

Forging Ahead with Desktop PC Power Supply Efficiency Improvements

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Agenda

- Intel's interest in desktop power supply efficiency and actions taken to date
- EPA's plans to revise the ENERGY STAR* computer specification to consider active mode and power supply efficiency
- Ecos Consulting's* 80 Plus Program* – using electric utility funding to buy down the extra cost of efficient computer power supplies
- Strategies for success: opportunities to work together to improve computer energy efficiency

Key Message

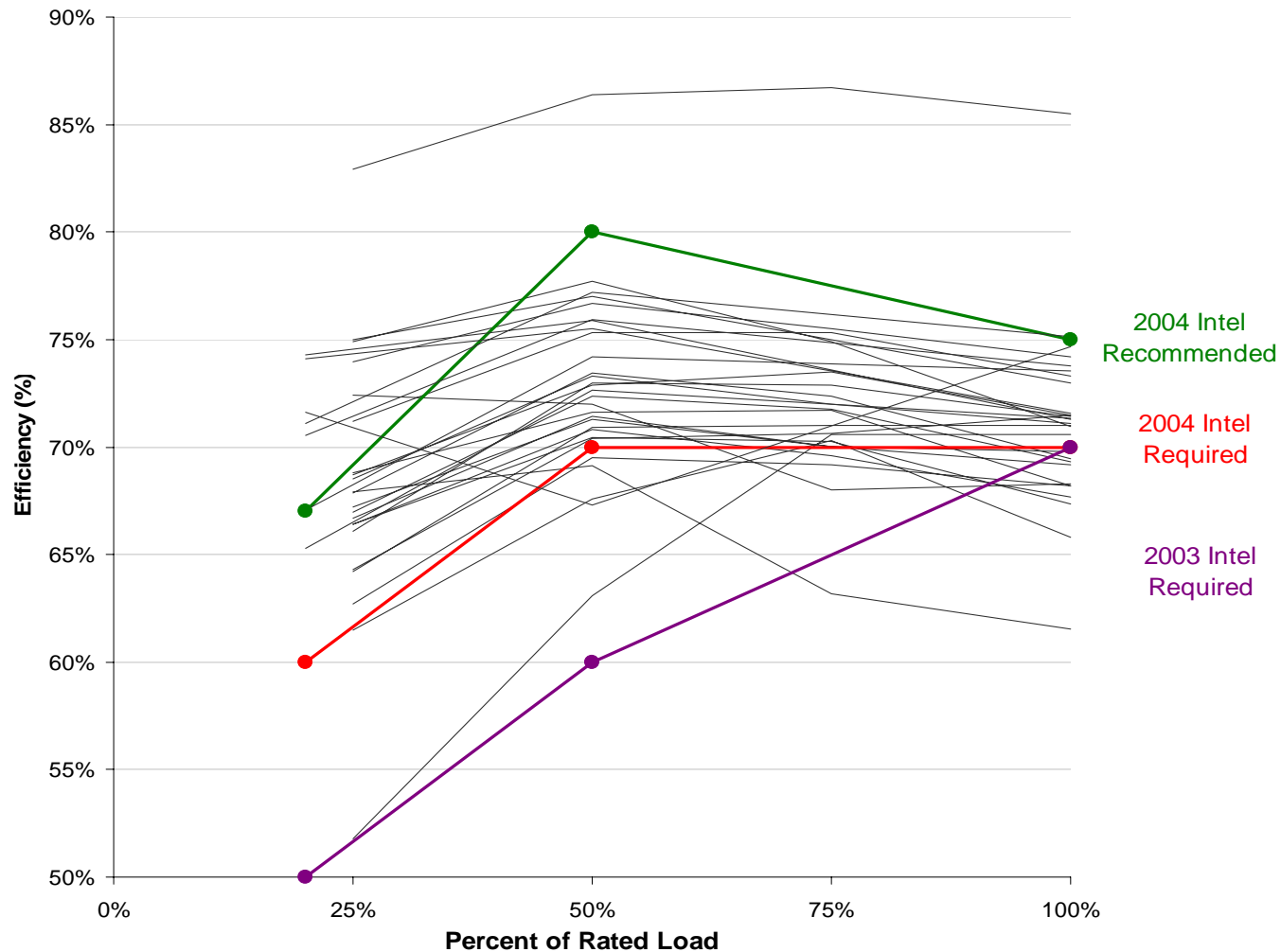
Why do we need to improve the efficiency of desktop power supplies (PSU)?

