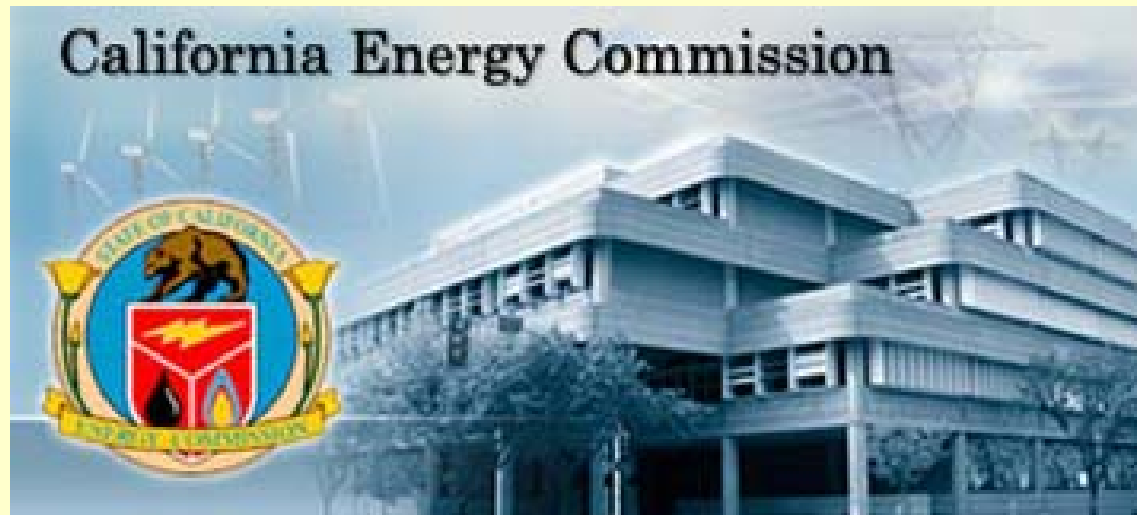




# Energy efficient electronics: policy options and technology opportunities



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Berkeley Wireless Research Center, March 2006





## Topics

- Policy context:
  - Overview of CEC
  - Why efficiency is important to California
  - Growing energy use of electronics
  - CEC standards for electronics
  - What's going on in other countries and states
- Technology opportunities:
  - Building an efficient DTA and DVR





## Overview of CEC

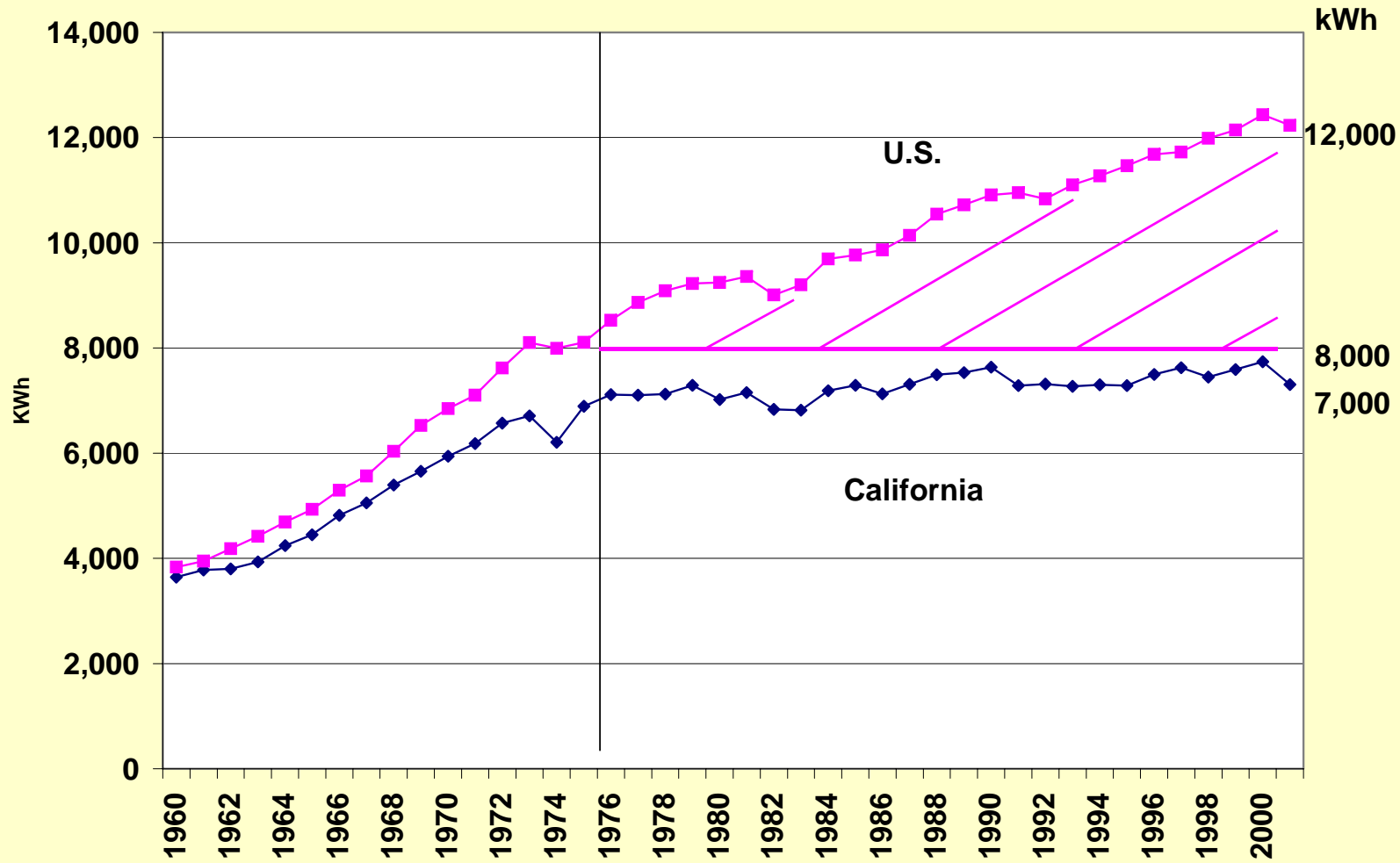
- Created in 1975 to be California's energy policy agency:
  - Power plant licensing
  - Efficiency standards for buildings and appliances
  - Energy supply and demand assessments
  - Research (~\$80 M/yr)
  - Renewables (~\$220 M/yr)
- 5 commissioners appointed by Governor
- 450 staff, \$360 million budget
- [www.energy.ca.gov](http://www.energy.ca.gov)





