

***How are we doing energy  
wise with the stuff  
connected to our computers  
and TVs that we don't see?***



Noah Horowitz

Senior Scientist

Natural Resources Defense Council

[nhorowitz@nrdc.org](mailto:nhorowitz@nrdc.org)

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# *Time to think more about*

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- Energy use of the TV and computer “ecosystems”:
  - *Cable, satellite and telco set top boxes (STBs)*
  - *Small network equipment – modems, routers, ONTs, satellite dishes*
  - *Video game consoles – PS3/4, and Xbox 360/One*
  - Surround sound audio/speaker bars
  - Printers

# NRDC 2013 Study on SNE

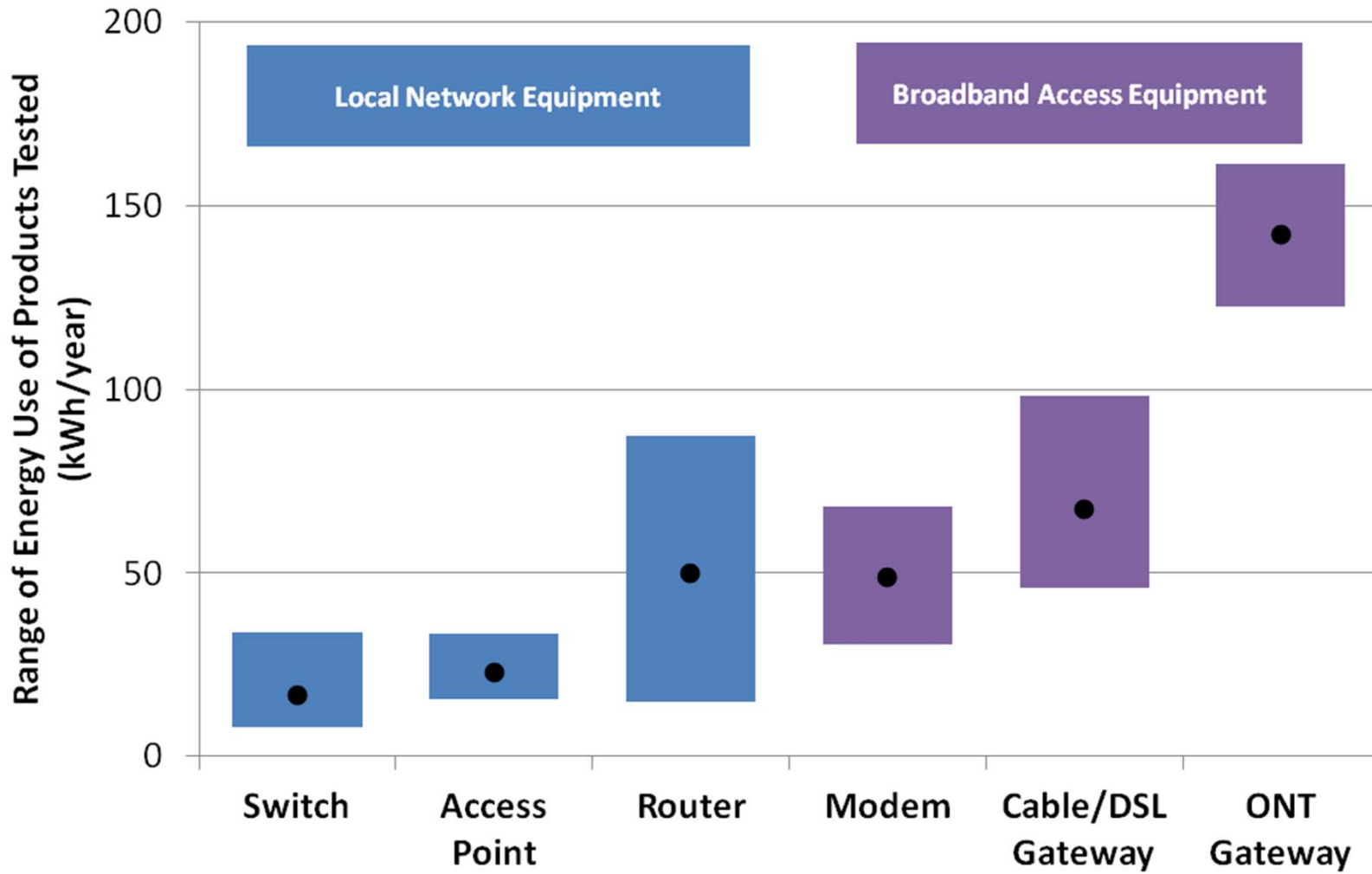
- Small Network Equipment – residential equipment such as modems and routers to access hi speed internet and to move data/video around the home.
- NRDC retained Ecova to measure cross section of products available on the market in late 2012
- For brief and full paper go to:  
<http://www.nrdc.org/energy/files/residential-network-IB.pdf> and <http://www.nrdc.org/energy/files/residential-network-IP.pdf>

