

# Ac-Dc Server Power Supplies: Making the Leap to Higher Efficiency

Presentation to APEC  
Austin, TX  
March 8, 2005

Chris Calwell  
Policy & Research Director  
Ecos Consulting  
[calwell@ecosconsulting.com](mailto:calwell@ecosconsulting.com)

## Meet Dr. Art Rosenfeld:

Visionary

California Energy  
Commissioner

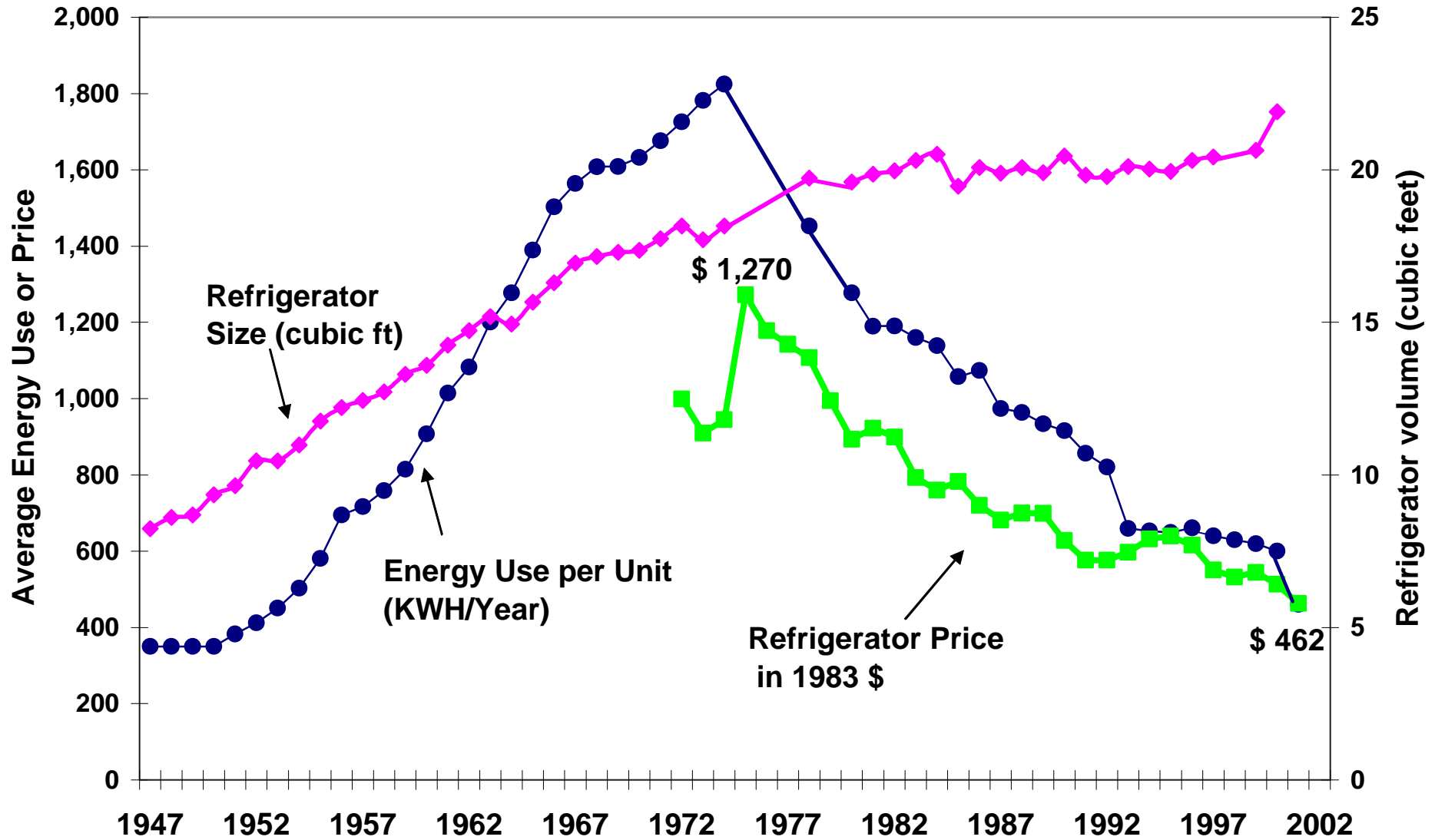
Nobel Prize-winning  
particle physicist

Tireless energy efficiency  
advocate:

“To those who say energy  
efficiency is nice, but real men  
build power plants, I say, ‘real  
men build *unnecessary* power  
plants.’”

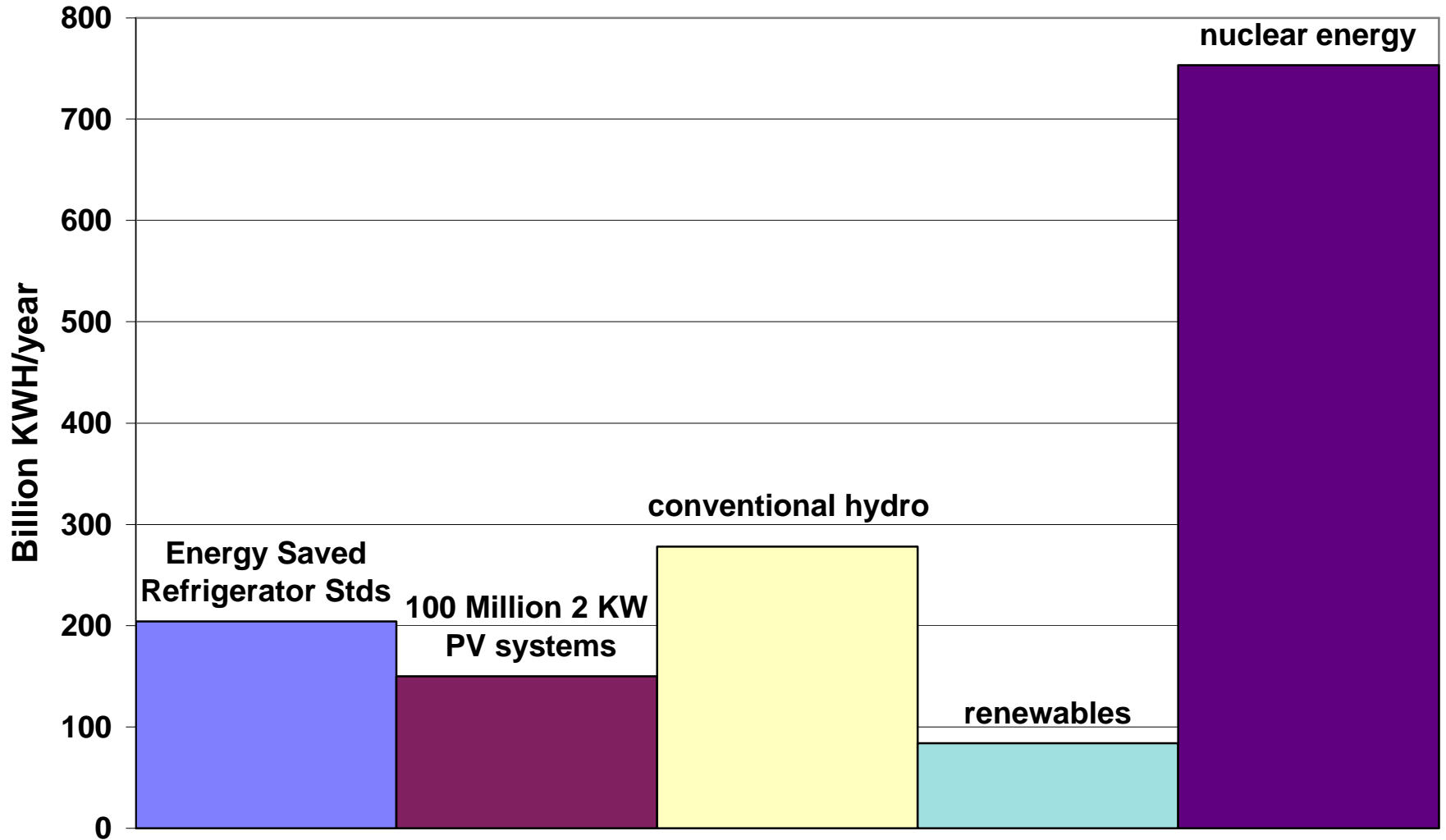


# United States Refrigerator Use v. Time



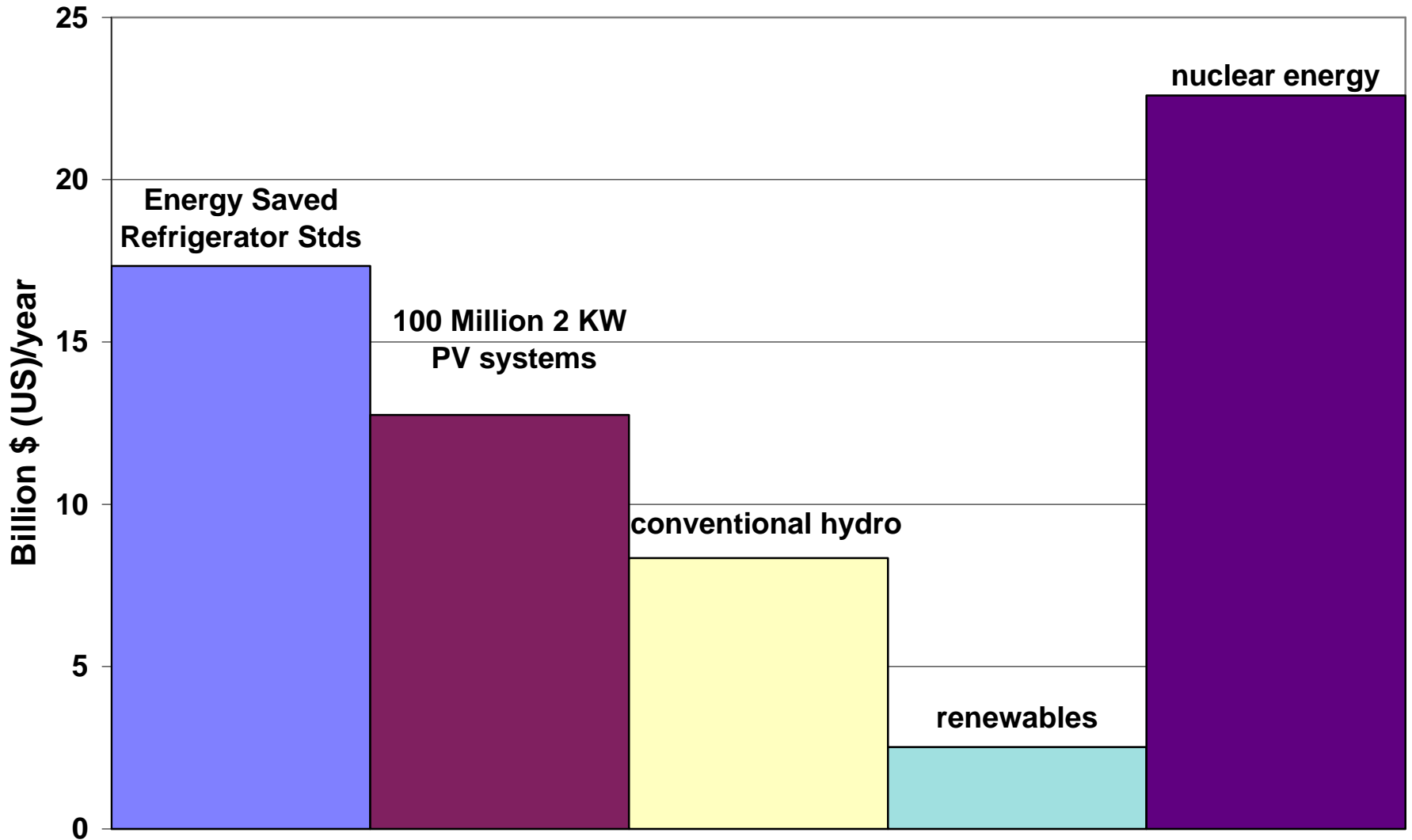
Source: Art Rosenfeld, California Energy Commission

