

Public Policies for Energy Efficiency in Electronics and Networks

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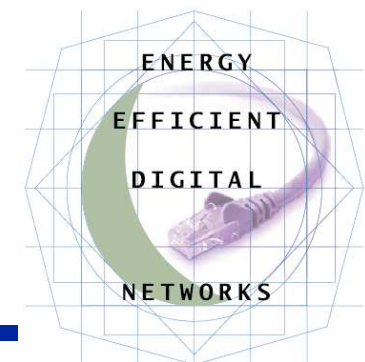
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Overview



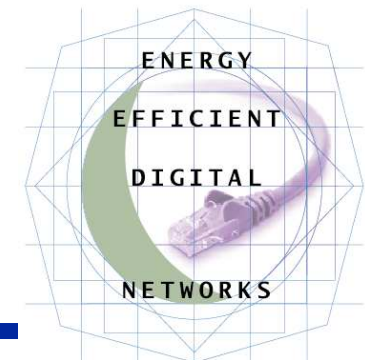
- **Background**
- **Why are policymakers interested in networks?**
- **EPA data center report**
- **Current and future policies**
- **Policy conclusions**
- **Industry actions**



LBL Research on Electronics and Networks



- LBNL has been researching energy efficiency in buildings for 30+ years (technologies and policies)
- Interest in electronics grew out of efforts to forecast energy use in buildings
 - “Miscellaneous” end-use growing 2-3x faster than others
 - Proliferation of IT and consumer electronics key to growth
- Increased focus on electronics energy use
 - Technical support to EPA ENERGY STAR
 - Energy use in low-power and standby modes
 - Growing realization that networks are in important driver of electronics energy use
 - Energy Efficient Digital Networks



Electronics and Networks



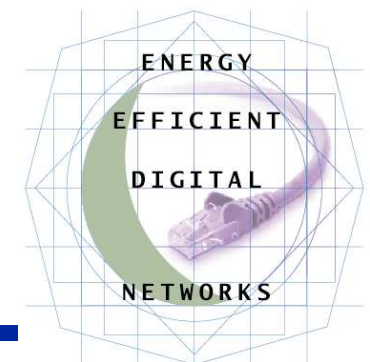
- Electronics are an end-use of electricity
 - “*Devices whose primary function is Information (obtain, store, manage, present)*”
 - Includes both Information Technology (IT) and Consumer Electronics (CE)
 - Much of this digitally networked already
- Electronics consumption in U.S. at least 250 TWh/year and rising
 - ~7% of all U.S. electricity consumption
 - 2/3 of future building-sector electricity growth is due to electronics and “other” (source: EIA AEO 2007)



What's driving policymaker interest in electronics?



- Rapid growth in energy use
- Climate change
- Energy security
- Peak load on power grid
- Networks and IT are critical infrastructure
 - Service economy key to national competitiveness
- Data centers combine all these interests
 - 2007 EPA report to Congress