- Users want smaller, quieter PCs
- Users demanding features that increase peak power use and total energy use
- More power means more heat and more noise, unless efficiency improves
- Reduces Total Cost of Ownership (TCO) with a potential slight initial cost increase
- Reducing environmental impact is increasingly important to customers and manufacturers



Intel's Efficiency Targets

Desktop Computer Power Supply Efficiencies: Measured Data Vs. Industry Specifications



2004 Intel Recommended Level likely to become Intel's Required Level sometime in 2005.

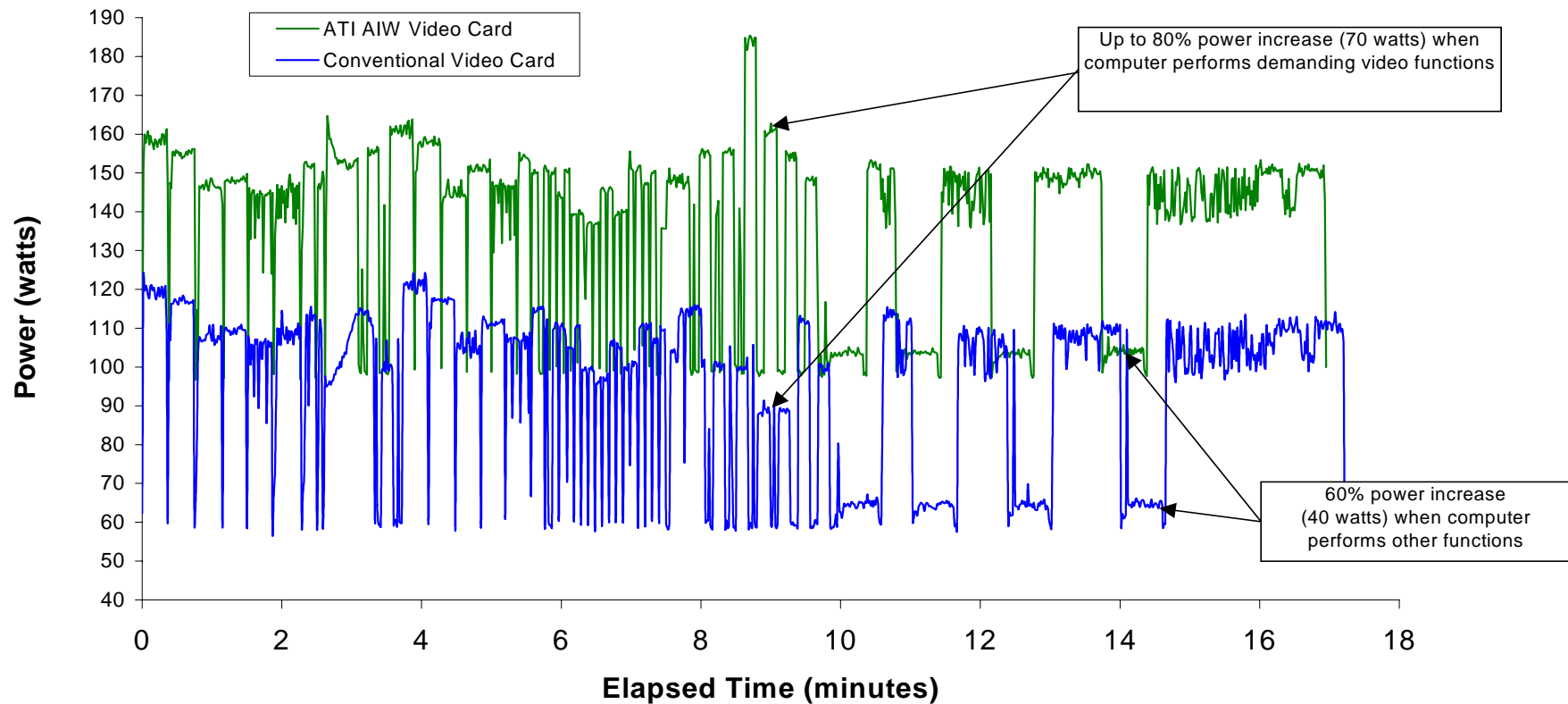
2005 Intel Recommended Level likely to rise as well, especially for the 20% load condition.