# Energy Saved vs Energy Generation in Billion KWH



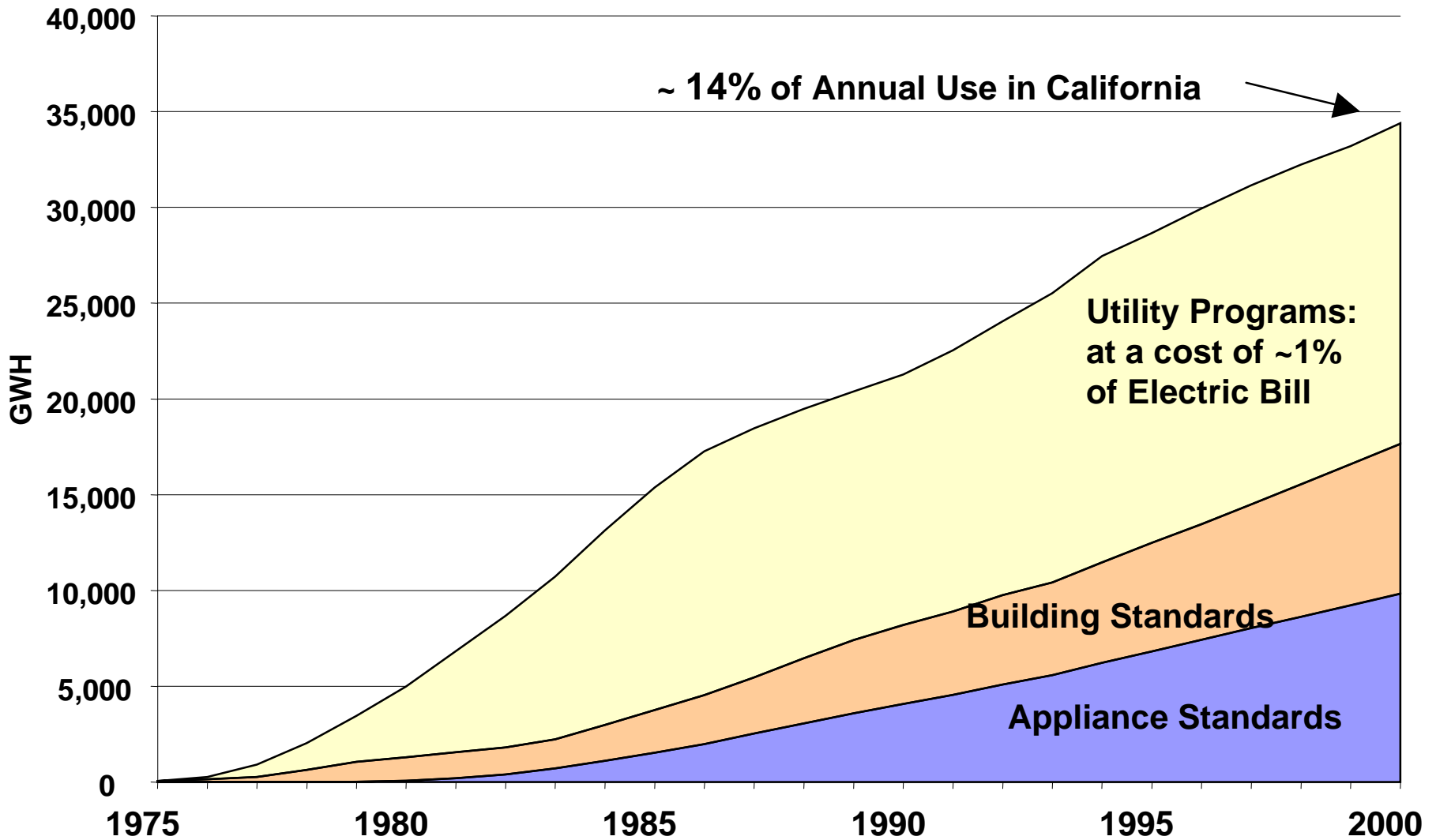
Source: Art Rosenfeld, California Energy Commission

# The Value of Energy Saved and Produced



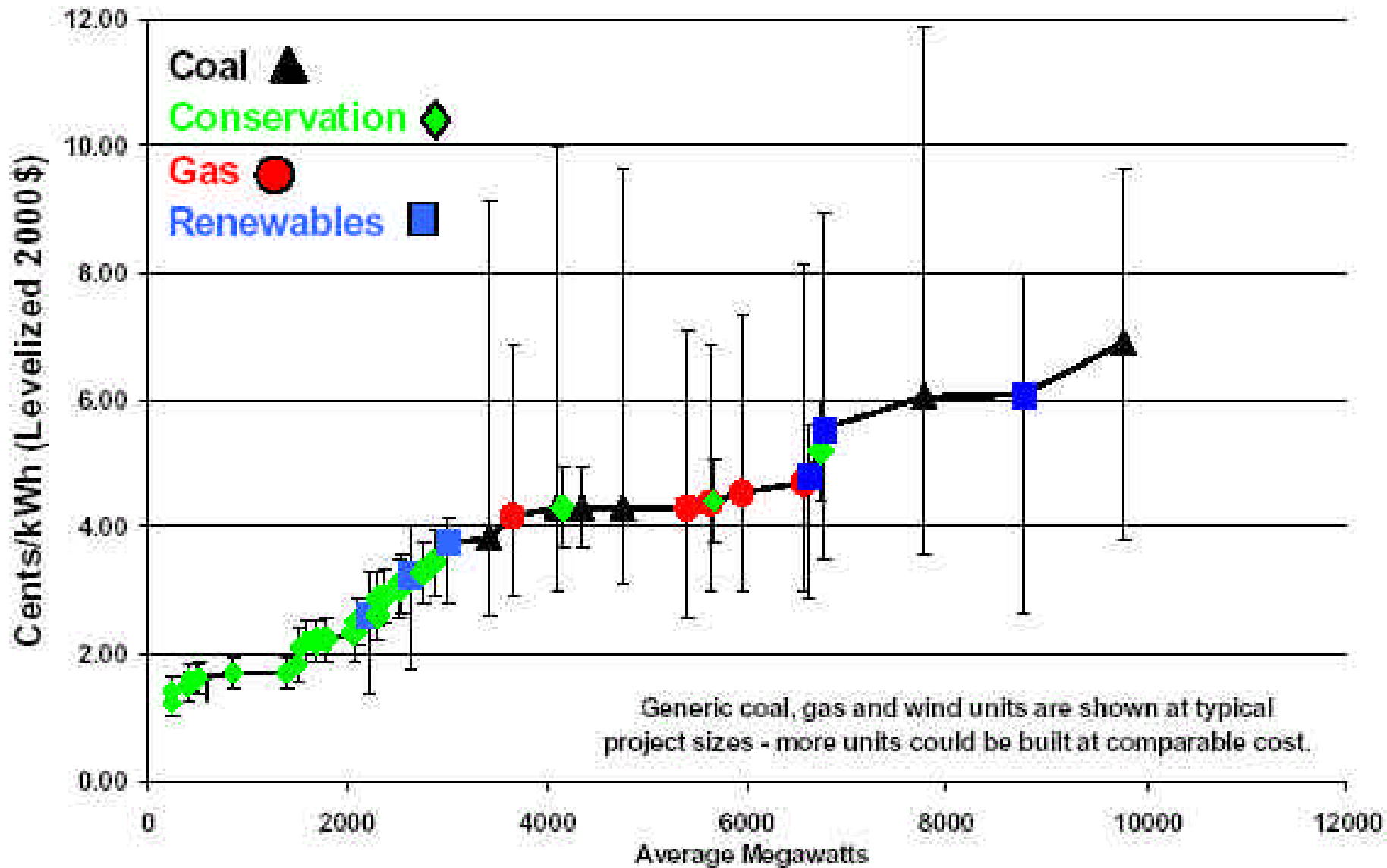
Source: Art Rosenfeld, California Energy Commission