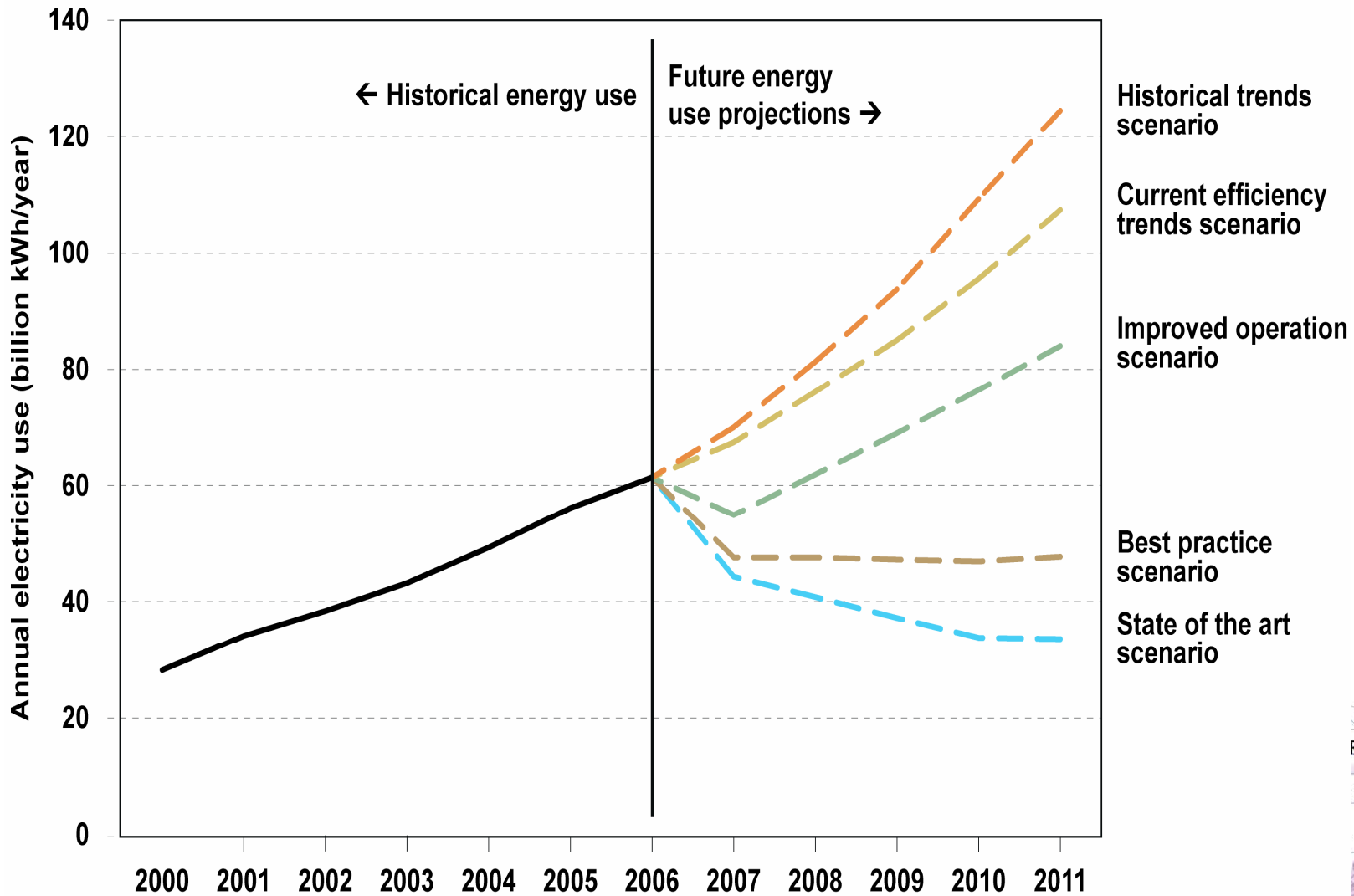
Public Law 109-431: EPA Report



- Purpose: **assess energy impacts on and from datacenters, identify energy efficiency opportunities, and recommend strategies to drive the market for efficiency**
- Goals:
 - **Inform Congress & other policy makers of important market trends, forecasts, opportunities**
 - **Identify and recommend potential short and long term efficiency opportunities and match them with the right policies**
 - **Identify areas for additional strategic research outside the scope of the report**