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## Total Electricity Use, per capita, 1960 - 2001





## Economic savings

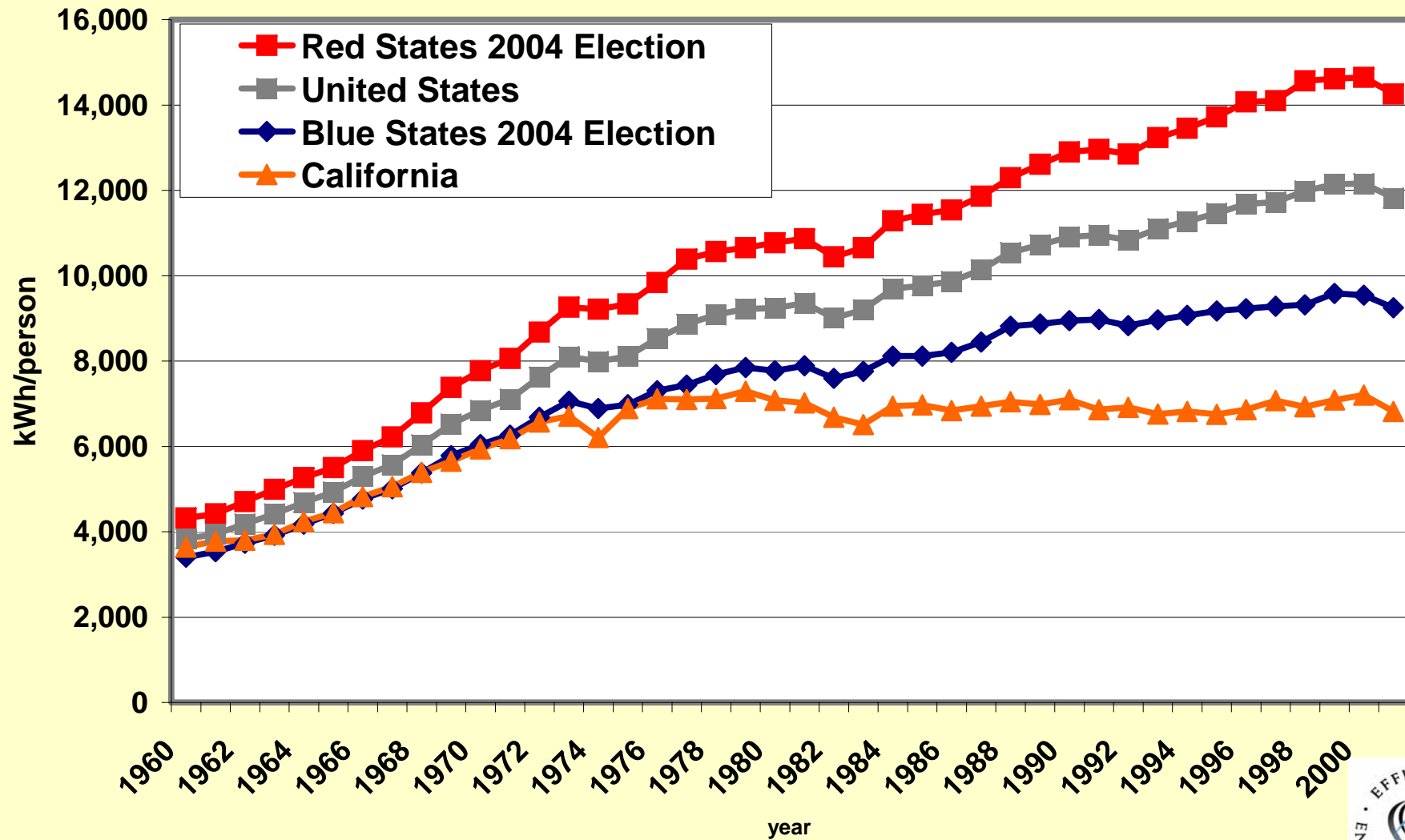
- If California electricity use had kept growing at the US rate, kWh/person would have been 50% higher
- California electric bill in 2004 ~\$32 Billion...
- so we've avoided ~\$16 B/yr of electricity bills.
- Net saving (accounting for cost of conservation measures and programs) is ~\$12 B/year, or about \$1,000/family/yr.
- **Appliance standards save ~\$3B/year (1/4)**





