Entertaining Solutions

by Lori Brandt

Most people know that an old refrigerator or lights blazing in an empty room can run up an electricity bill.

Not as many know that the new household energy hog is the growing number of consumer electronics, in particular, those boxes that serve as cable and satellite TV receivers. Ubiquitous in today's media-centric homes, set-top boxes are always "on." They can operate at near-full power, day in and day out, even when the consumer is not watching or recording a show.

Set-top boxes are part of the "plug load" – devices that plug into an electrical socket – including cell phone chargers, televisions, computers, printers, tablets, digital video recorders, cameras and more. Alone, these items may not use much energy, but multiplied, they add up. The average household, which contained only four or five devices 20 years ago, now has as many as 50.

The California Energy Commission is looking to the California Plug Load Research Center (CalPlug), established last year and housed at Calit2, for leadership. The Commission has awarded CalPlug a $1 million research grant to support development of energy-conserving solutions and industry standards, starting with set-top boxes.

Calit2's Irvine division Director G.P. Li serves as the center's interim director. Through collaborations with industry, commerce and government, he says, CalPlug plans to assist in developing future efficiency standards and incentive programs for manufacturers and retailers.

Twenty-one CalPlug student researchers, from engineering, computer sciences, business and social sciences, are organized into six teams evaluating plug-load energy use and seeking solutions.

The electricity required to operate all the set-top boxes in the U.S. is equal to the annual household electricity consumption of the entire state of Maryland and results in 16 million metric tons of carbon dioxide emissions, according to a Natural Resources Defense Center fact sheet.

"Set-top boxes and digital video recorders consume astronomical amounts of energy, and may now be one of the largest consumers of electricity in the average American home," writes U.S. Sen. Dianne Feinstein. In a letter to CEOs of America's largest cable and satellite providers, she urges them to phase out inefficient set-top boxes and provide models that reduce utility bills. "These boxes cost households $3 billion annually in utility bills, with $2 billion of that expense incurred when boxes are not actively in use."

The U.S. Environmental Protection Agency's ENERGY STAR program launched a set-top box program in 2009, with an improvement target of 40 percent for ENERGY STAR models over traditional set-top boxes. Revised guidelines, effective last year, require an additional 30 percent average reduction.

"Set-top boxes involve multiple stakeholders – manufacturers, service providers, utilities and customers – and present real operating challenges for improving efficiency," says Matt Malinowski, a consultant who works with the EPA on the ENERGY STAR program. "CalPlug offers a neutral environment where everyone can work together."

"We know there is great potential for improving the efficiency of these boxes and reducing the cost of operating them," explains Bradley Meister, a senior mechanical engineer at the Commission. "It was important to find a center that could stay on top of what is possible in energy efficiency and pull together the major players, as well as look at human behavior."

CalPlug recently hosted a day of workshops and demonstrations to build collaborations. Nearly 60 experts gathered, including television service providers, set-top box and microelectronics manufacturers, utility and public agency representatives and academic researchers.

DIRECTV representative Steve Dulac was there, showing off his company's new energy-saving, multi-room HD-DVR architecture that features remote user interface technology found in Samsung Smart TVs. DIRECTV, recognized by the EPA three years running for excellence in energy-efficient product design, intends to continue its momentum.

"We hope to build on our success through ongoing collaboration with other CalPlug workshop attendees," Dulac says.

CalPlug is currently measuring the power consumption of a variety of set-top boxes and exploring design alternatives to reduce energy use. Because two-thirds of the energy used by the boxes is consumed when they are off, researchers are looking at the potential of employing a light sleep mode and a deep sleep mode.

"The challenge is designing a sleep mode that quickly wakes up and reconnects, so the box can still receive updates from content providers and customers don't suffer unacceptable interruptions of service," says Arthur Zhang, CalPlug's technology manager. "Our goal is to make design recommendations that achieve significant differences in power consumption, are feasible for manufacturers and are user-friendly."

"We are confident that our work with CalPlug can contribute to increased efficiency in set-top boxes," adds Li. "We want to lighten the load – on families' energy bills and on long-term damage to our environment."

1	Fan/Air Purifier	100 kWhr/ $25
2	Laptop	200 kWhr/ $50
3	Monitor	200 kWhr/ $50
4	Tablet	10 kWhr/ $2.5
5	Game Console	50 kWhr/ $13
6	Home Theater System	300 kWhr/ $75
7	Game Console	50 kWhr/ $13
8	TV	300 kWhr/ $75
9	Blu-ray Player	50 kWhr/ $13
10	Laptop	100 kWhr/ $25
11	TV STB (2011)	92 kWhr/ $23
12	TV STB (2007)	125 kWhr/ $31
13	TV STB (2005)	230 kWhr/ $58
14	Tablet	20 kWhr/ $5
15	Desktop Computer	250 kWhr/ $63
16	Monitor	100 kWhr/ $25
17	Printer	200 kWhr/ $50
18	Heater	100 kWhr/ $25

All data is based on annual estimated usage
Dollar figures are based on a rate of 25 cents per kWhr

The cost to a homeowner of keeping electronic devices like these plugged in and ready to use approaches $600 a year.

photo: Paul R. Kennedy