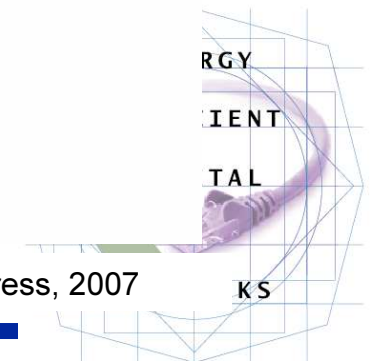


Projected Data Center Electricity Use 2007 to 2011



Includes power conversion and cooling

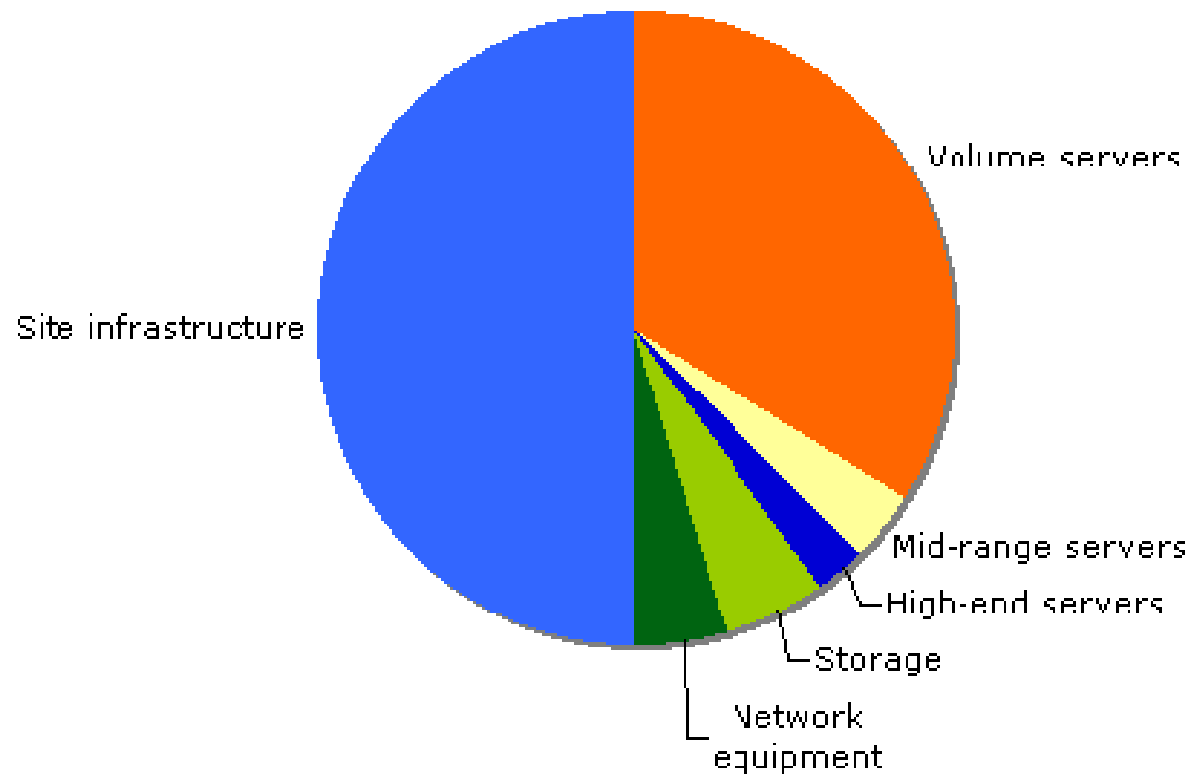
Source: EPA report to Congress, 2007



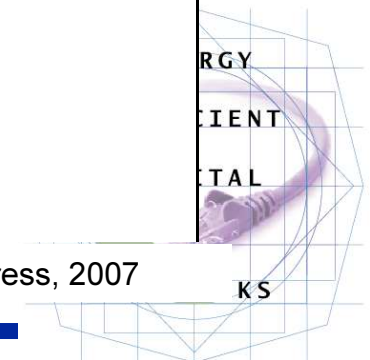
Electricity Use by End-Use Component 2006