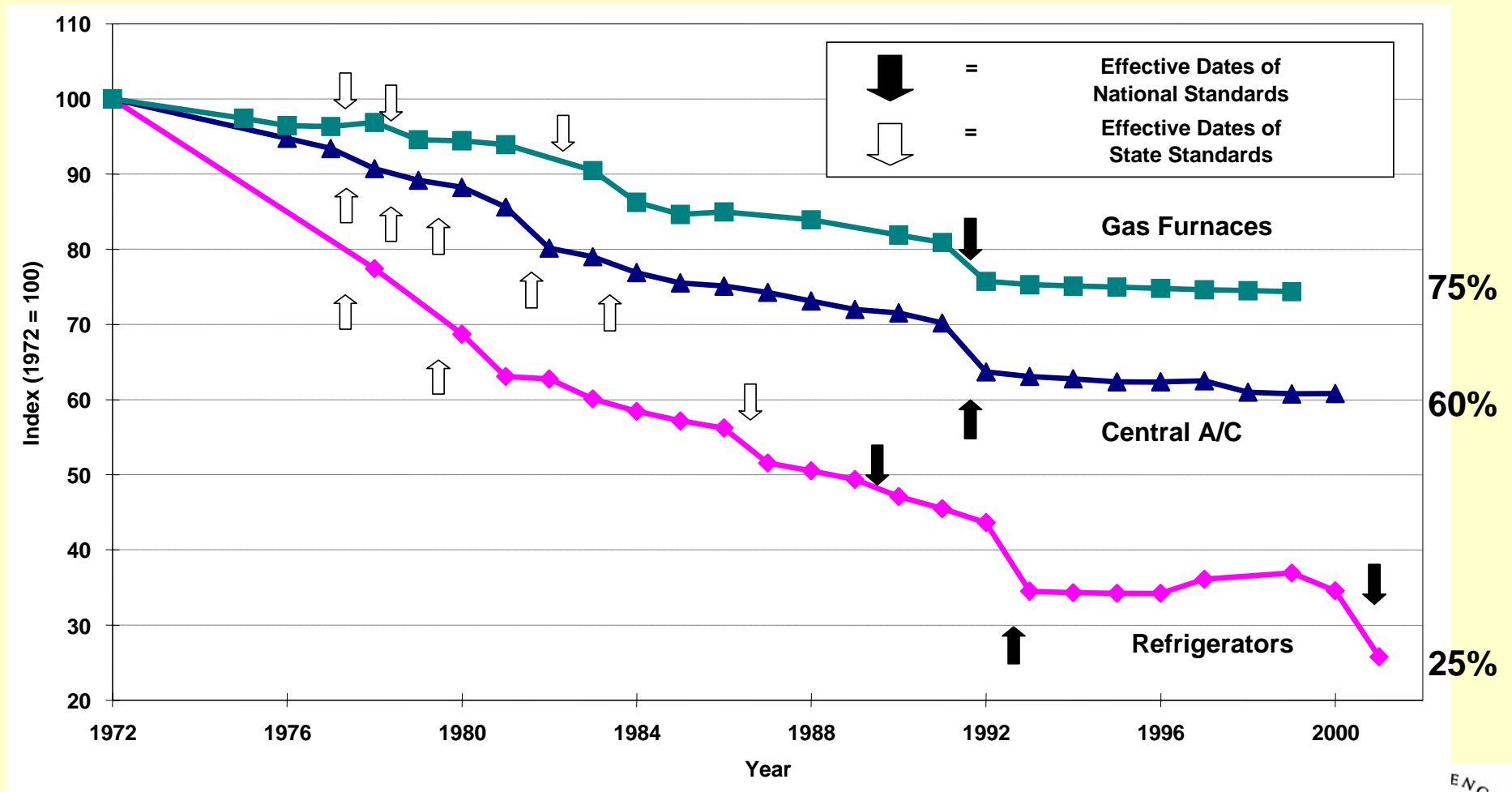
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## Per Capita Electricity Consumption





## Impact of Standards on Efficiency of 3 Appliances



Source: S. Nadel, ACEEE, in ECEEE 2003 Summer Study, [www.eceee.org](http://www.eceee.org)