# GWh Impacts from Programs Begun Prior to 2001



Source: Art Rosenfeld, California Energy Commission

# How the Northwest Plans to Meet New Electricity Needs Between Now and 2025

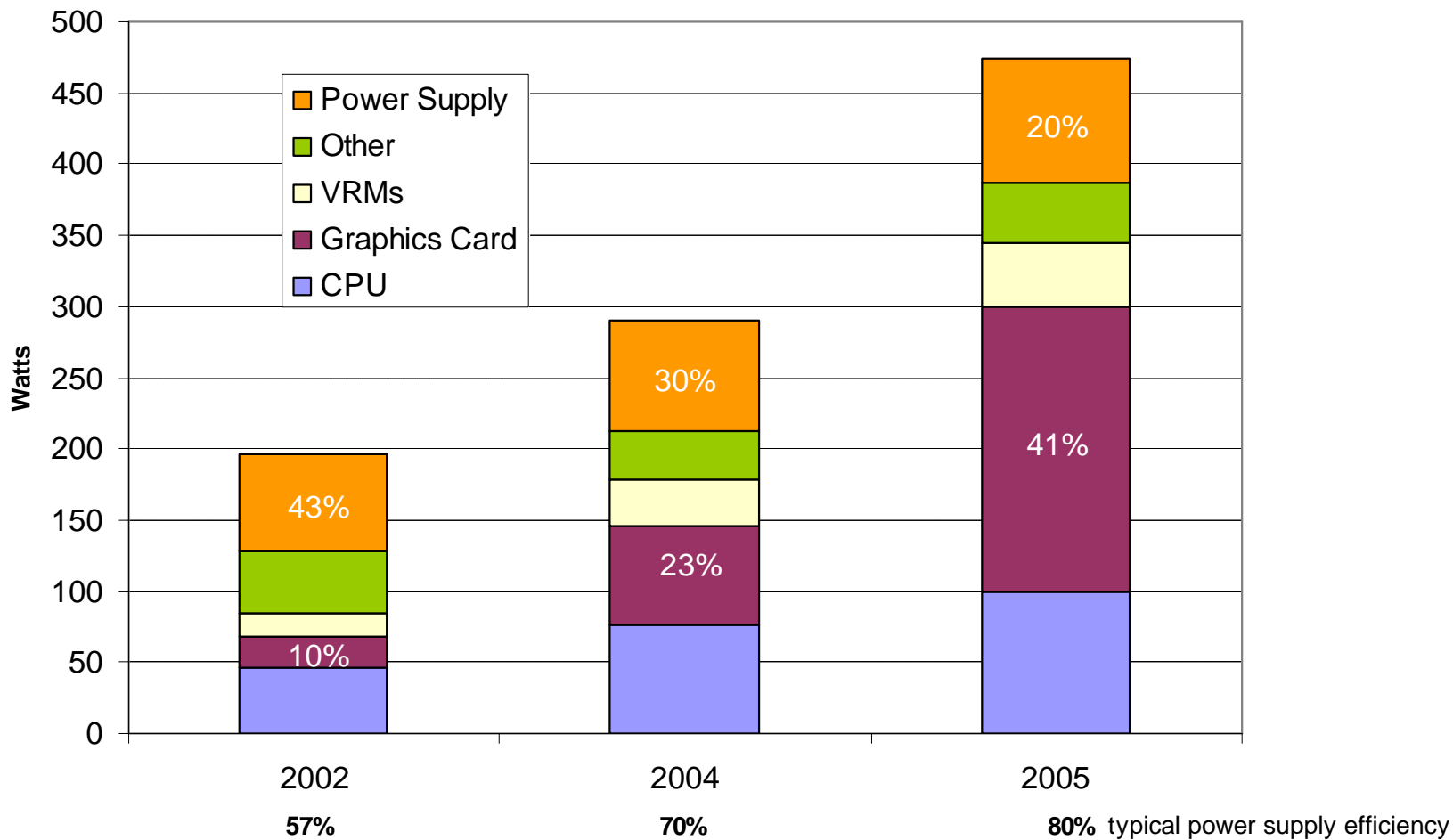


# Why Is It Important to Reduce Server and Desktop Computer Energy Use?

- IT equipment consumes \$8 billion of electricity every year (100 billion kWh)
- Computer electricity use is growing over twice as fast (3.2%/yr) as total electricity use (1.4%/yr)
- As everything else has gotten more efficient, computers are a growing chunk of the opportunities left for saving energy
- Reducing power saves money, reduces heat and noise, and improves reliability
- It's cheaper and better for the environment to save energy in computers than generate it in power plants

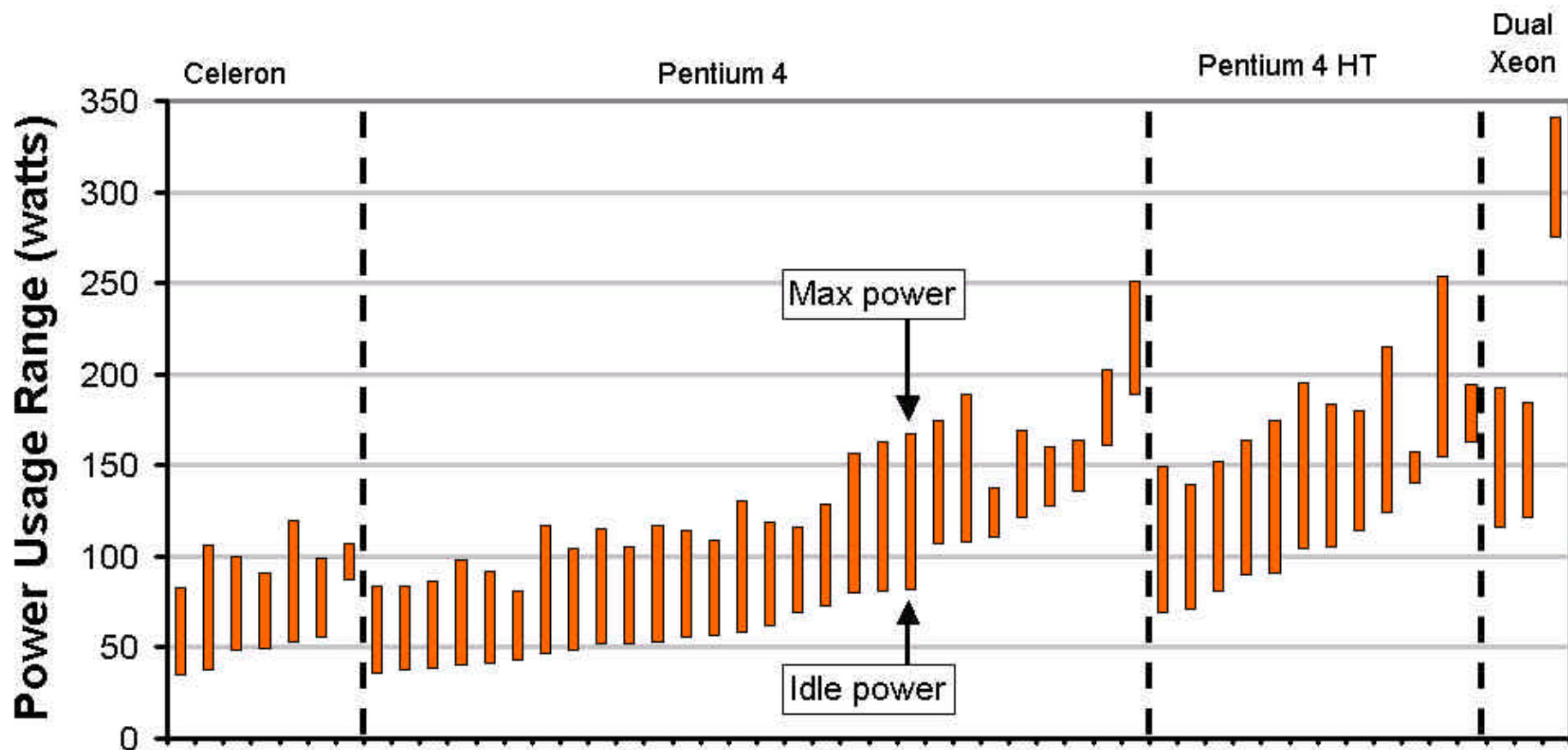
# Computer Purchase Prices Are Falling, But Operating Costs Are Rising Fast

Projected Change in Peak Power Consumption of Desktop Computers



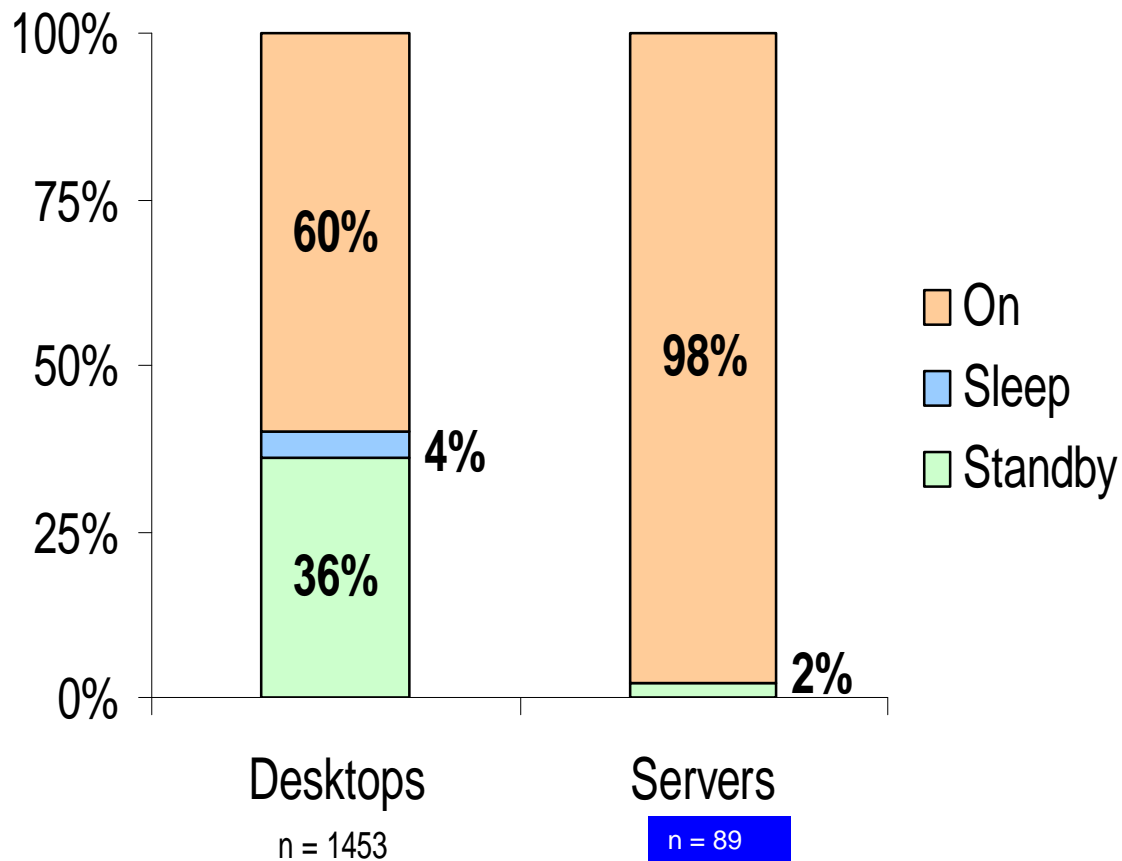
# Desktop, Workstation, and Server Power Use is Continuing to Escalate