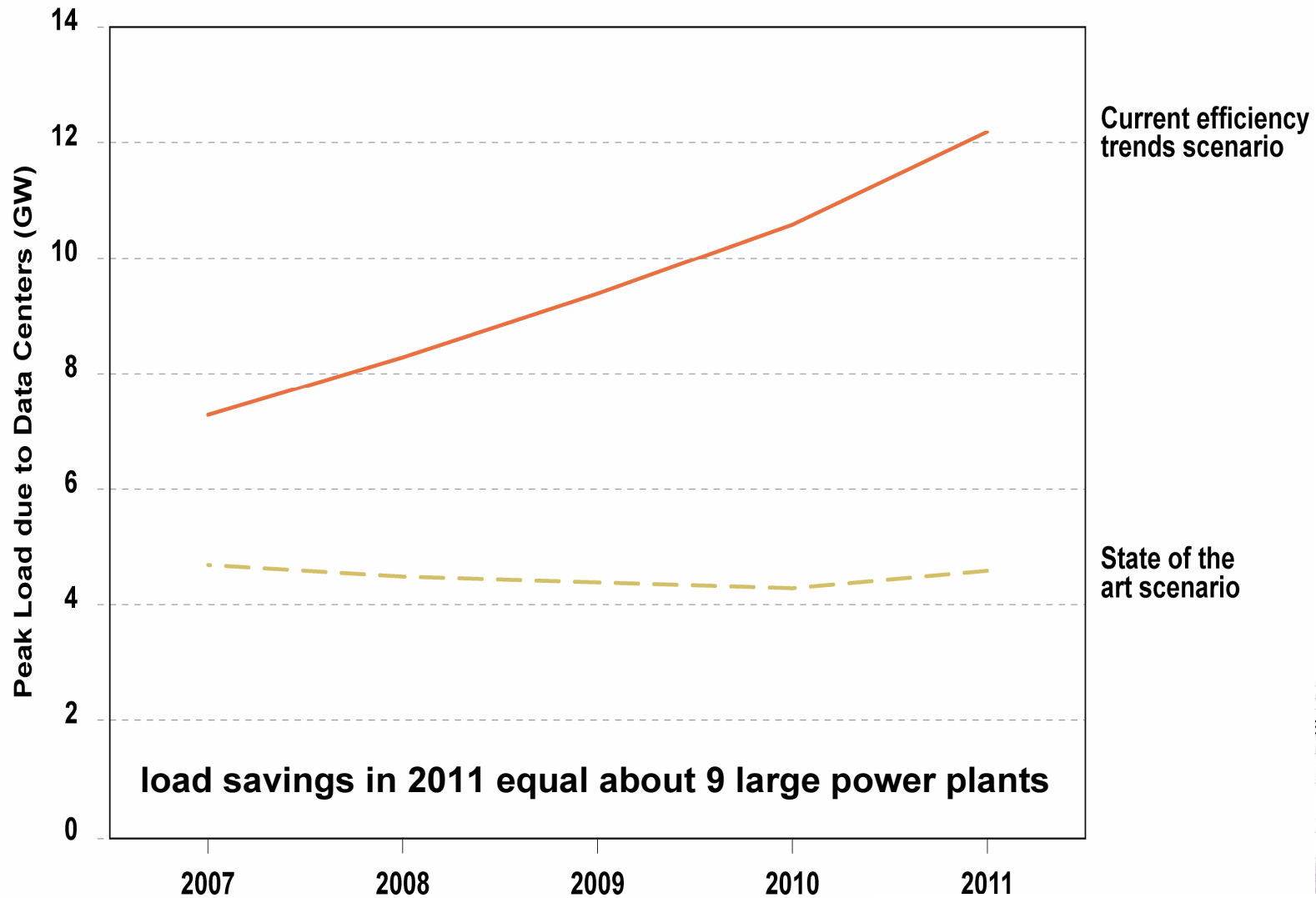
Total U.S. Data Center consumption in 2006 = 61.4 TWh