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Video Card Power Use is Rising Rapidly – Now 50 to 150 Watts in the Most Powerful Designs

Impact of ATI*All-In-Wonder 9800 Video Card on
HP* Media Center PC Power Use



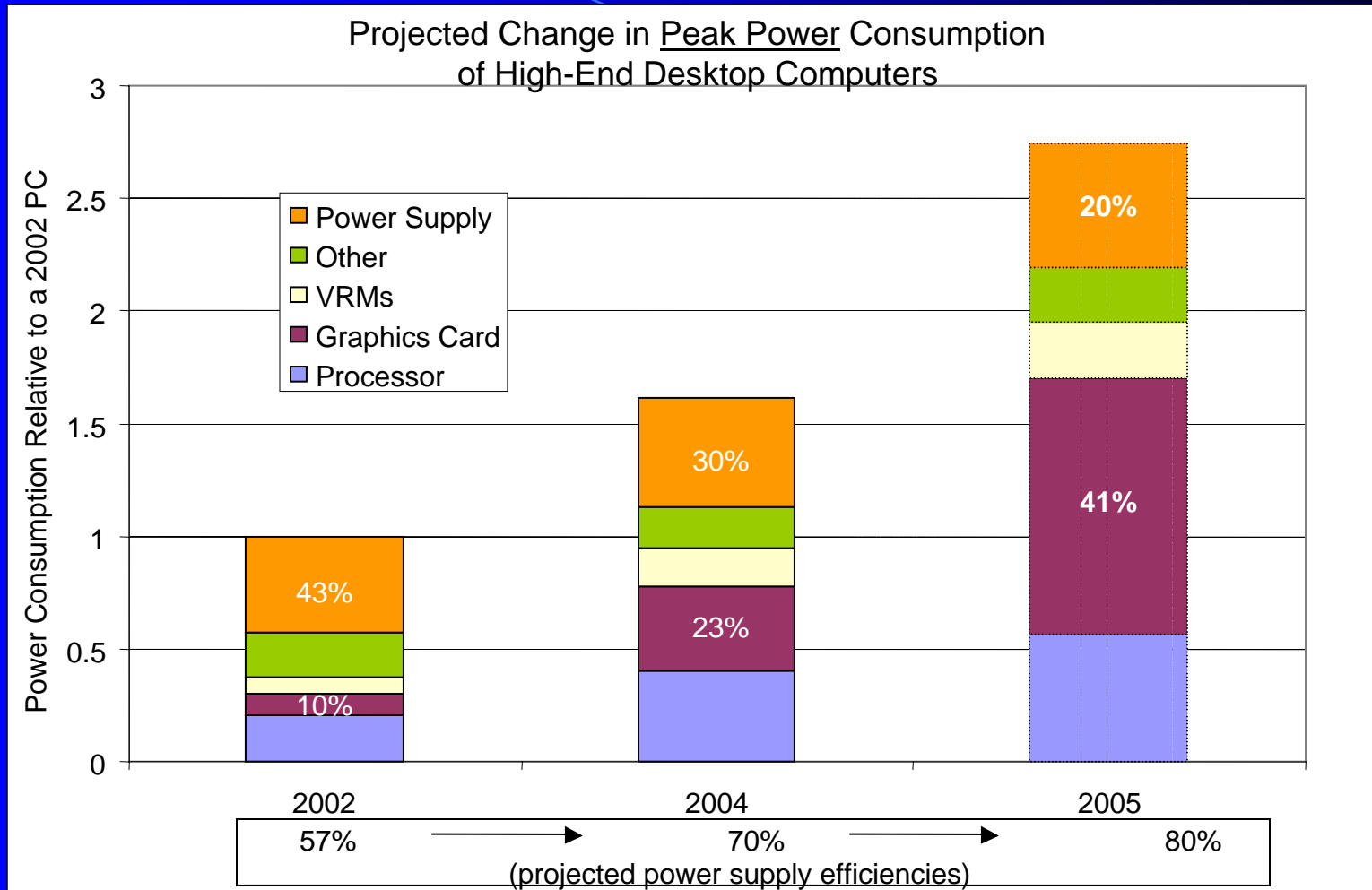
System Tested: 2.66 GHz Pentium® 4 H.P.* Media Center Desktop PC during PCMark* 2004 Benchmark testing