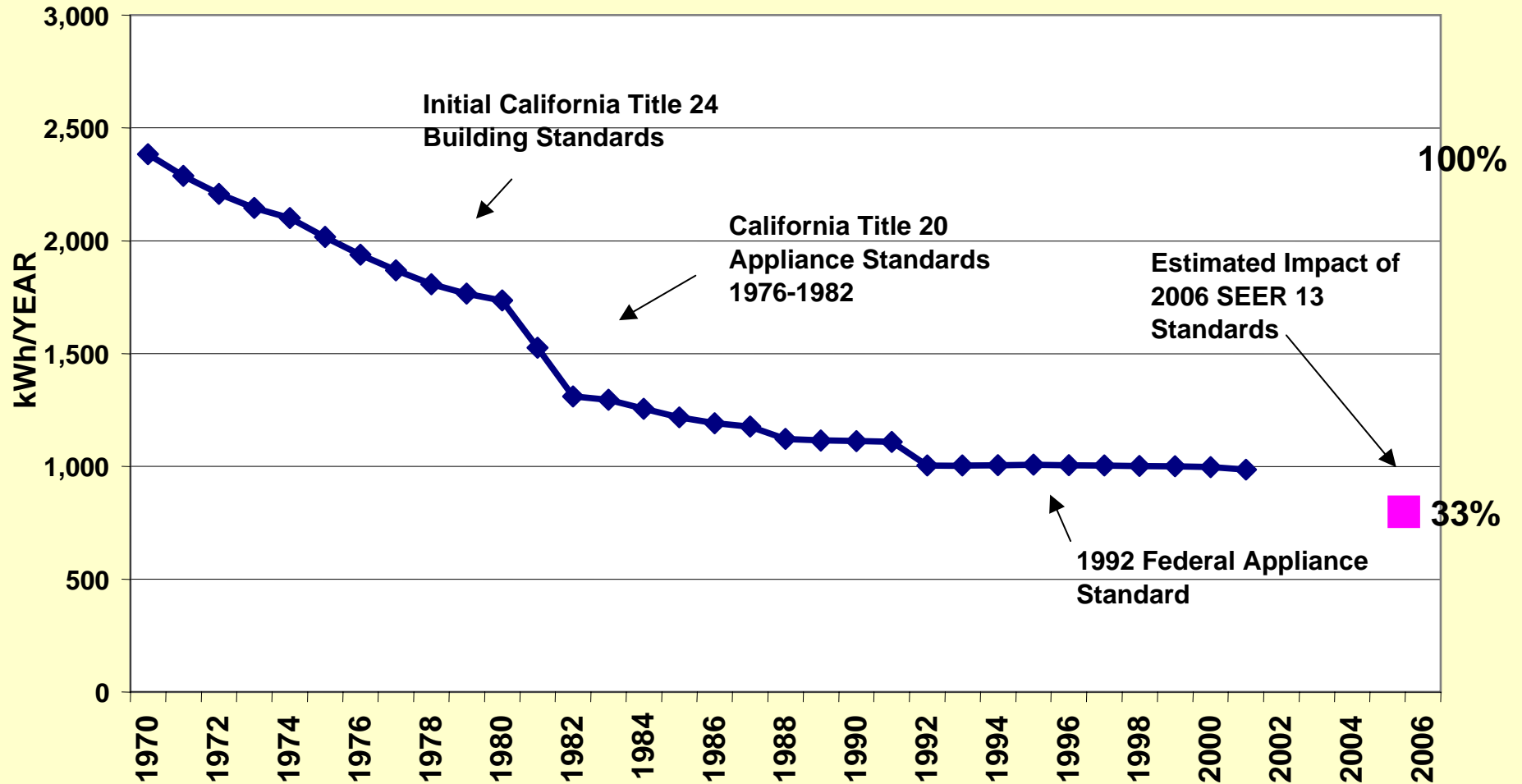




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## Annual Usage of Air Conditioning in New Homes in California