Manufacturer Reported Power Data on Desktop PCs



# Relying on Sleep Mode Isn't Enough Anymore

Percentage of Computers Found in Each Mode During LBNL Night Audits



Need a technology change that guarantees lower energy use in all modes of operation

# Power Reduction – Planar View

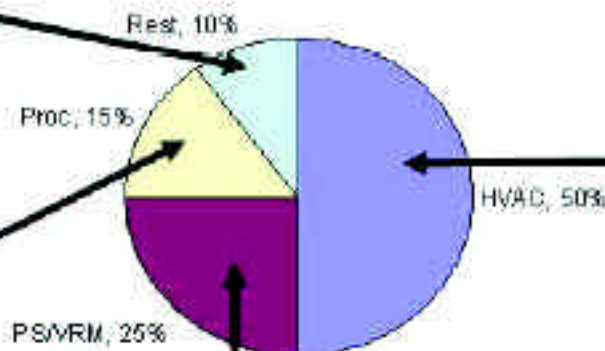
- Intel technology investments paying off
  - DDR2-400 30 to 40% lower power than DDR1-400†
  - Continued planar component integrations

Advanced memory, I/O integration, low-power drives

Remove leakage component, new adaptive circuits, take advantage of thermal headroom

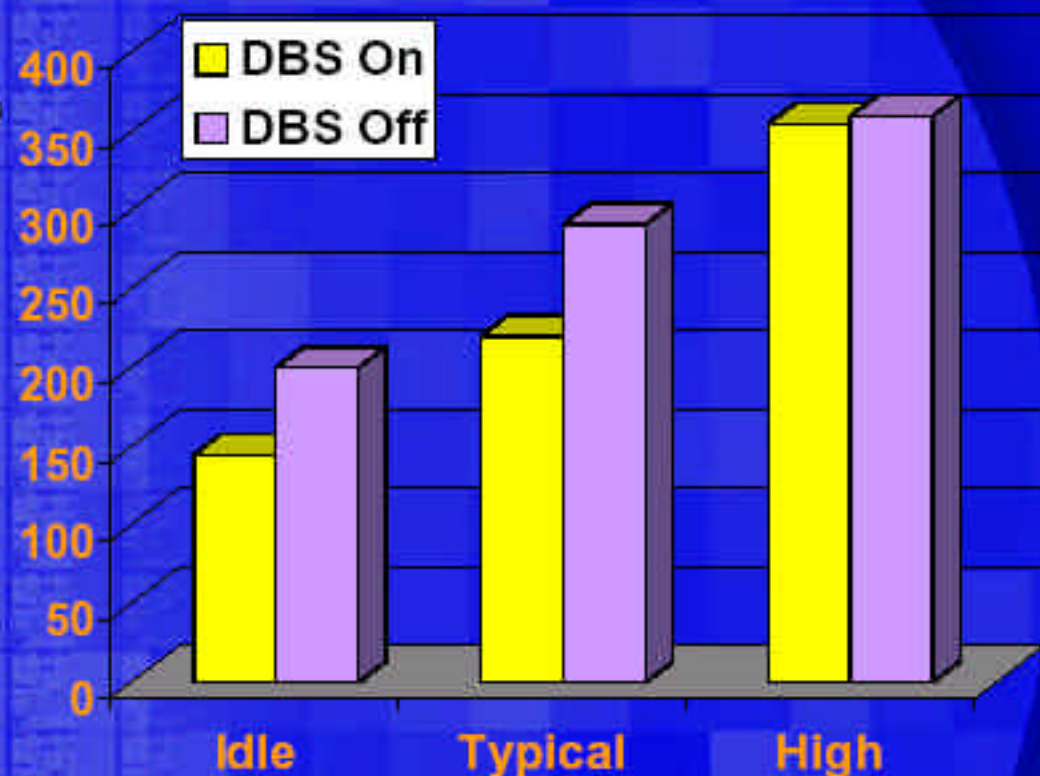
Multi-point highly efficient PS/VRM's, and reduced number of discrete voltages

Reduce Over-blowing via predictive heat-load analysis



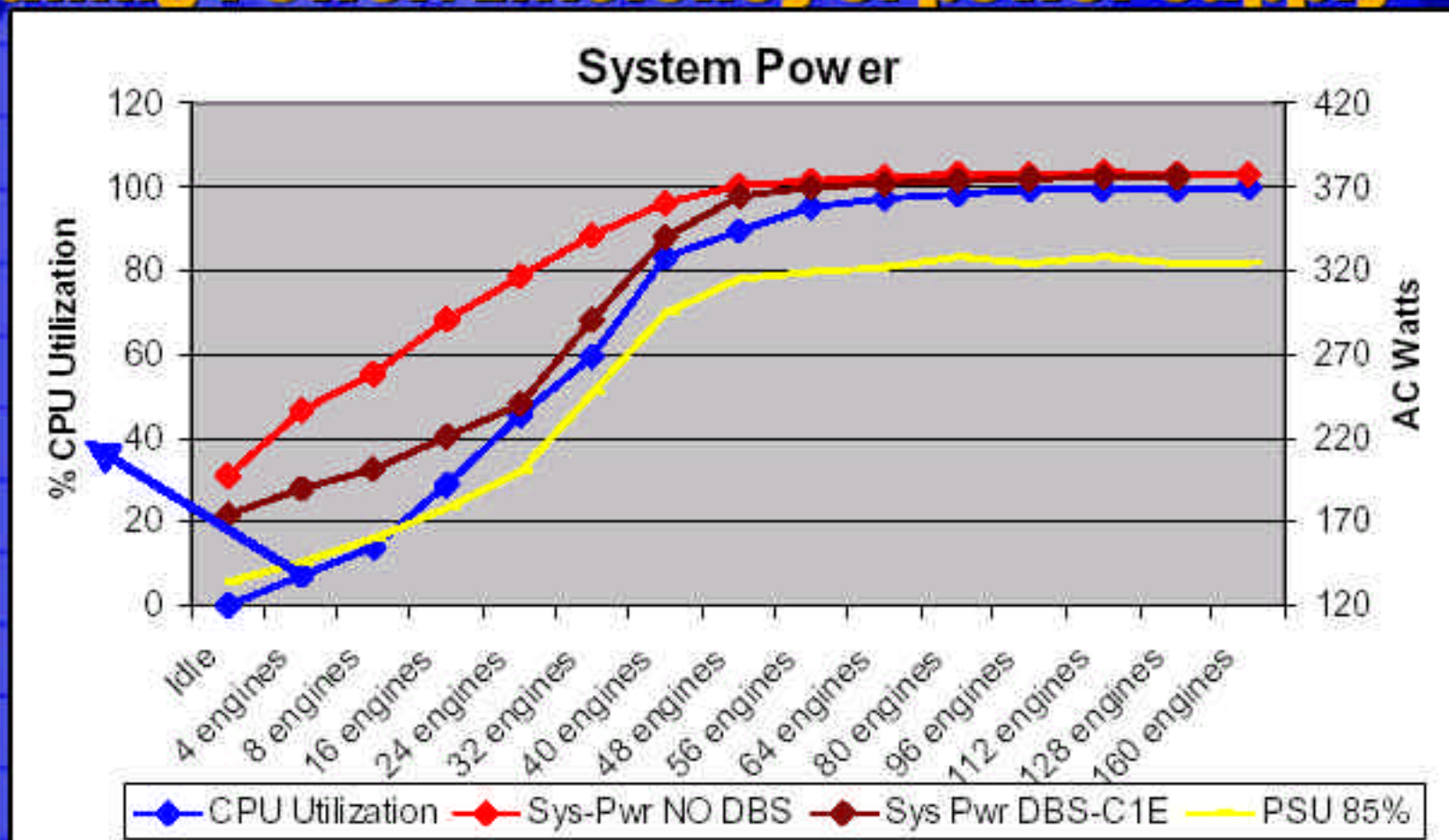
# DBS Benefits

- Power saving up to 24%
- Performance: No measurable impact
- Higher Performance/Watts



**DBS improves Performance/Watts**

# Tuning Power: Efficiency of power supply



# Intel's Family of Power Tools

- **Intel® Power Gauge:**

- Utility measures actual power consumption
- Real time data collection instead of worst case assumptions



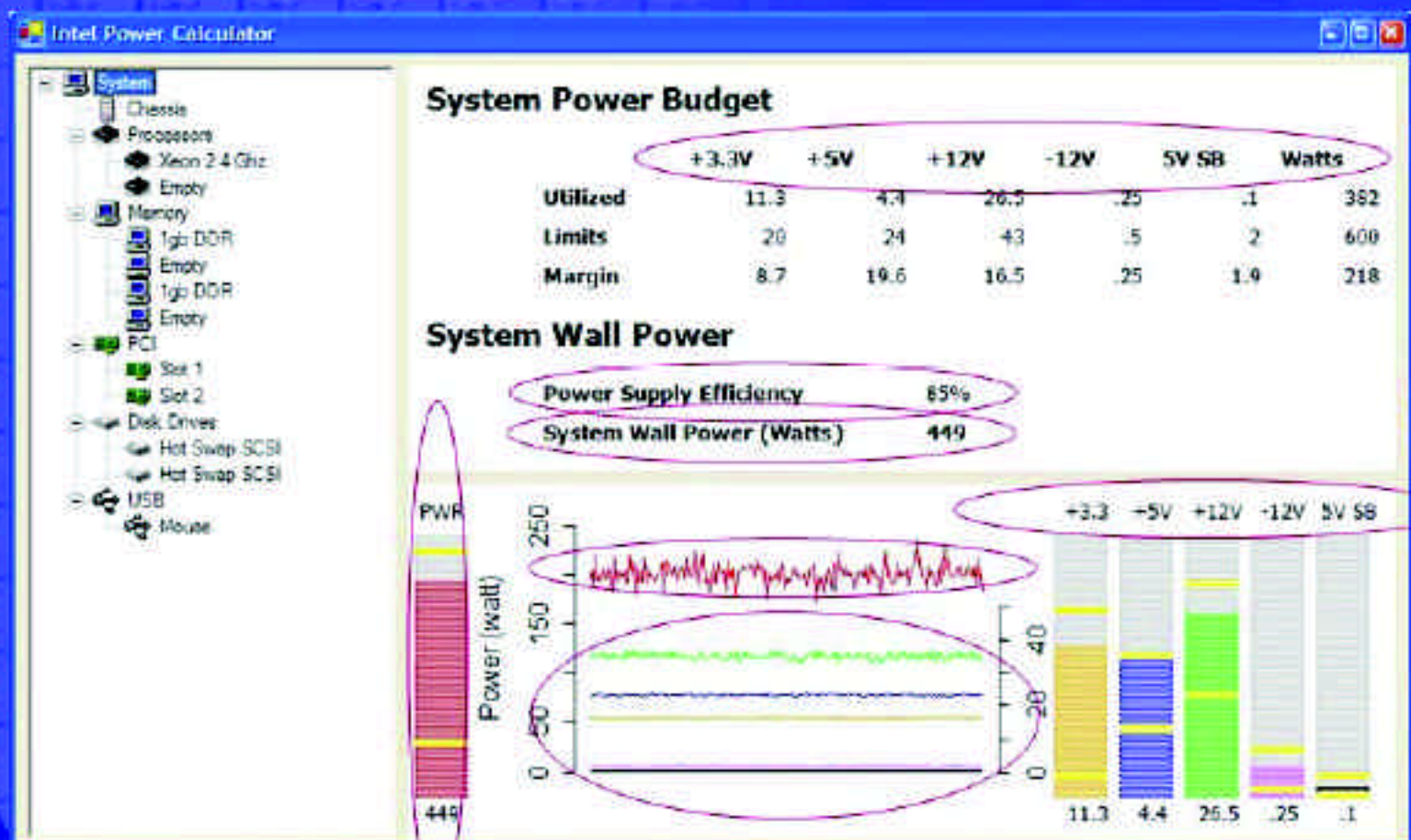
- **Intel® Power Calculator:**

- Utility estimates worst case system power
- Uses actual system components versus nameplate (full configuration)