# Summary of Findings

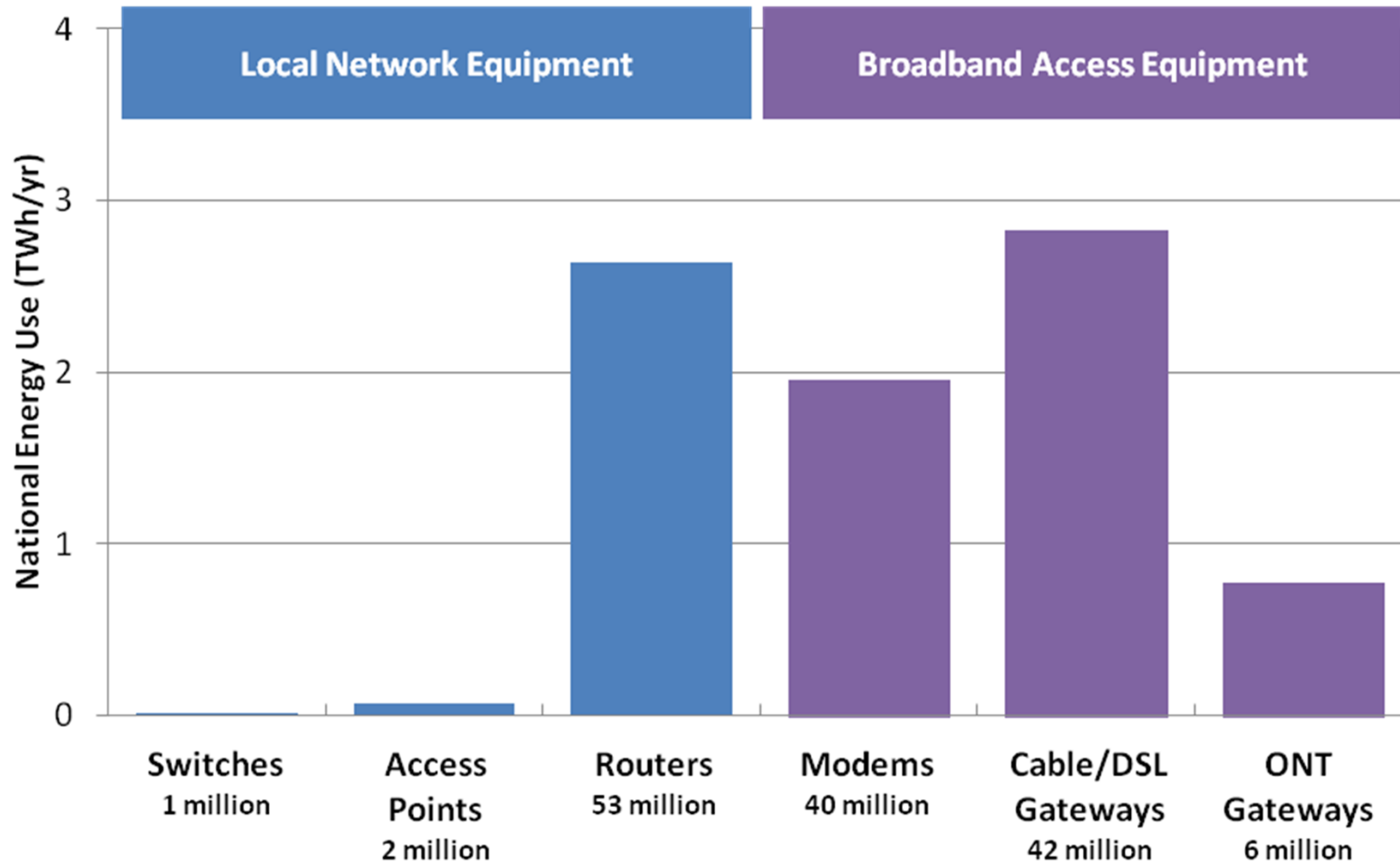
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- **U.S. consumers spend about \$1 billion per year to power their small network equipment**
- In 2012, SNE devices in U.S. homes consumed approximately 8.3 billion kWh of electricity
- Nearly equivalent to the annual output of three average (500 MW) coal-fired power plants
- **5 million metric tons of carbon dioxide emissions/yr**
- Equivalent annual tailpipe emissions of 1.1 million cars
- Nearly equal to the total annual electricity use of all of the households in Silicon Valley