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Power Consumption



Projected data is merely a projection and has been simulated and is provided for informational purposes only.
Projected Data was derived using simulations run on a simulator. Differences in system hardware or software design or configuration may affect actual performance.



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ENERGY STAR* Context

- Energy Star program is voluntary; co-managed by EPA & DOE
- Specifications initially target the most energy efficient 25% of available models in the marketplace.
- Goal: motivate industry to produce more efficient products *and* consumers to buy them.
- In 2003, ENERGY STAR prevented more than 48 million metric tons of carbon dioxide pollution, equivalent to the emissions of more than 30 million cars.
- Existing computer specification needs to be updated:
 - Last revised in July 2000; 98% of models comply. Label no longer differentiates.
 - Power management enabling rate only about 5% in commercial sector — probably also low in residences.
 - Specification does not currently address active (“on”) mode.
 - New spec: additional energy savings potential is significant.



EPA's Initial Thoughts

Considering phased approach:

Tier 1

Set sleep and off power limits, and address active mode via power supply efficiency.

Tier 2

- I) Fix the “network problem” with power management
- II) Seek more comprehensive approach; recognize products that use energy efficiently across all modes.

Either:

A. Prescriptive approach – set component efficiency requirements for power supply, video card, etc.

AND/OR

B. Performance approach – use benchmark to measure performance of computer and measure energy use. Create efficiency metric.

ENERGY STAR* Tier 1 Initial Ideas

Efficient Power Supply

Internal PS – efficiency levels of 67% at 20% loading; 80% at 50% loading and 75% at 100% loading

External PS – must meet EPA ENERGY STAR external power supply specification. See www.energystar.gov/powersupplies and www.efficientpowersupplies.org for additional information

Updated Power Levels

Sleep — Desktop, Laptop, Workstation: < 5W; Integrated Computer: <9W
(achieved via Instantly Available PC (IAPC) and other technologies)

Off — Desktop: < 2W; Laptop: < 1W; Workstation: < 2W; Integrated Computer < 5W;
Federal Energy Management Program (FEMP) “standby” levels

Potential Savings – 1 to 2 billion kwh/year worth about \$80 to \$160 million/year in lower energy bills

Tier 2: Fixing the “Network Problem” and Thinking Holistically

Context

- Users and IT managers increasingly want PCs to be available 24/7 (office and residential); unrealistic to fight this
- Existing Wake-On-LAN and remote power on (RPO) schemes not satisfactory -- leads to rampant disabling
- More consumer electronics becoming like PCs and needing continuous network presence

Goal

- Most Tier II machines should be asleep most of the time – savings potential of more than \$1 billion per year
- Requires smarter NICs or very low idle power

Why Benchmarking?

- Need “real-world” instead of “peak-performance” benchmarking software
- Would recognize synergies in hardware and software design, promoting models that scale total power use closely to workload in real time

EPA's Next Steps

- Discuss Tier 1 ideas with input and participation from all interested stakeholders, including European Union (EU).
- Get stakeholder input on eventual tier 1 first draft and discuss target effective date for Tier 1 – early 2006 (?)
- Initiate research into Tier 2 specification – input on component efficiencies and benchmarking software welcomed.