*Reliable, standardized approach to help optimize rack utilization*

# Tools - Sample GUI

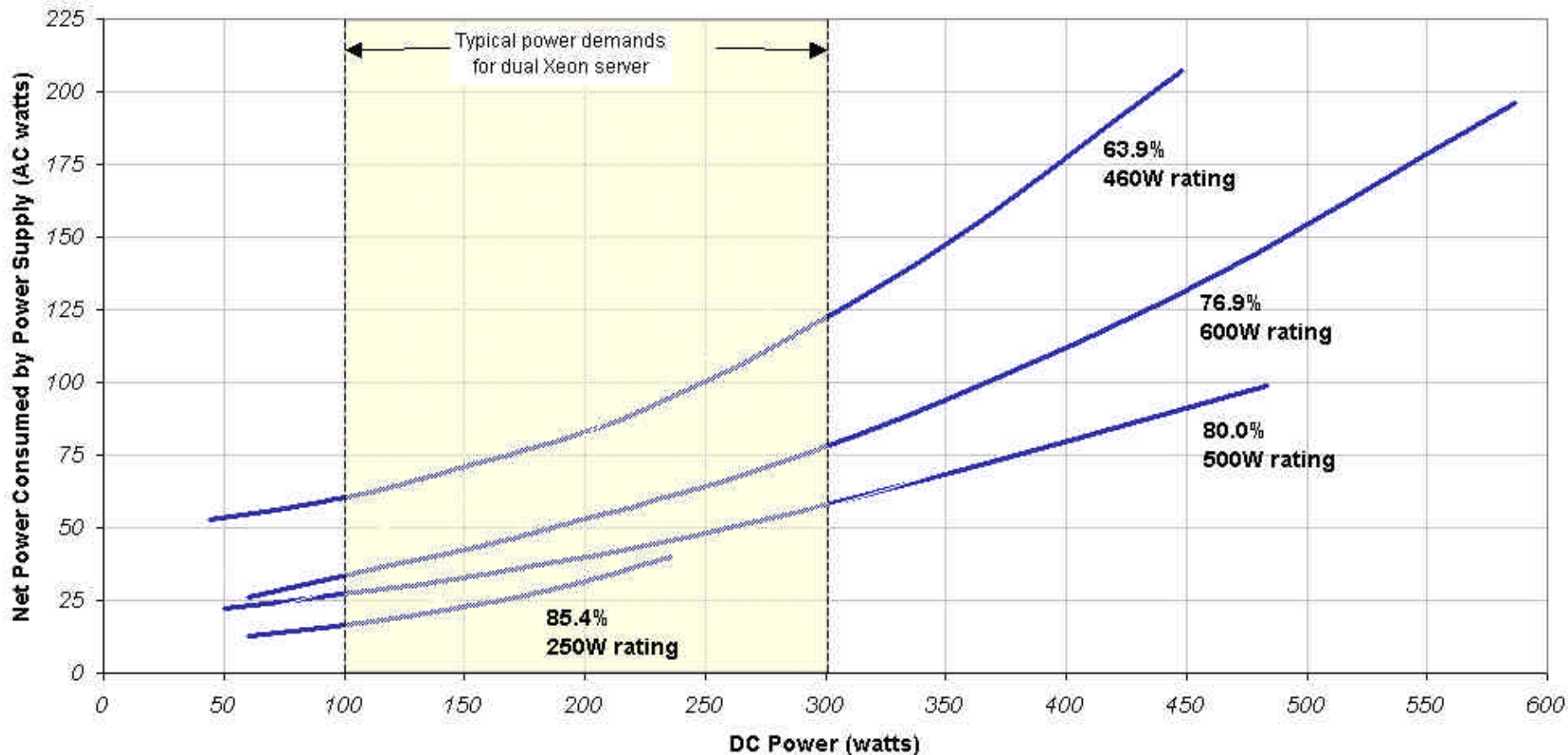


Load

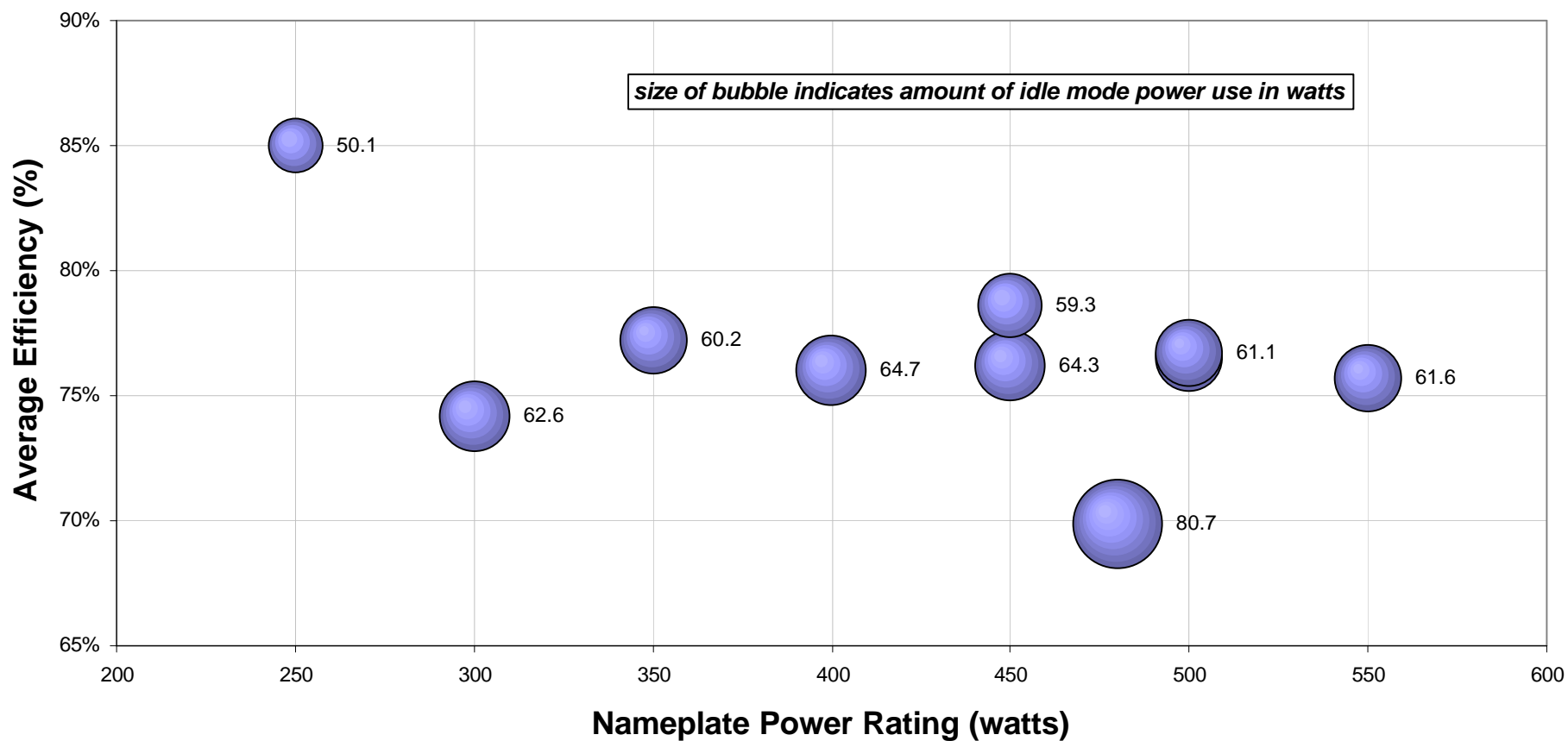
Efficiency Line

# Need Proper Sizing and High Efficiency

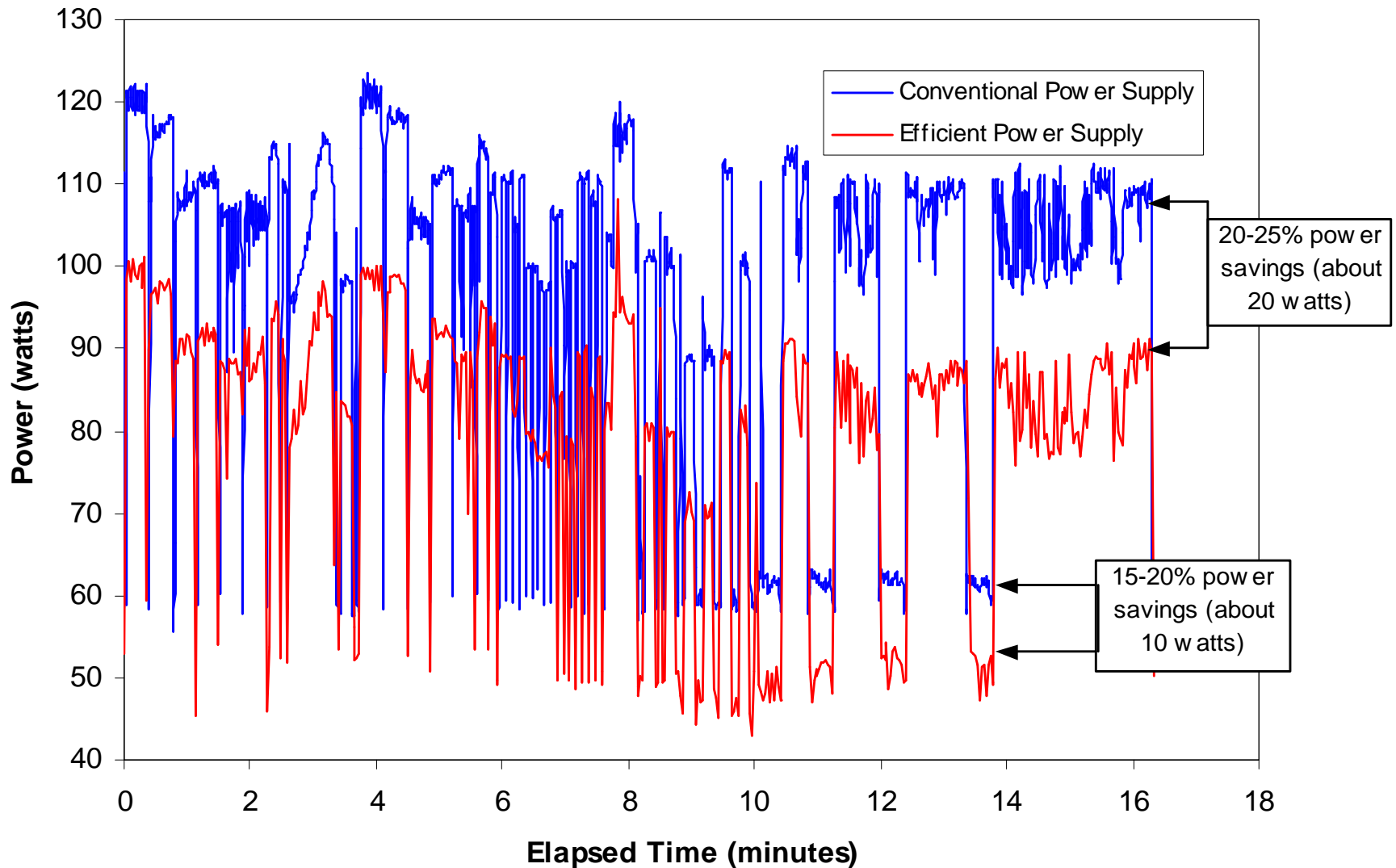