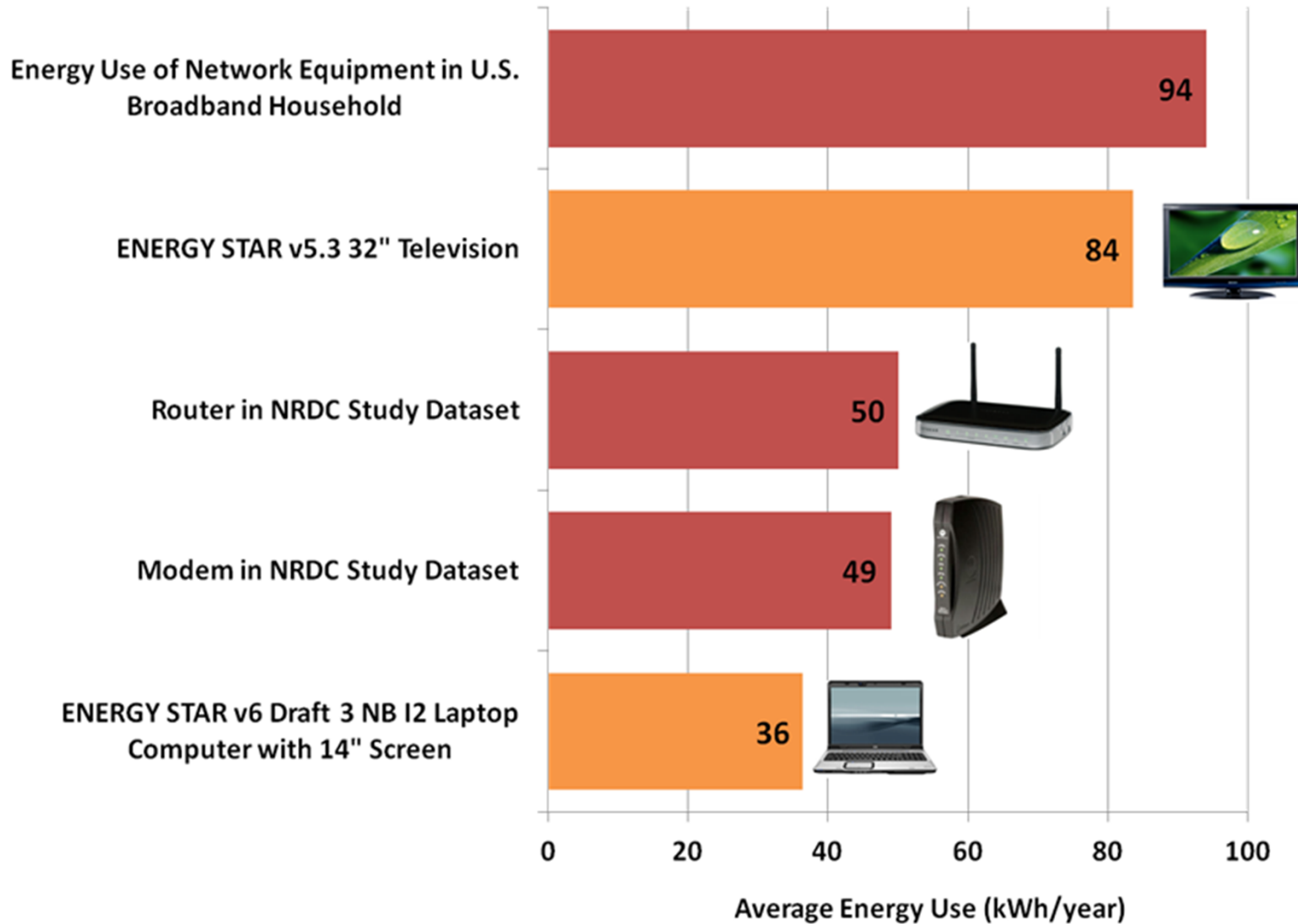
# Range of energy use and average (shown as black dot) of each product group tested



# U.S. residential small network equipment energy use



# Energy use of network equipment compared to other consumer electronics appliances



# Energy savings opportunities with no user impacts

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## Two primary efficiency technologies for SNE:

1. IEEE 802.3az Energy Efficient Ethernet

enables Ethernet ports and components to enter sleep mode in between data packets

2. Wi-Fi power scaling technologies, enabling Wi-Fi routers to:

- a) operate at reduced power when no Wi-Fi clients connected,
- b) reduce signal strength when connected clients in close range, and
- c) enter low power states between packets without affecting performance