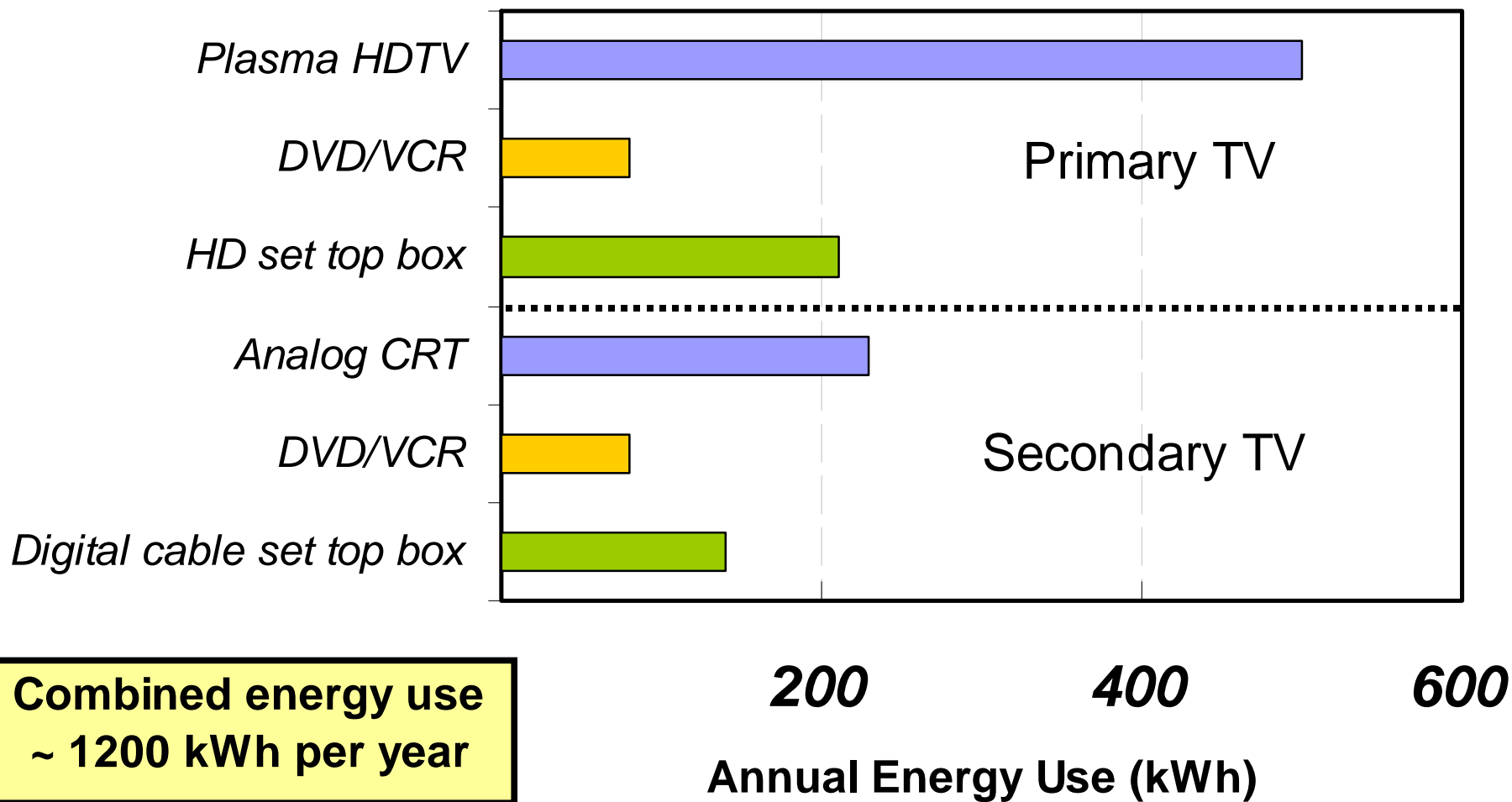
Annual drop averages 4% per year



Source: CEC Demand Analysis Office



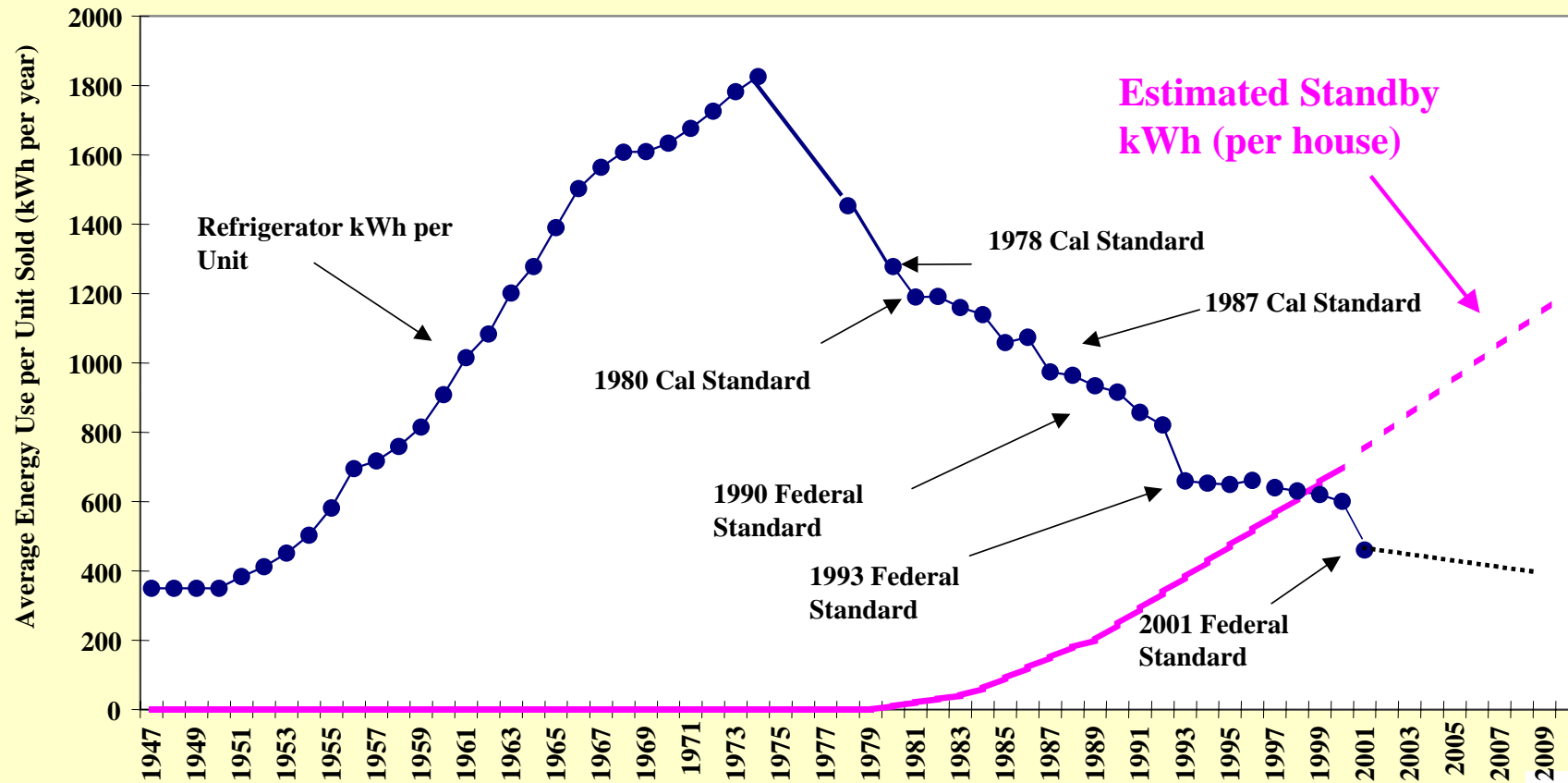
## Household Energy Use for Entertainment Electronics