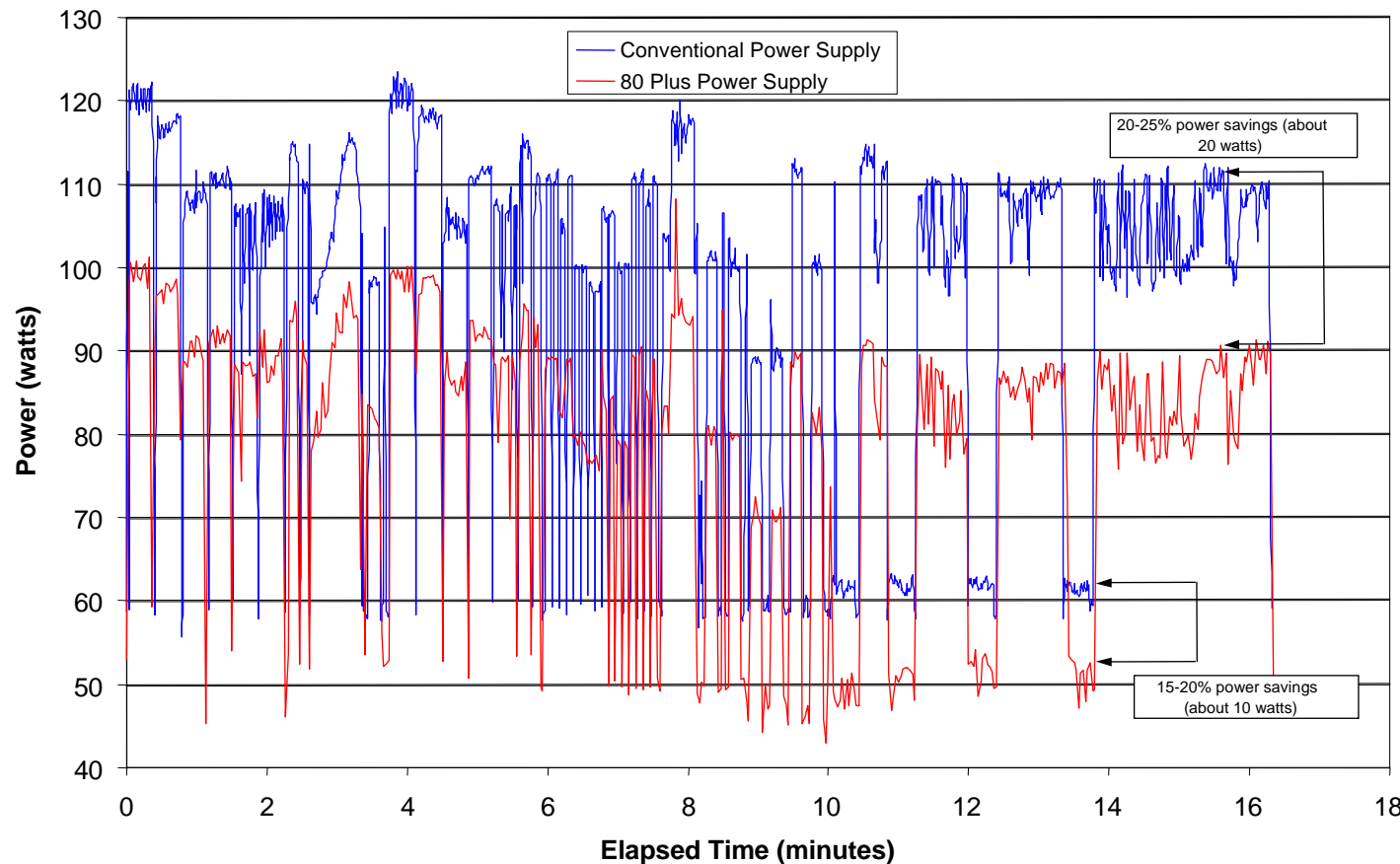
Indicators of Power Supply Energy Use and Savings Opportunities

- More than 3.1 billion power supplies now in use in the U.S.
- Annual U.S. sales of 450 to 600 million units in all applications
- External units already being addressed by ENERGY STAR*. Internals represent large new opportunity to save energy, especially in PCs.
- About 6 to 10% of U.S. electricity use is *converted* from high voltage AC to low voltage DC in power supplies: (200 to 340 billion kwh/year worth \$16 to \$27 billion/year)
- About 3 to 4% of U.S. electricity use is *consumed* inside power supplies: (100 to 140 billion kwh/year worth \$8 to \$11 billion/year)
- About 1 to 2% of U.S. electricity use could be *saved* by more efficient power supplies (35 to 70 billion kwh/year worth \$3.4 to \$6.8 billion/year)!