Source: EPA report to Congress, 2007



Peak Electricity Load Due to U.S. Data Centers



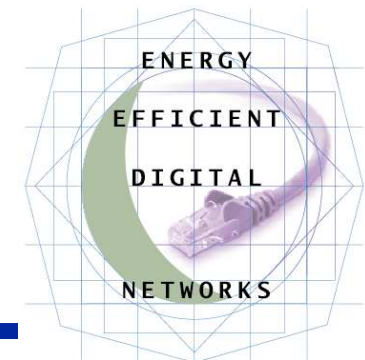
Source: EPA report to Congress, 2007



Current and Future Energy Efficiency Policies



- **Voluntary programs**
- **Information and education programs**
- **Minimum efficiency standards**
- **Other policies**



Voluntary Programs



- US

- ENERGY STAR product labeling
- ENERGY STAR for commercial buildings



- Europe

- EU Code of Conduct for Broadband Equipment (and draft CoC for Data Centers)



- Industry initiatives

- Climate Savers Computing
- Green Grid



ENERGY STAR Product Labeling



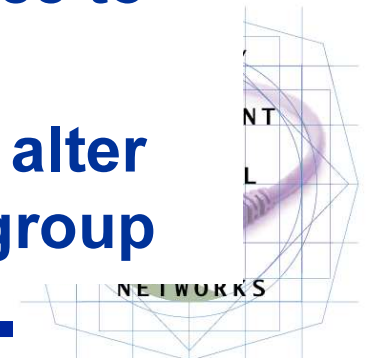
- **Currently covers some networked products**
 - PCs, imaging equipment
 - PCs: Current: Drop link speed in sleep and off
Proposed for next spec: EEE and Proxying
- **Several other products in process**
 - Set-top boxes (service-provider network is key)
 - Enterprise servers (network-reporting of power)
 - Add EEE to all specs at appropriate time (servers, STBs, displays, imaging, ...)
- **Considering enterprise storage equipment**
- **Considering network equipment, based on EU CoC and LBNL research**



EPA ENERGY STAR for Commercial Buildings – Rating System



- **Monitor actual as-billed energy data**
- **Create a whole building indicator (0-100 scale)**
 - **Capture the interactions of building systems not individual equipment efficiency**
 - **Includes all loads (data centers, IT equipment)**
 - **Track energy use accounting for weather and operational changes over time**
- **Allow for peer group comparison**
 - **Compare a building's energy performance to its national peer group**
 - **Track how changes at the building level alter the building's standing relative to peer group**



EU Code of Conduct for Broadband

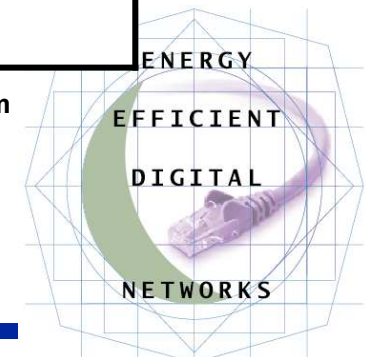


- **Manufacturers voluntarily commit to make >90% of their products meet On and Off power specs**

End-user equipment for residential and SOHO	Network Equipment
DSL modem Cable modem PLC modem	DSL port (ex: ADSL2)
(DSL) router with/without WLAN	Combined port (ex: MSAN)
Small hubs and switches	NTBA (ISDN terminator)
WLAN access points	
VOIP handset	
Optical network termination	

Source: http://sunbird.jrc.it/energyefficiency/html/standby_initiative_broadband%20communication.htm

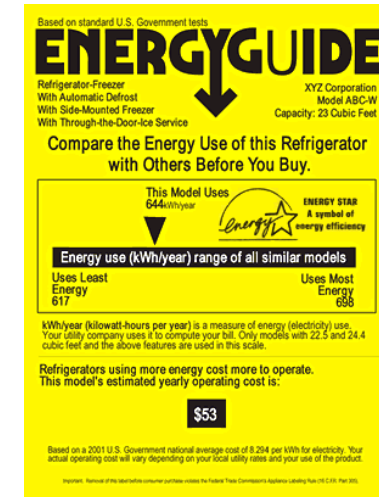
Example: ADSL modem, maximum 6W on, 0.3W off