**Power Consumed Through Server Power Supply Inefficiency**  
for a single power supply system



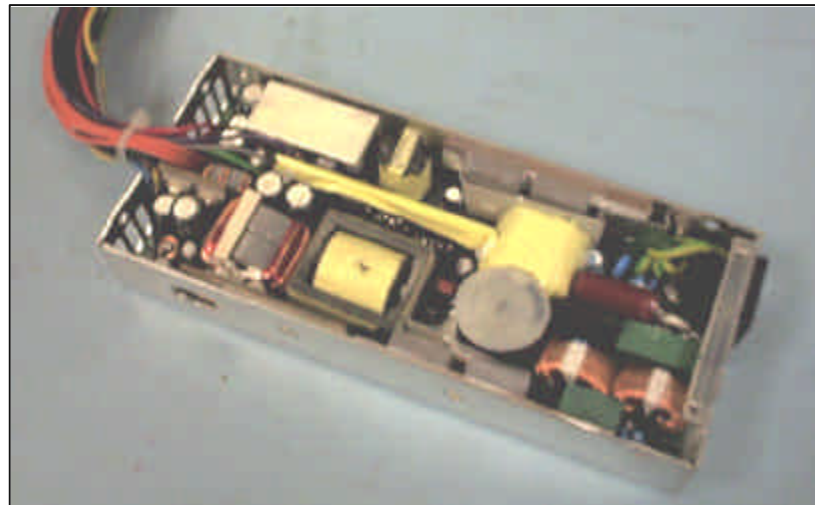
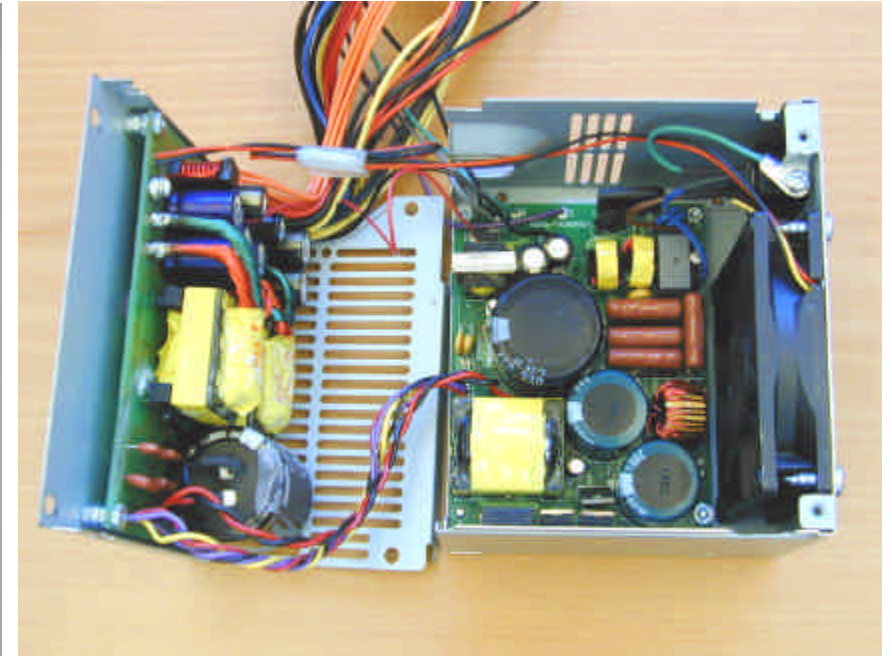
## Idle Power Wattage Affected by Average Power Supply Efficiency and Power Supply Size