Example: TrendNet's GREENnet



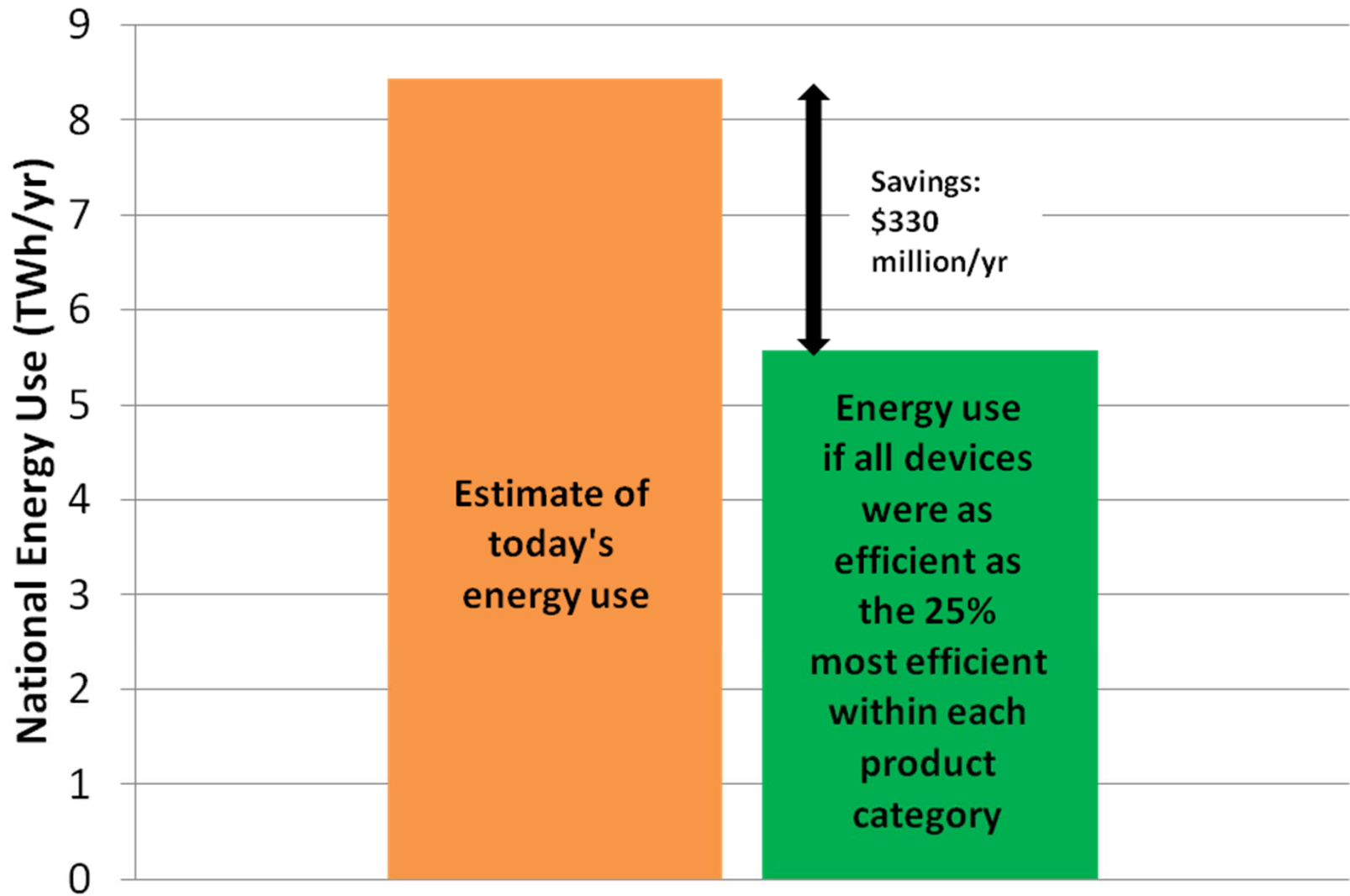


# Energy Savings Opptys/Suggestions

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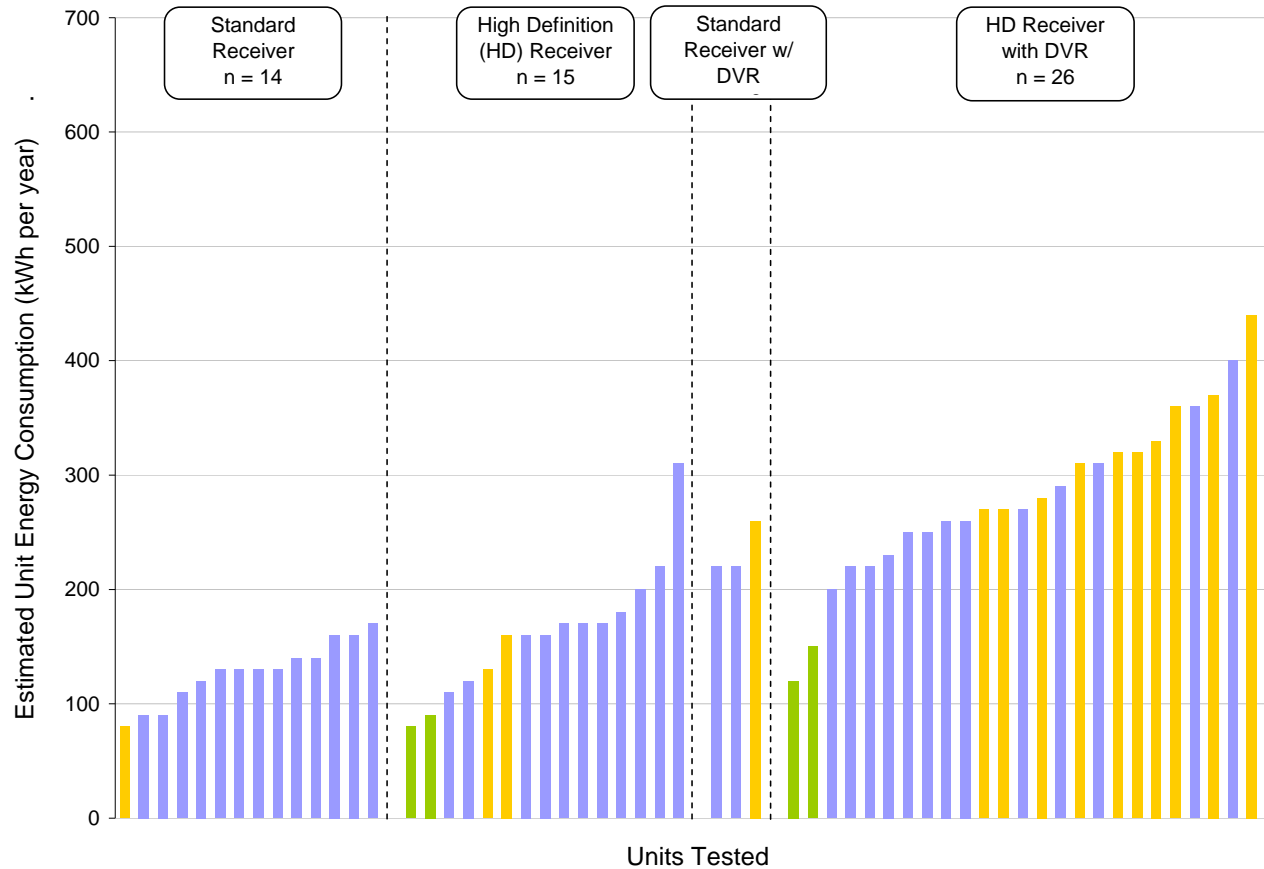
- Encourage/incent manufacturers, retailers and service providers to purchase more efficient models. *(note modems and routers bought by customer at retail or provided by cable or phone company)*
- Promote models that are qualified for ESTAR's new specification
- Need to make sure computers are also IEEE enabled to ensure modem savings are achieved.

