups or classrooms
- Designing and rendering course materials for workforce training
- Designing educational games and exhibits
- Target audiences include utility customers, retailers, commercial establishments, manufacturers and consumers





Creating Connections. Powering Innovation. Boosting Efficiency.

Source: U.S. Department of Energy: Energy Information Administration, Annual Energy Outlook 2009 Early Release

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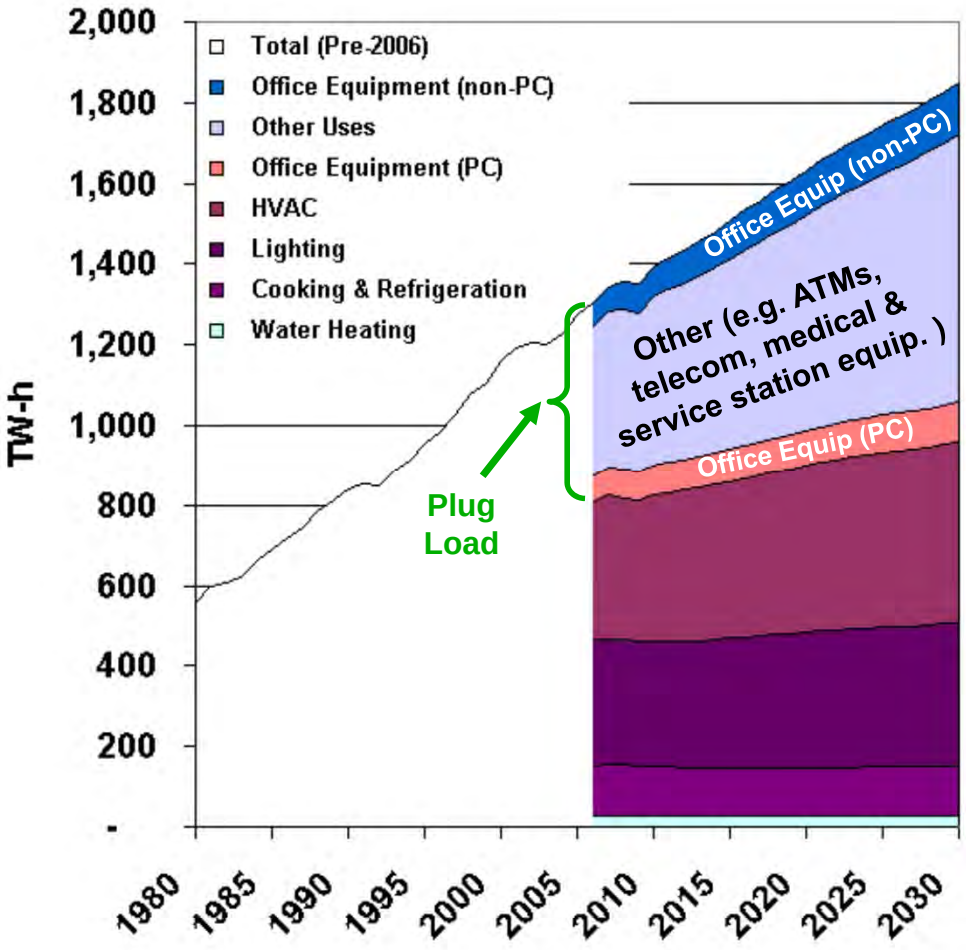
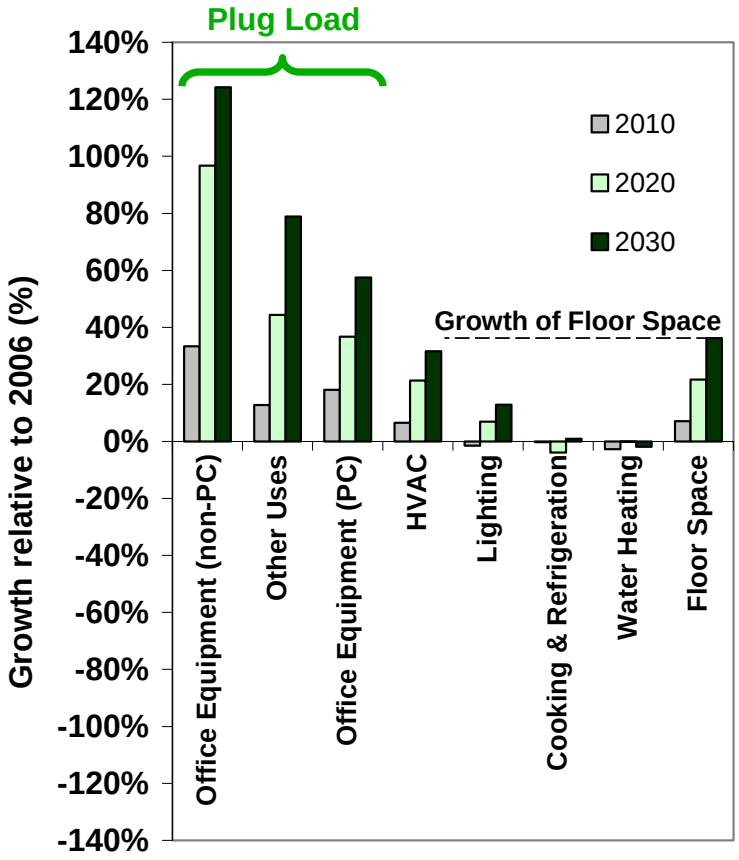
Commercial Electricity Consumption





Source: U.S. Department of Energy: Energy Information Administration, Annual Energy Outlook 2009 Early Release


Apps for Energ
Award Ceremon