Source: *Power Supply Efficiency What Have We Learned* – Ecos Consulting* February 2004 prepared for California Energy Commission* PIER Program

Improving Power Supply Efficiency Cuts PC Energy Use Decisively

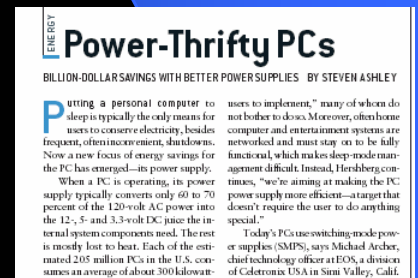
Impact of Power Supply Efficiency on Energy Use of a 2.66 GHz Pentium 4 HP Desktop Computer During PCMark 2004 Benchmark Testing



Media Coverage:



Wall Street Journal*
February 26, 2004



Scientific
American* June
2004

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80 Plus* – Setting the Bar for Computer Power Supply Efficiency

Intel Technology

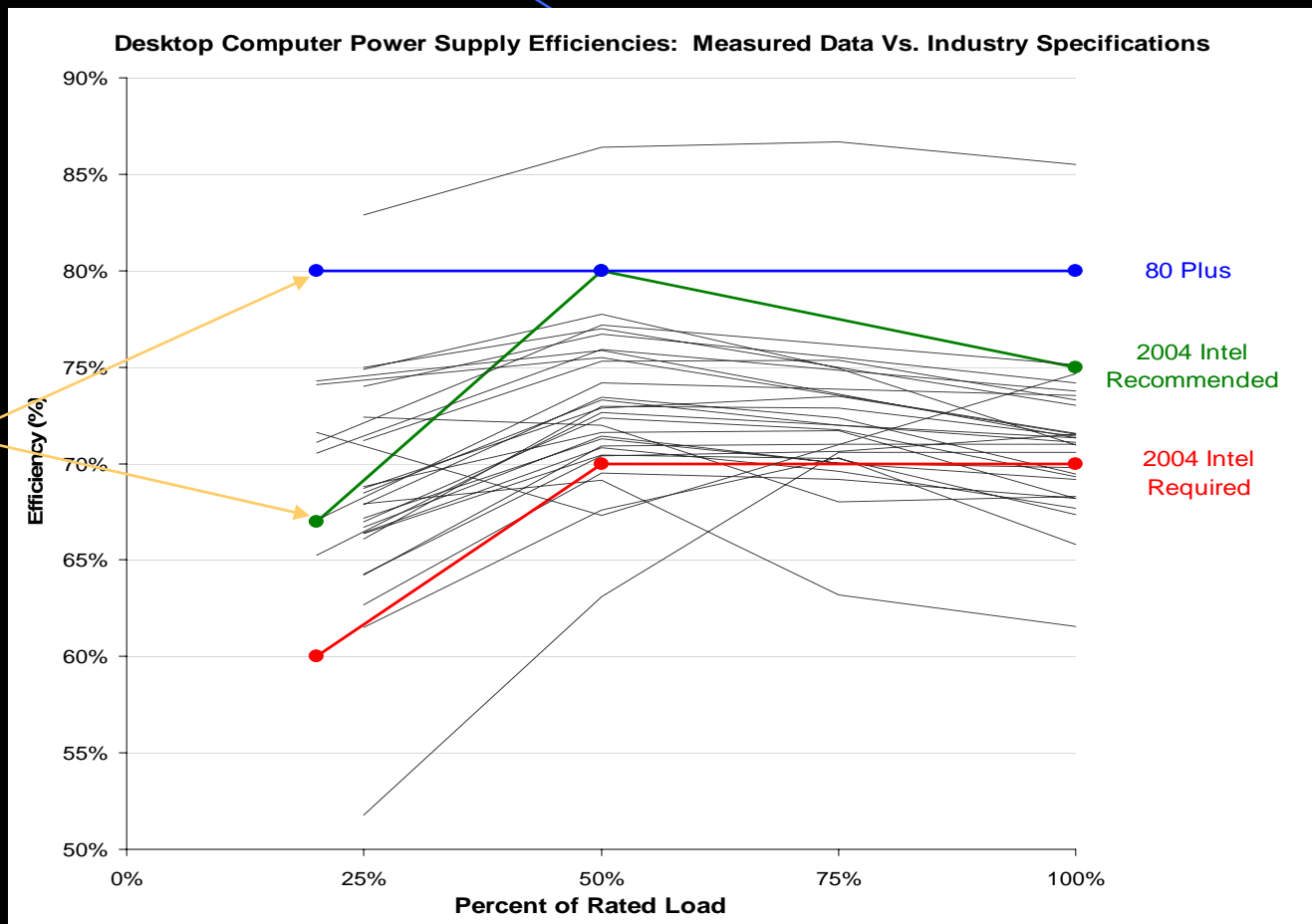
Symposium

2004

80 Plus is significantly more stringent than Intel's 2004 Recommended Level at 20% load.

PCs commonly run at 20-30% load during most of their operating hours.

Efficiency improvements at low load increase energy savings substantially.



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What Is 80 Plus*?

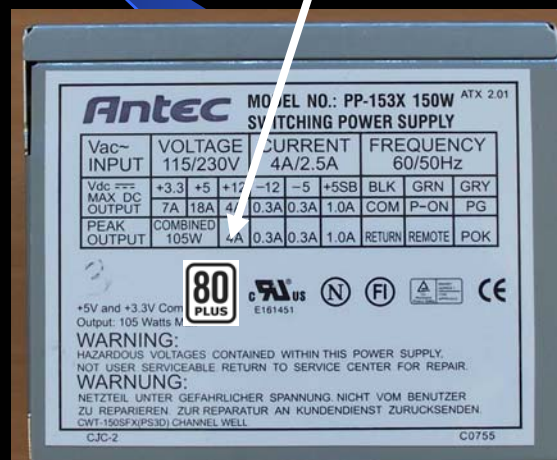
Intel Technology

Symposium

2004

- A program funded by electric utilities to pay the extra cost of making highly efficient desktop PC power supplies.
- Qualifying units must be **at least 80% efficient** at 20%, 50%, and 100% load, plus have a **power factor of at least 0.9** at 100% load.
- Utility payments of \$5 per qualifying PC will lead to annual energy savings of 85 kwh/unit, or more than \$25 over a computer's 4 year life.
- Ecos will pay incentives and provide marketing support for all qualifying PCs shipped into the service territories of participating utilities throughout the U.S.

Qualifying units can use the logo and earn \$5 incentives