# U.S. residential small network equipment energy use and savings potential



# Energy Use of STBs in 2010 (will be in field for 3 or so more years). **New ones much better.**

NRDC'S 2010 SURVEY OF ENERGY CONSUMED BY SET-TOP BOXES Cable Satellite IPTV



# STB Overview per NRDC 2011 Study

Nearly Two-Thirds of Annual U.S. Set-Top Box Energy Use Occurs When Viewers are Not Watching or Recording Content



## RESULTS IN...

Electricity Consumption:  
3 Power Plants (500 MW each)  
Emissions:  
5 Million Metric Tons CO<sub>2</sub>/year  
Cost to Consumers:  
\$1 Billion/year

## RESULTS IN...

Electricity Consumption:  
6 Power Plants (500 MW each)  
Emissions:  
11 Million Metric Tons CO<sub>2</sub>/year  
Cost to Consumers:  
\$2 Billion/year

**In Use** = watching or recording a show

**Not In Use** = not watching or recording a show



## Things are getting better

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- Moving away from temporary trend towards 1 DVR per TV, and move to multi room DVR on main TV and low energy using thin clients on 2<sup>nd</sup> and 3<sup>rd</sup> TVs. Satellite the leader here.
- Light sleep on recent cable DVRs – spins down hard drive => saves around 5 -7 W
- ESTAR 3 boxes about 30% better.
- ESTAR 4 coming, save another 20 to 30%

# STB Developments/goals

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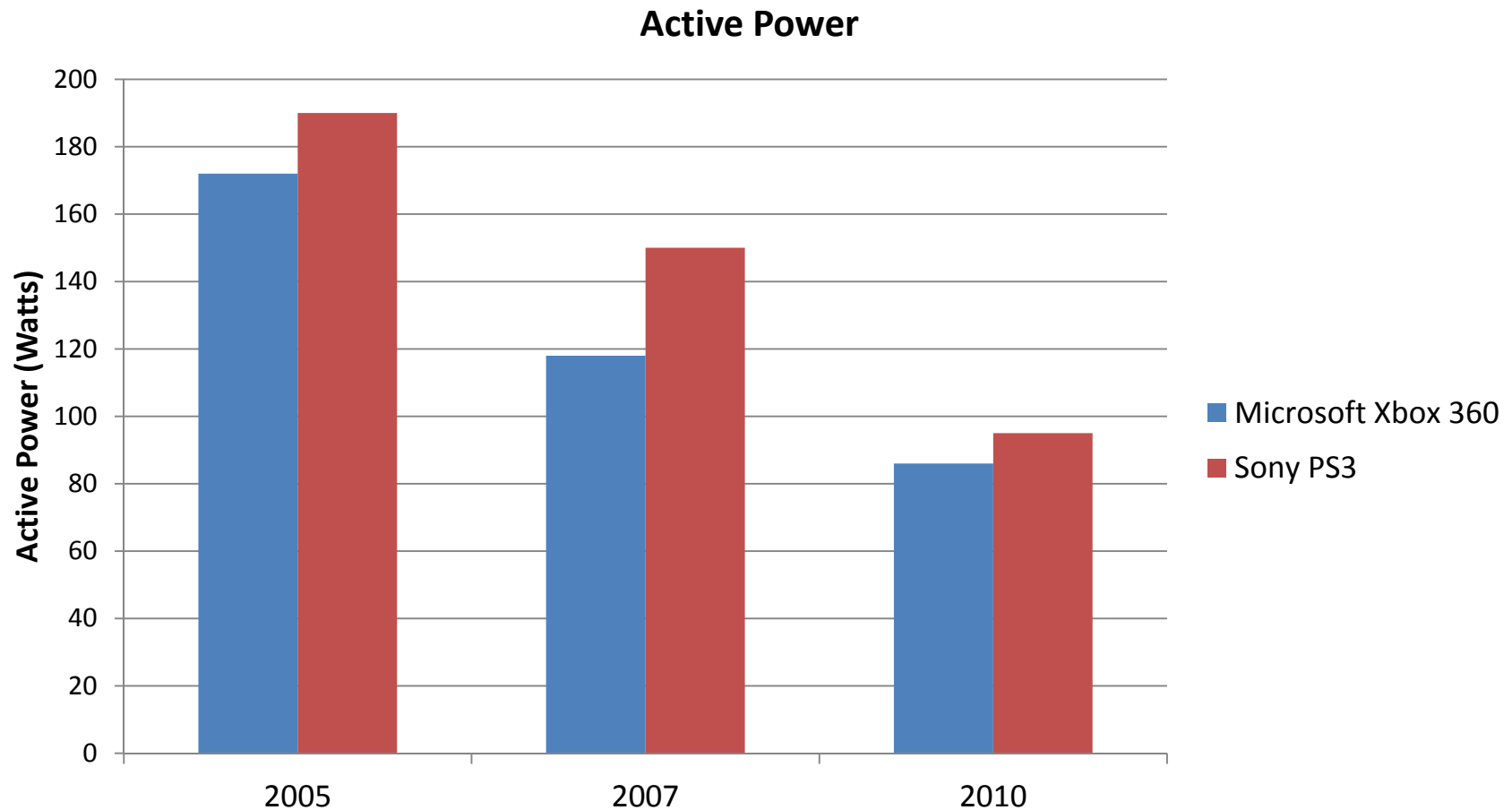
- Industry and advocates working towards “voluntary agreement” that will result in:
  - Firm purchase commitments by service providers (roughly equal to \_\_\_\_\_ by 20XX)
  - Posting of model specific energy use of all new STBs
  - Annual field verification testing of selected STBs
- Whats coming? - whole home “gateway STBs” that include DVR and possibly data modem, router, and/or telephony. ***WILL THIS INCREASE OR DECREASE WHOLE HOME ENERGY USE?***