Information & Education Programs



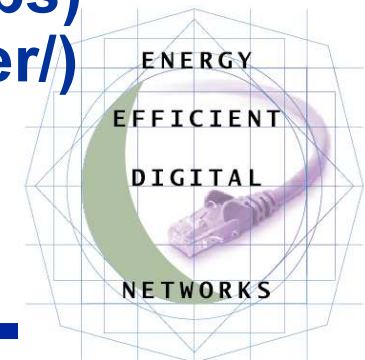
- “Grandfather” of labeling programs is EnergyGuide
 - Products with mandatory standards
 - Energy Independence and Security Act of 2007 directs EnergyGuide labels for several new electronic products
 - Energy-use “labeling” also effective in product directories, catalogs, etc.
- Tools and calculators
 - DOE developing Save Energy Now assessment protocol and tool for data centers
 - Working with Green Grid to include IT equipment in the assessment tool



Minimum Efficiency Standards for Electronics



- **US:** Energy Independence and Security Act of 2007 included standards for external power supplies
- **California:** Standards in place for TVs, audio, and power supplies. Considering standards for several home electronics products (set-top boxes, etc.) (www.energy.ca.gov/appliances/)
- **Australia/New Zealand:** considering regulations for home electronics, office equipment, external power supplies (www.energyrating.gov.au)
- **Japan:** Top Runner program has draft standard for average efficiency of small routers (<200 Mbps) and “L2” switches (www.eccj.or.jp/top_runner/)



Other Policies



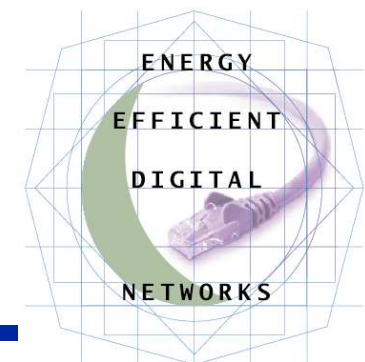
- **Utility programs**

- Rebates offered for 80 Plus PC power supplies
- CA utilities offer rebates for calculated savings (e.g., reduce server energy by 50% through virtualization)



- **Government purchasing**

- Federal and some state governments use ENERGY STAR for purchasing spec
- Federal government also sets specs for products not covered by ENERGY STAR



Other Policies (2)



- **Building codes**
 - None currently address network equipment
 - Appropriate for equipment installed during construction (network infrastructure?)
 - For buildings with PV generation, provide DC power distribution?
- **Technology procurement**
 - Pull new technologies/products into the market through large-volume purchases
 - Successfully used for refrigerators, windows, light fixtures



Policy Conclusions



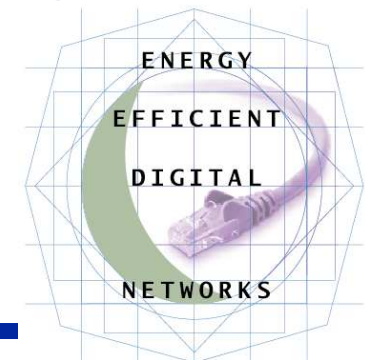
- **Nearly all policies require clear definition of:**
 - **Product categories**
 - **Test procedures**
 - **Power modes**
- **Test environment for networked equipment must include the network and associated workloads**
 - **# of ports connected, speed, traffic levels, etc.**
- **Difficult for regulatory policies to keep pace with rapid change in electronics industry**
- **International harmonization is important**
- **Magnitude of climate challenge driving policy-makers to look for all CO2 reductions**
 - **McKinsey study: electronics lowest-cost mitigation option**
 - **Despite enabling savings elsewhere in economy, can't ignore electronics energy use**



Industry Actions for Energy Efficiency



- **Work with LBNL and others to define product categories and test procedures**
- **Consider common industry methods of providing product power data**
- **Help drive international harmonization of network-related public policy requirements**
- **Work to ensure future network standards address energy use**
- **Use network to help reveal energy use patterns in data centers and buildings generally**





Questions?

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