NRDC, "Tuning in to Energy Efficiency: Prospects for Saving Energy in Televisions," January 2005.



# Refrigerator and standby energy use





## “Zero energy” new homes

- Goals:
  - 70% less electricity => getting down to ~2,000 kWh/yr
  - 25% less energy than Title 24
  - 1 kW on peak
- Electronics are a problem!
  - 1,200 kWh/ yr for TVs, etc.
  - 100-200 W for standby



## California's appliance standards

- Standards are minimum efficiency requirements for appliances that are offered for sale in the state, and manufactured after the effective date of the standard.
- Criteria: standards must be feasible and cost-effective.
- Enforcement: manufacturers must certify that their appliances meet the standards.
  - CEC maintains on-line databases of certified products.
- Update standards about every three years.
- Website: [www.energy.ca.gov/appliances](http://www.energy.ca.gov/appliances)





## Audio and video equipment standards

<i>Appliance Type</i>	<i>Effective Date</i>	<i>Maximum Power Usage (Watts) During Standby/Active Mode</i>
Compact Audio Products	January 2007	2 W Standby for those without a permanently illuminated clock display 4 W Standby for those with a permanently illuminated clock display
Televisions	January 2006	3 W Standby
Digital Versatile Disc Players and Digital Versatile Disc Recorders	January 2006	3 W Standby
Digital Television Adapters	January 2007	8 W Active 1 W Standby



## External power supply standards effective July 2006 (Tier 1)

Namplate output	Min. efficiency in active mode
0-5 W	~50%
5-50 W	~70%
50+ W	84%
	Max. power in standby
< 10 W	0.5 W
> 10 W	0.75 W





## Electronics standards in other states

- Consumer audio and video products
  - CA, NY
- Digital TV adapters
  - CA, NY
- External power supplies
  - CA, NY, AZ, MA, OR, RI, WA





## Looking back...2005

- Announced external power supply design competition winners, APEC, Austin, Mar 2005
  - [www.efficientpowersupplies.org/competition.html](http://www.efficientpowersupplies.org/competition.html)
- TV workshop, SF, June 28
  - [www.energystar.gov/index.cfm?c=revisions.tv\\_vcr\\_spec](http://www.energystar.gov/index.cfm?c=revisions.tv_vcr_spec)
- Set top box workshop, SF, June 29
  - [www.energystar.gov/index.cfm?c=revisions.settop\\_box\\_spec](http://www.energystar.gov/index.cfm?c=revisions.settop_box_spec)
- “Global Cooperation on 1 Watt,” Seoul, Nov 1-2
  - [www.standbyforum.co.kr/](http://www.standbyforum.co.kr/)
- Battery charger workshop, SF, November 17
  - [efficientproducts.org/bchargers/bcwkshp\\_11-05/index.html](http://efficientproducts.org/bchargers/bcwkshp_11-05/index.html)
- Internal power supply workshop, Phoenix, Jan 19, 2006
  - [www.efficientpowersupplies.org/ips\\_workshop.html](http://www.efficientpowersupplies.org/ips_workshop.html)