# The Holy Grail – True Deep Sleep

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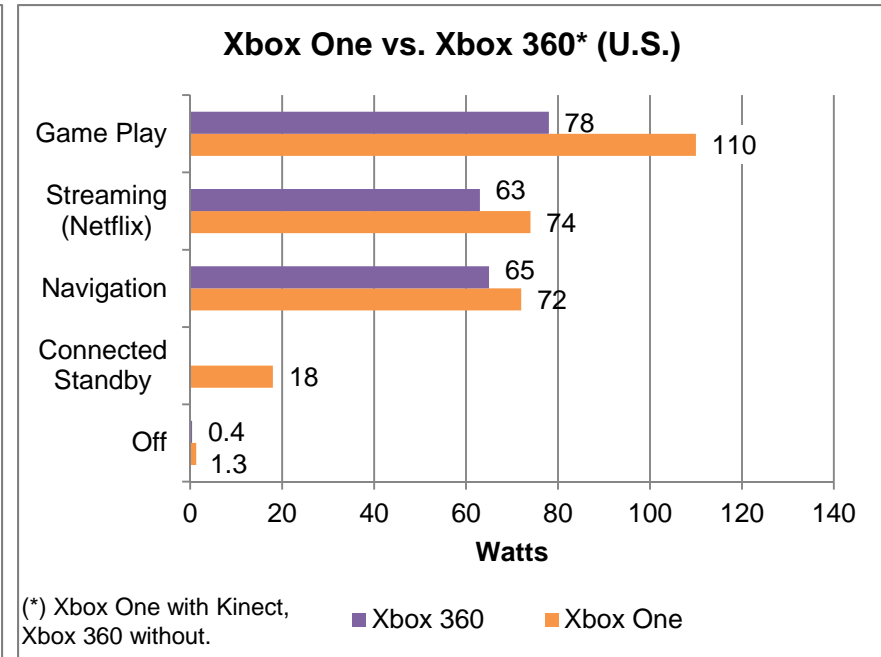
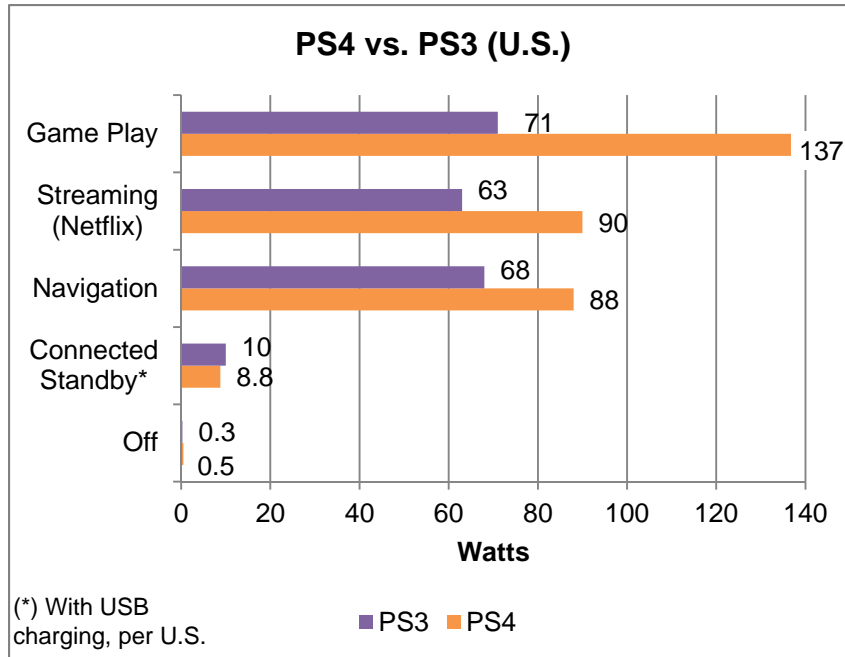
- Interim Solution – automatically power down between 1 and 5 am, but slow wake. Also allow user to schedule different times.
- Goal –STBs use very low power levels when no one is watching but can still:
  - A) have near “instant on”/“resume” (< 15 seconds wake time?) when user returns*
  - B) wake to receive updates*
  - C) wake to record prescheduled show and then go back to sleep*