# Highly Efficient Power Supplies Cut PC Energy Use in All Modes of Operation

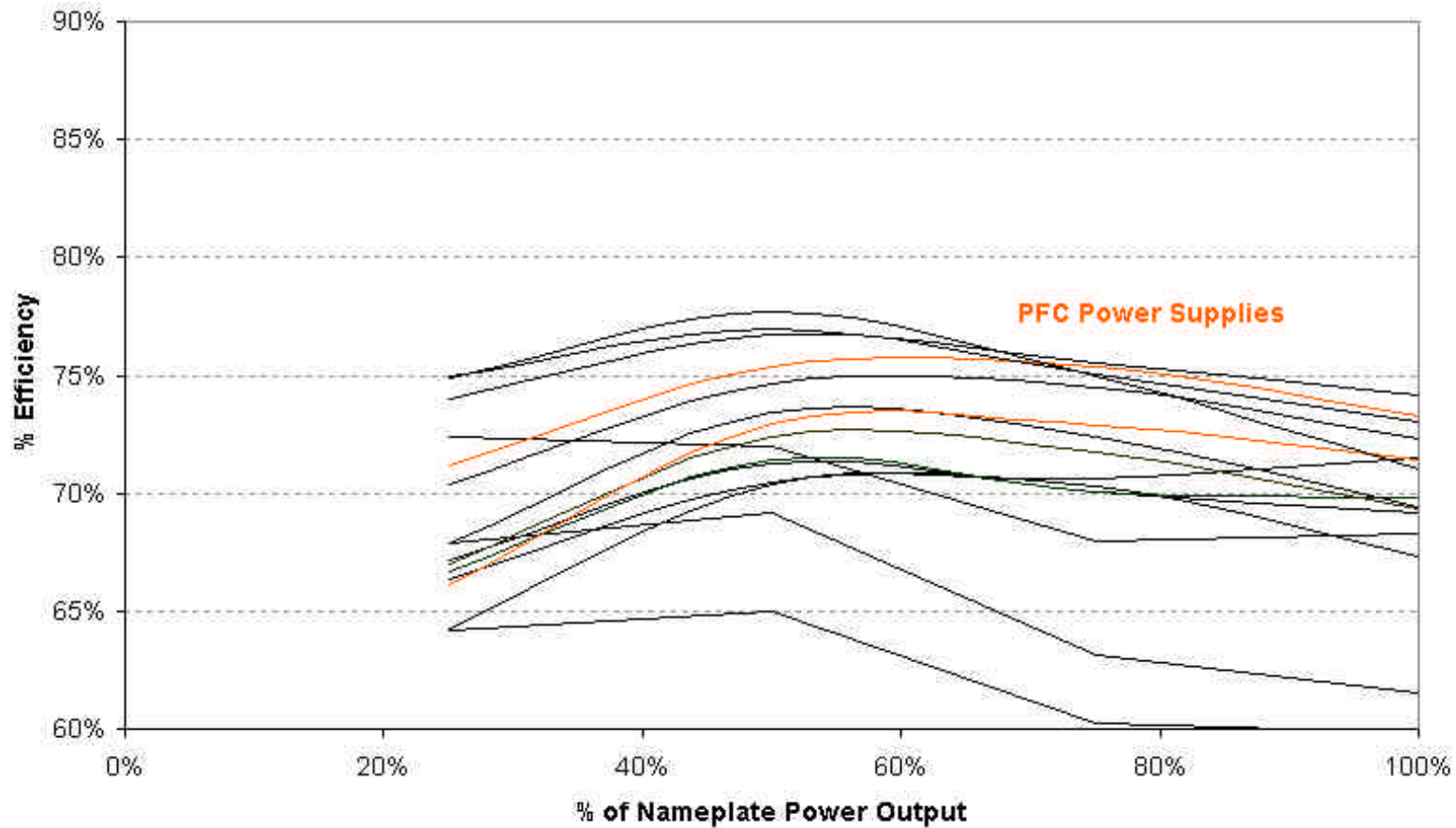


# More Efficient Power Supplies Can Be Simpler and More Reliable than Traditional Designs



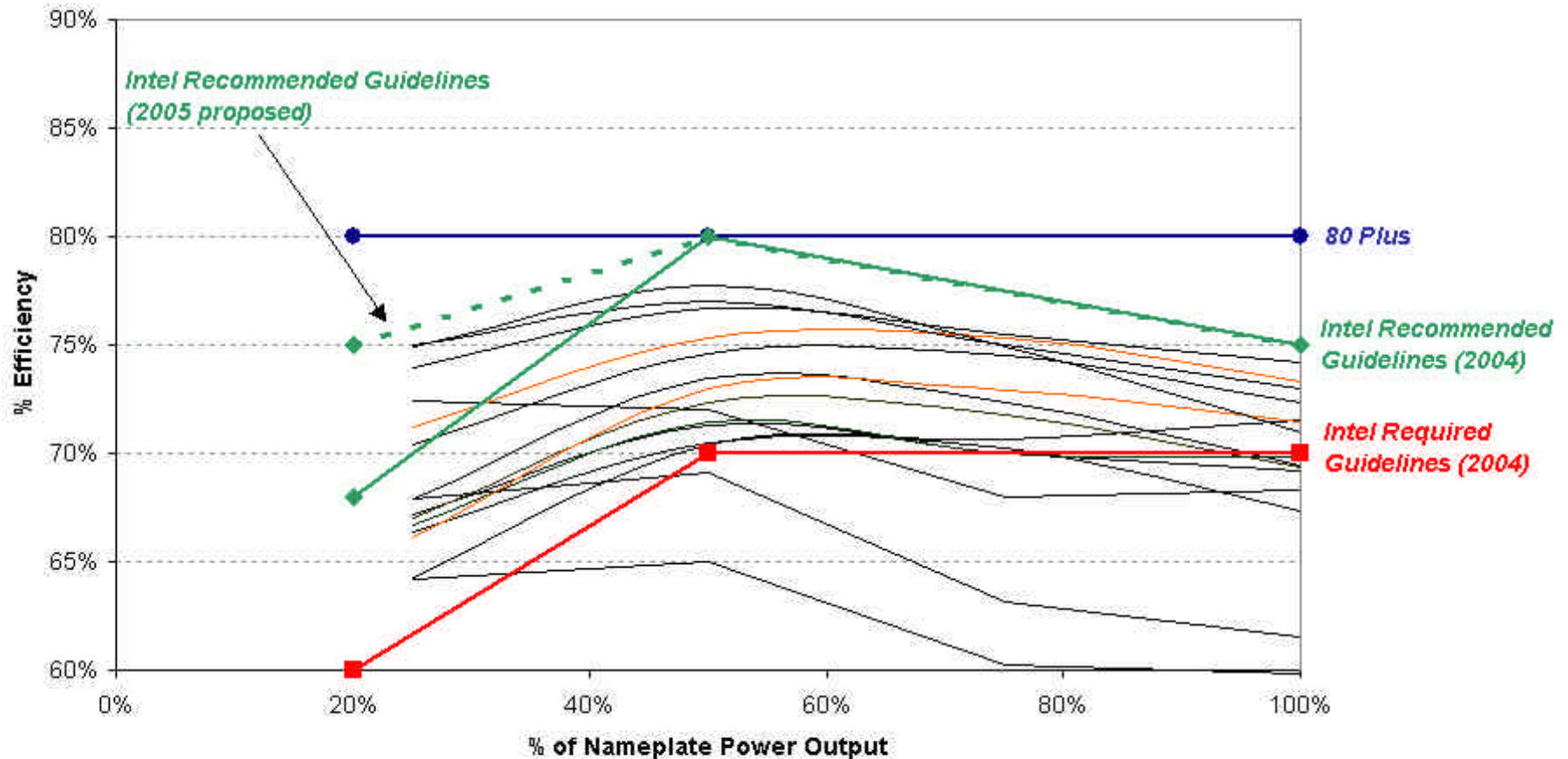
# Typical Efficiency Levels in mid-2004

Measured Desktop Power Supply Efficiencies



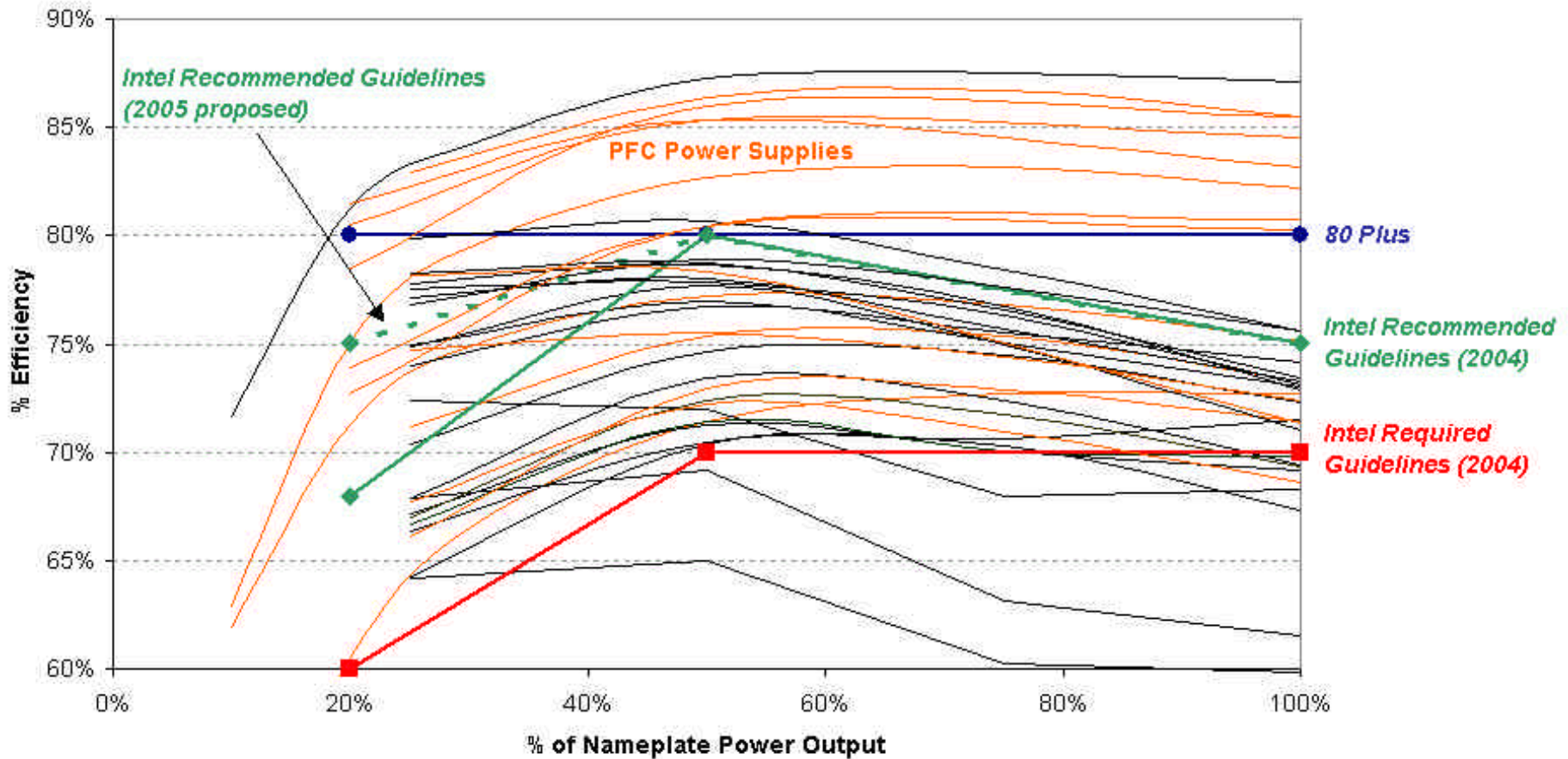
# Intel and the Electric Utilities Introduce New Efficiency Specifications