Example only – not a qualifying model

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Key Facts about 80 Plus*

Intel Technology
Symposium
2004

- Program will run from the end of 2004 through at least early 2006.
- Ecos expects \$2 to \$5 million of total funding from west coast and northeast utilities.
- Money is available on a first-come, first-served basis. PC and power supply market leaders can get paid now to comply with pending ENERGY STAR* and Intel specs.
- First-ever chance to collaborate with utilities in educating customers about the value of efficient design in PCs (and possibly low-end servers).
- Program saves electricity for \$0.025 to \$0.030 per saved lifetime kwh – cheaper than new power plants.

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Call to Action

- Improve efficiency and power quality of desktop PC power supplies to meet increasing system power demands
- Reduce power consumption of video cards at full and partial load
- Look for efficiency opportunities in the whole power conversion chain, including dc-dc conversion



For More Information...

- Web page links
 - www.formfactors.org - Intel power supply site
 - www.energystar.gov - EPA Energy Star* program site
 - www.efficientpowersupplies.org - global power supplies site
 - www.80plus.org - source for details on 80 Plus* Program
- Reference materials
 - *ATX12V Power Supply Design Guide*
 - *SFX12V Power Supply Design Guide*
 - *Thin Form Factor with 12-Volt Connector (TFX12V) Power Supply Design Guide*
 - *Compact Form Factor with 12-Volt Connector (CFX12V) Power Supply Design Guide*
 - *Lowprofile Form Factor with 12-Volt Connector (LFX12V) Power Supply Design Guide*