# Recent Improvements in Xbox 360 and PS3 Since Launch



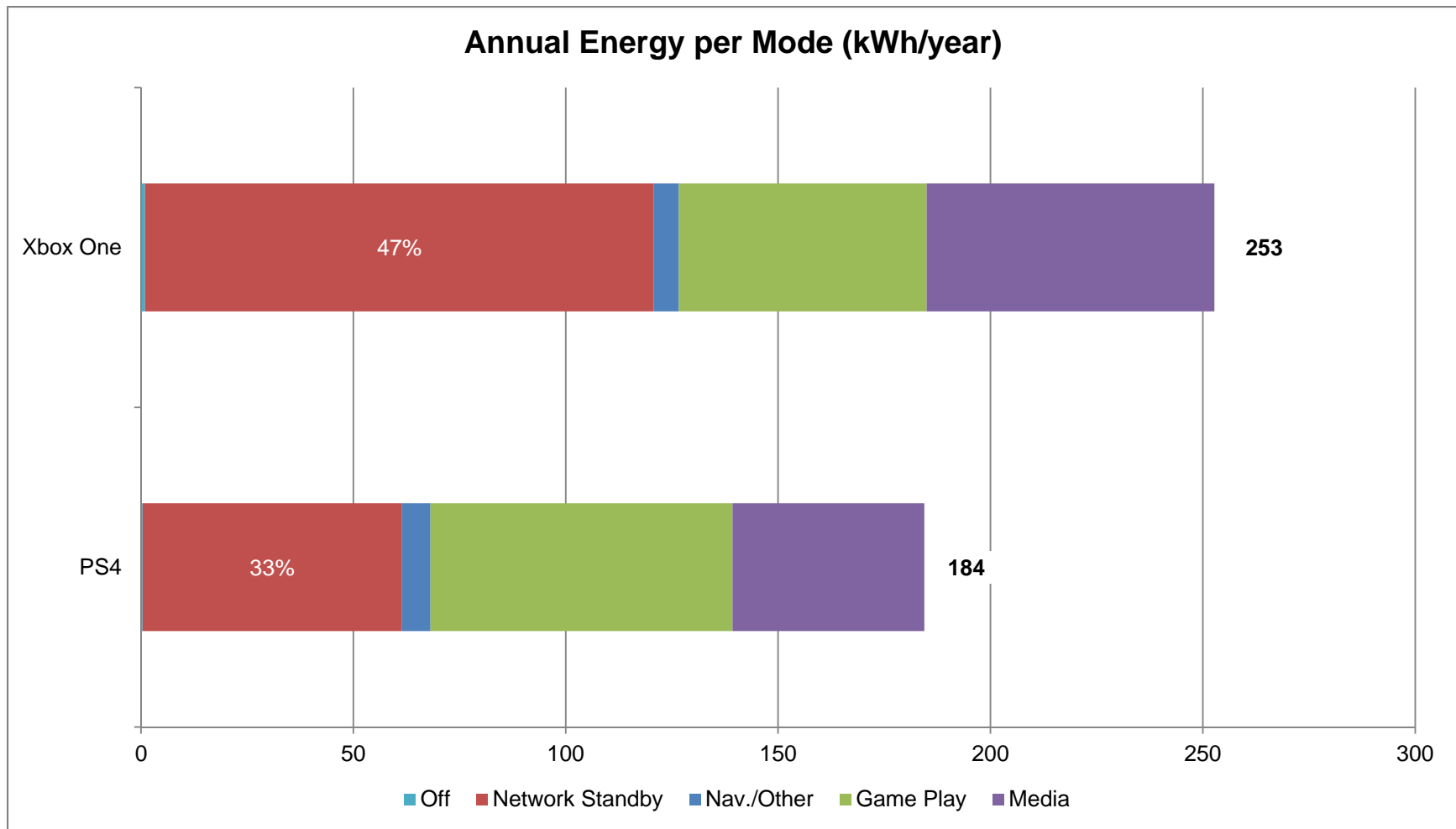


# Power Levels: New Gen vs. Previous Gen



- Power levels increased significantly on PS4, less so on Xbox One.
  - Xbox 360 numbers do not include Kinect. Xbox One Navigation and Media power may be very close to Xbox 360 with Kinect
  - Note that there may be differences in video quality between the two consoles (720p/1080p, upscaling...)
- Better power scalability (reduction from highest to lowest active power): 50% for new gens vs. 25% for previous gens.