## Looking forward...2006

- Jan 30 workshop to review issues raised by industry
  - [energy.ca.gov/appliances/notices](http://energy.ca.gov/appliances/notices)
- Jan 31 workshop on servers and desktop computers at Sun Microsystems (EnergyStar)
  - [www.energystar.gov/index.cfm?c=products.pr\\_esads\\_conf](http://www.energystar.gov/index.cfm?c=products.pr_esads_conf)
- Developing test procedure for TVs in active mode
- Developing test procedure for battery chargers





## Technical challenge: building an efficient DTA and DVR

- Background:
  - CEC set efficiency standard: 8W active, 1W standby
  - Pace offered a DTA that met those specs, but industry says US signal needs more power (12+W active).
  - Paul Rudnick says DTA can be done for 2W active!
- CEC wants to create a project to build efficient DTAs and DVRs
  - ASAP!



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## Collaborators

- CEC PIER program
  - Ron Hofmann
- Noah Horowitz - NRDC, San Francisco
- Paul Rudnick - Silicon Valley engineer/entrepreneur
- Jim Beck - Sun
- UC?



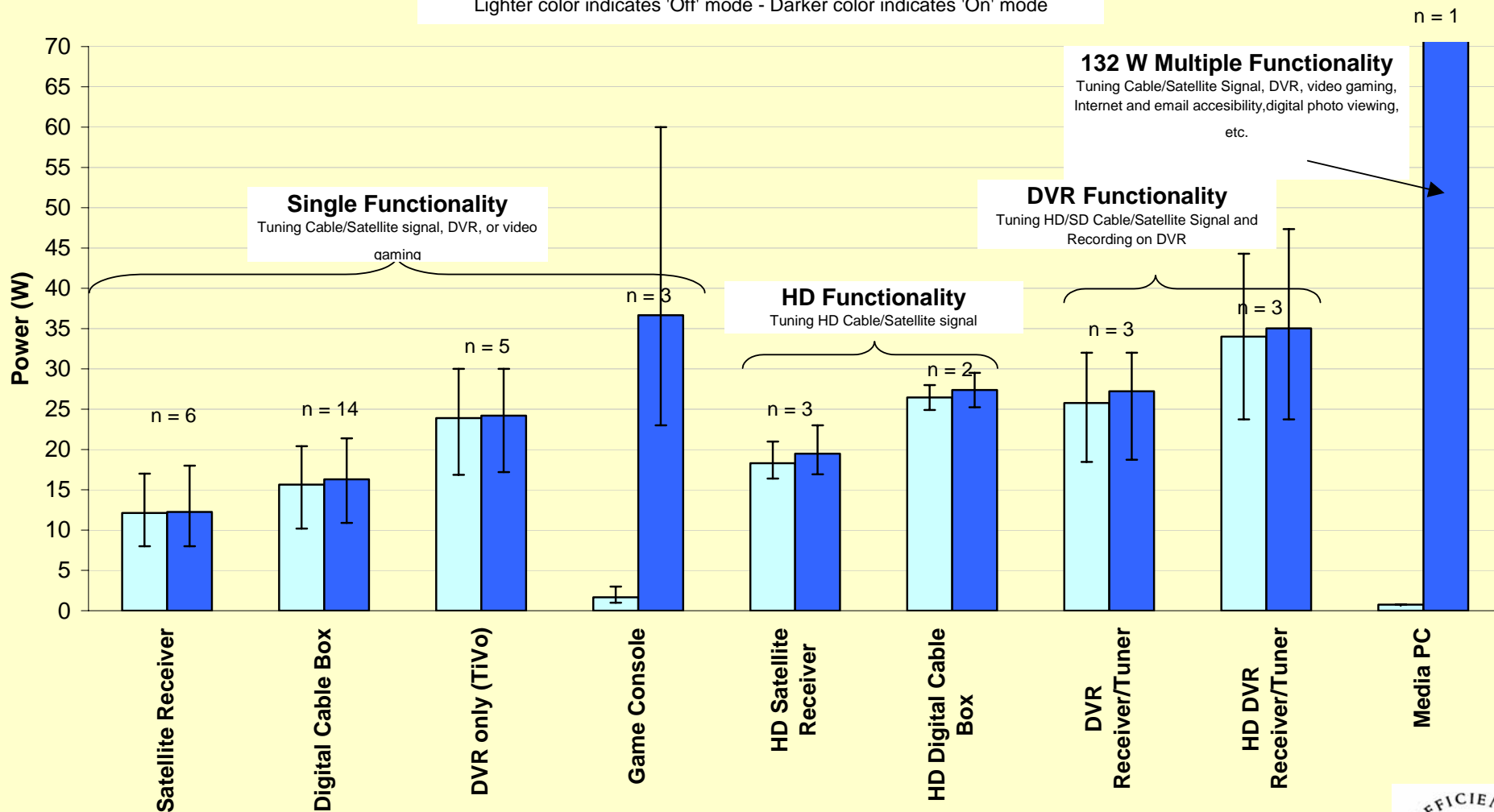


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## Results of NRDC/Ecos Research

### Power Use of Set Top Boxes When 'Off' and 'On'

Lighter color indicates 'Off' mode - Darker color indicates 'On' mode



**132 W Multiple Functionality**  
 Tuning Cable/Satellite Signal, DVR, video gaming, Internet and email accessibility, digital photo viewing, etc.