## Measured Desktop Power Supply Efficiencies



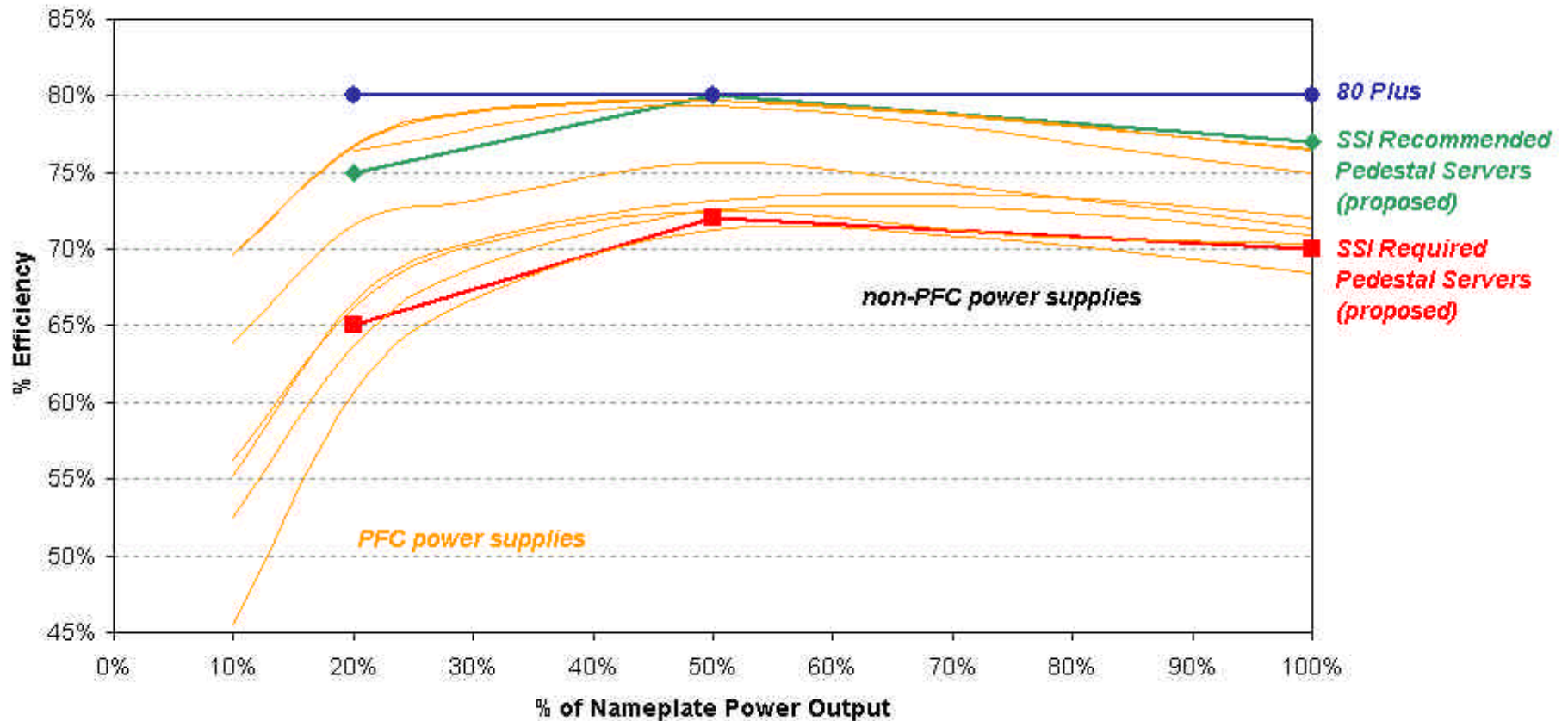
# Efficiency Levels in March 2005

## Measured Desktop Power Supply Efficiencies



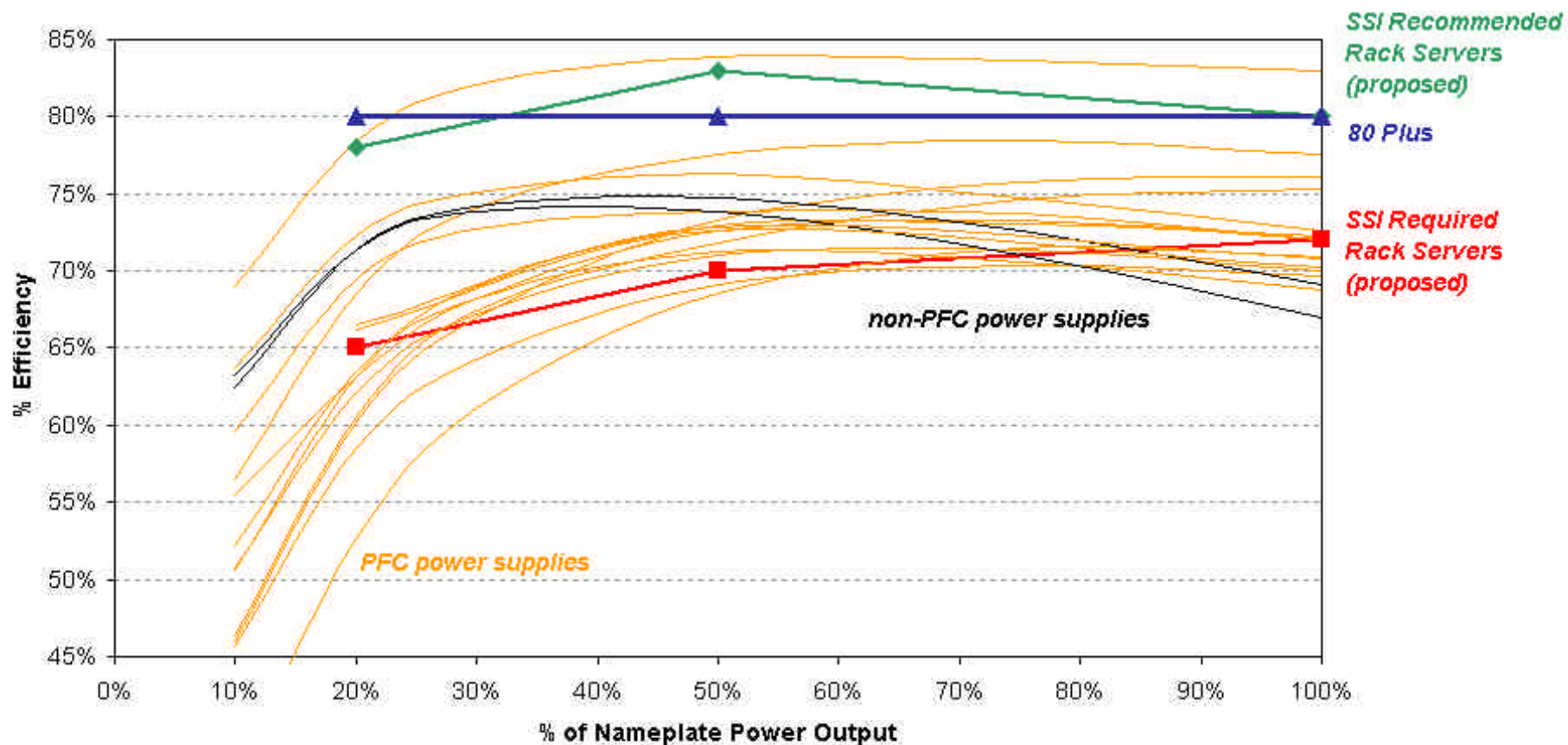
# Can We Do the Same with Servers?

## Measured Pedestal Server Power Supply Efficiencies



# Proposed SSI and ENERGY STAR Levels for Rack Servers Are Even Higher than 80 Plus

Measured Rack Server Power Supply Efficiencies





## 80 Plus – The Opportunity

- Manufacturers can get paid now to be compliant with future ENERGY STAR levels
- Create market differentiation and profit opportunities for innovators other than expanding power supply wattage
- Escape from the “commodity trap” of the power supply business
- Third party validation of efficiency & power factor to help market products in U.S. and internationally

# 80 Plus Funding Support



# 80 Plus Qualifying Power Supplies



- First 80 Plus compliant PS – Feb 2005
  - Seasonic SS - 400HT
  - 400W, ATX12V, PFC
- Celetronix and Acbel also have qualifying designs awaiting official certification
- OnSemi introduced a prototype at APEC 2005 that it believes will qualify
- Commergy, GTI Power, iWatt, and others all have promising technology that may qualify in the future
- No qualifying server units to date
- Visit [80Plus.org](http://80Plus.org) for more details.

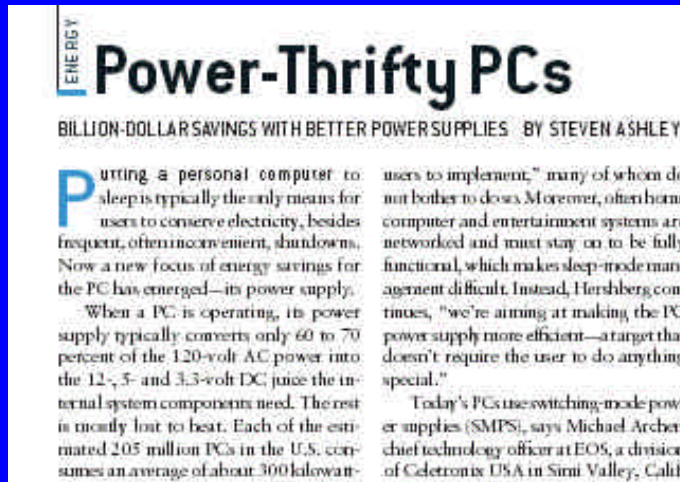




# Media Coverage



Wall Street Journal  
February 26, 2004



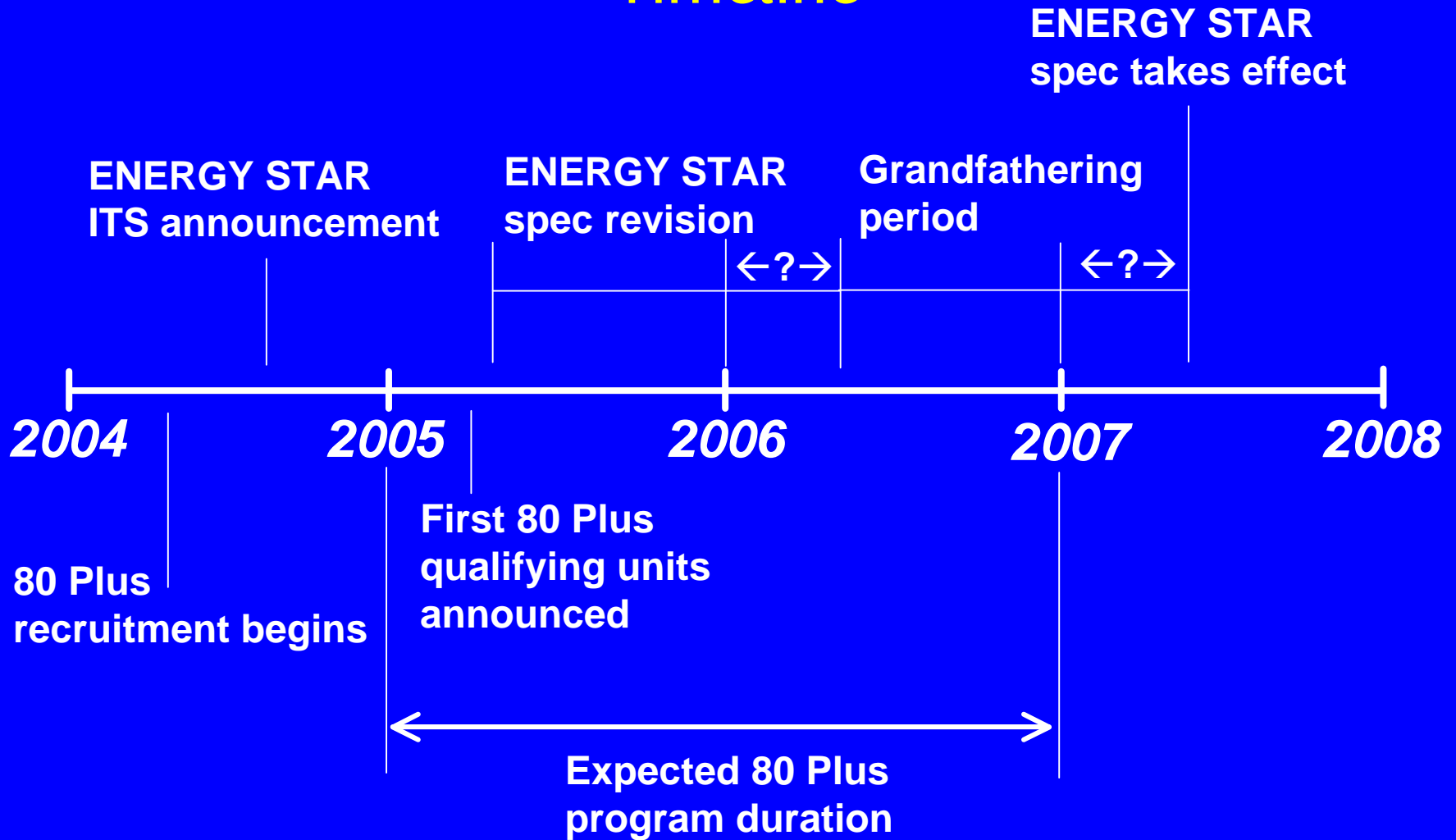
Scientific American  
June 2004



Consumer Reports  
January 2005

Ziff Davis' senior technical editor, Bill Machrone, also wrote two recent articles on computer energy efficiency for *PC Magazine*: "The Electron Leak," October 5, 2004 and "Electron Leak? Raging Torrent!" November 16, 2004.

# Desktop and Server Power Supply Developments Timeline



# Progress in the Development of an Environmentally Preferred Desktop PC



IBM PS/2e



NEC PowerMate Eco



Apple iMac G5



# Apple's iMac G5

Idles at 50 watts (including 17" LCD screen)