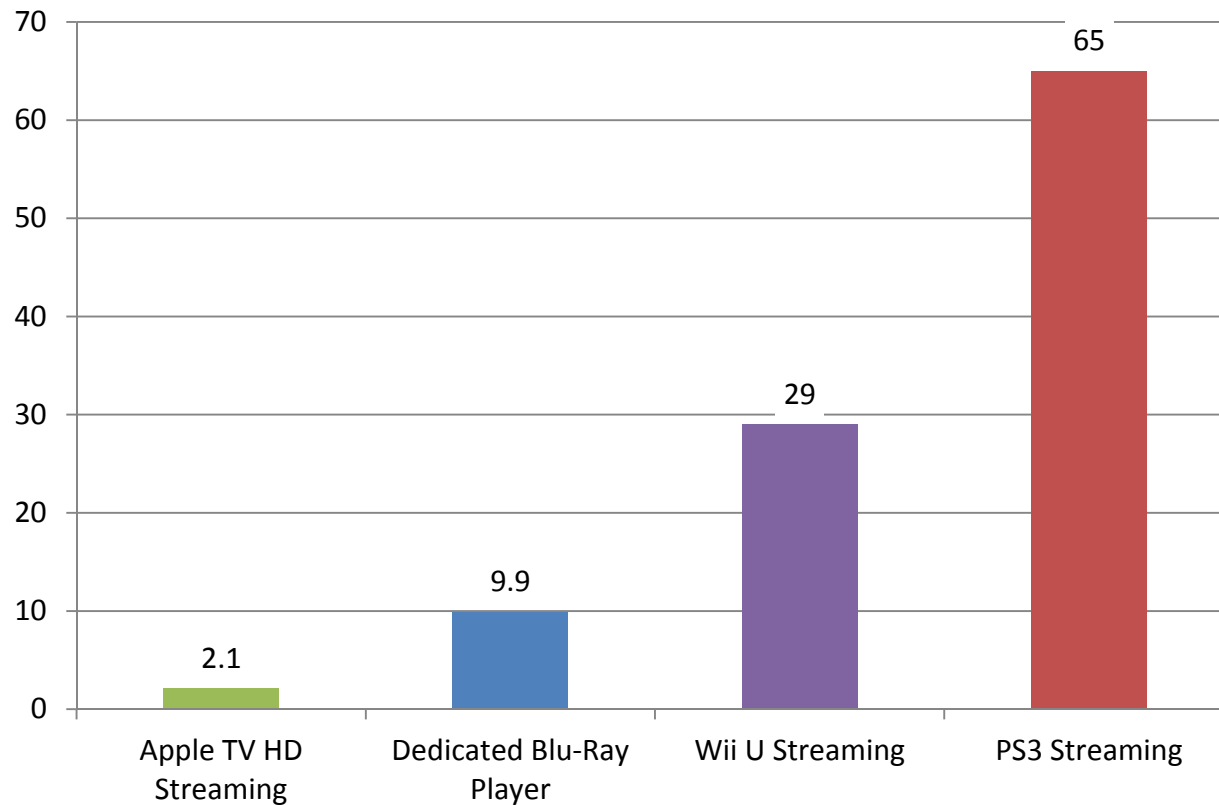
# Annual Energy Use – Note high % from connected standby



Movie Play – Video Game Consoles use far more energy than the most efficient standalone devices



**Movie Streaming Power Use (Watts)**



With increasing use of consoles to play movies (both disk-based and streaming) and shows from Apps like Hulu, efficiency of video playback is becoming more critical

# The Nightmare Energy Use Scenario

- Game console stays in some higher power state always “listening” for voice command, even at 3 AM.
- Game console used as media hub for watching TV. This means you have both game console and STB on at the same time whenever someone is watching TV.

– *“Essentially, the new Kinect is Microsoft's bet that it is best suited to win the battle for control of the TV user interface over cable and set manufacturers”*

(Adweek 9/23/2013: <http://www.adweek.com/videowatch/xbox-makes-bold-push-own-living-room-152650>)

# Last Question?

- *What impact will shift to ultra high definition (UHD) have on CE energy use? Its 4 times more content so:*
  - More powerful modems and routers
  - UHD set top boxes (ESTAR 4.1 to provide 15 kWh/yr adder)
  - UHD TVs
  - UHD game consoles
  - UHD computers
- The key is good power scaling (use less power when not moving, watching UHD content)

# Acknowledgements

- Thanks to Ecova for cutting edge field work and analysis on STBs and SNE -- Gregg Hardy, Chris Calwell, Jeff Swofford and their team of analysts.
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- LBL's Bruce Nordman and others for leading the effort on energy efficient ethernet
- EPA and ENERGY STAR for development and timely updates to their specifications for consumer electronics products.