**DVR Functionality**  
 Tuning HD/SD Cable/Satellite Signal and Recording on DVR

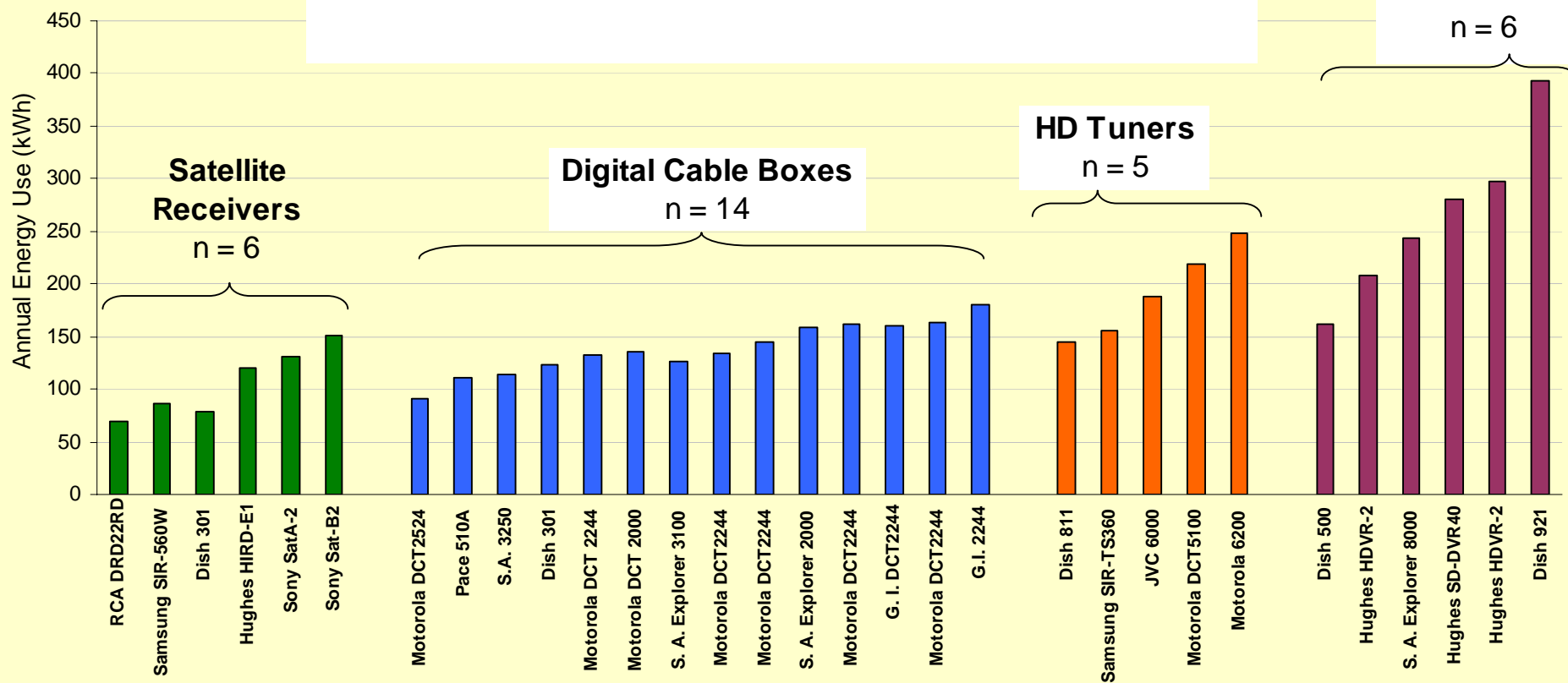
**HD Functionality**  
 Tuning HD Cable/Satellite signal

**Single Functionality**  
 Tuning Cable/Satellite signal, DVR, or video gaming





# NRDC/Ecos Research December 2004 Annual Energy Use of Measured Set Top Boxes





# Potential Savings from an Auto Low Power Mode

If, starting in 2006, all STBs sold met these low power mode guidelines, by 2008 we would save:

	15 W Level	5 W Level
National Energy Savings (billion kWh)	7.6	13.7
CO2 Savings (millions of tons)	5.1	9.2
Value of Electricity Savings	> \$500 million	\$1 billion
Equivalent Number of American Households Powered for One Year	742,000 (Connecticut)	1,343,000 (Minnesota)
Percent of US Annual Residential Electricity Use	0.7%	1.3%
Number of 500 MW Power Plants Running for a Year	1.7	3.1
Number of Cars off the Road for One Year	609,000	1,103,000
Equivalent Number of Commuter Cars off the Road for One Year	Phoenix	Houston