Energy Efficient AC-DC External Power Supplies: Technical Background and California Update

Presentation at CECP power supply meeting

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on behalf of the Natural Resources Defense Council

NRDC

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Power Supply Research Background

- Ecos began its power supply research for NRDC in 2001; we now also work with the California Energy Commission and Lawrence Berkeley Laboratories on power supply efficiency projects
- We identified two categories of power supplies: internal (found inside the product they are powering) and external (found outside of the product they are powering). Internal power supplies are a major long term opportunity for energy savings, but external power supplies are easier to address in the short term.
- Savings from more efficient power supplies automatically occur in all operating modes (standby, sleep, and active). Standby energy use is important and great progress is being made there. But about 75% of all power supply energy use occurs in the active mode. Designs that cut standby power use do not automatically improve active mode efficiencies – labeling and standards are needed.
- We found that improvements to power supply energy efficiency could save 1-2% of all U.S. electricity use – about 30 to 60 billion kWh/year. The global savings potential is much larger – about 4 times as much.

Energy Efficient Power Supplies Have Other Advantages, Reducing Size, Weight, Heat Output, and Shipping Cost

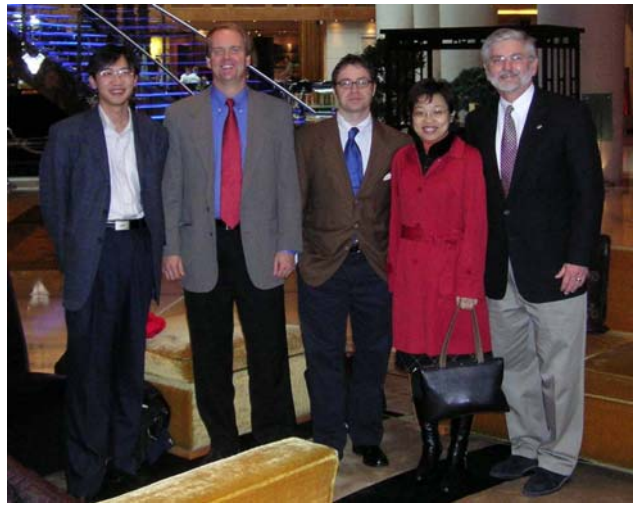
Market Research Findings

The North American market is currently the largest in the world for sales; China is the largest manufacturer of power supplies in the world and will eventually be the largest for sales.

We estimate about 1.0 to 1.5 billion power supplies are currently in use in China, with annual sales of perhaps 200 to 300 million units (and rising rapidly).

	North America		Global	
Power Supply Type	Unit Sales / Year	Total Units in Use	Unit Sales / Year	Total Units in Use
External	> 250 million	> 1.5 billion	0.9 to 1.0 billion	> 5 billion
Internal	> 250 million	> 1.6 billion	0.7 to 0.9 billion	> 5 billion
Total	> 500 million	> 3.1 billion	1.6 to 1.9 billion	> 10 billion

The Energy Foundation funded NRDC & Ecos Consulting in 2003-2004 to work with CECP, CNIS, Energy Star, and the California Energy Commission on strategies to improve power supply energy efficiency

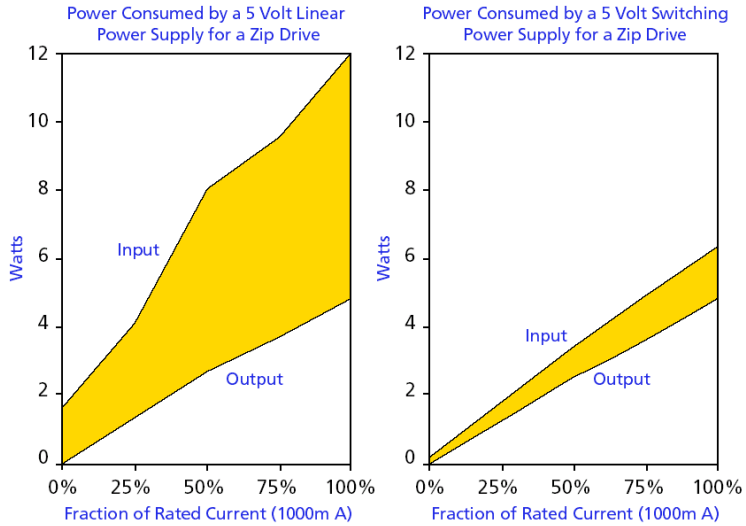


CECP – Ecos/NRDC - Energy Star - CNIS – CEC

Project Goals:

- Collaboration on standardized test method and product measurements at Ecos Consulting/NRDC and CEPREI
- Joint market research and outreach to Chinese manufacturers (November 2003 meetings included presentation to SPSS in Shanghai, manufacturer factory visits in Guangzhou, visit to CEPREI test lab, and three-way government meetings in Beijing)
- International harmonization of proposed product definitions, specification stringency and timing, and labeling strategies for efficient power supplies

Key Features of Standard Test Procedure

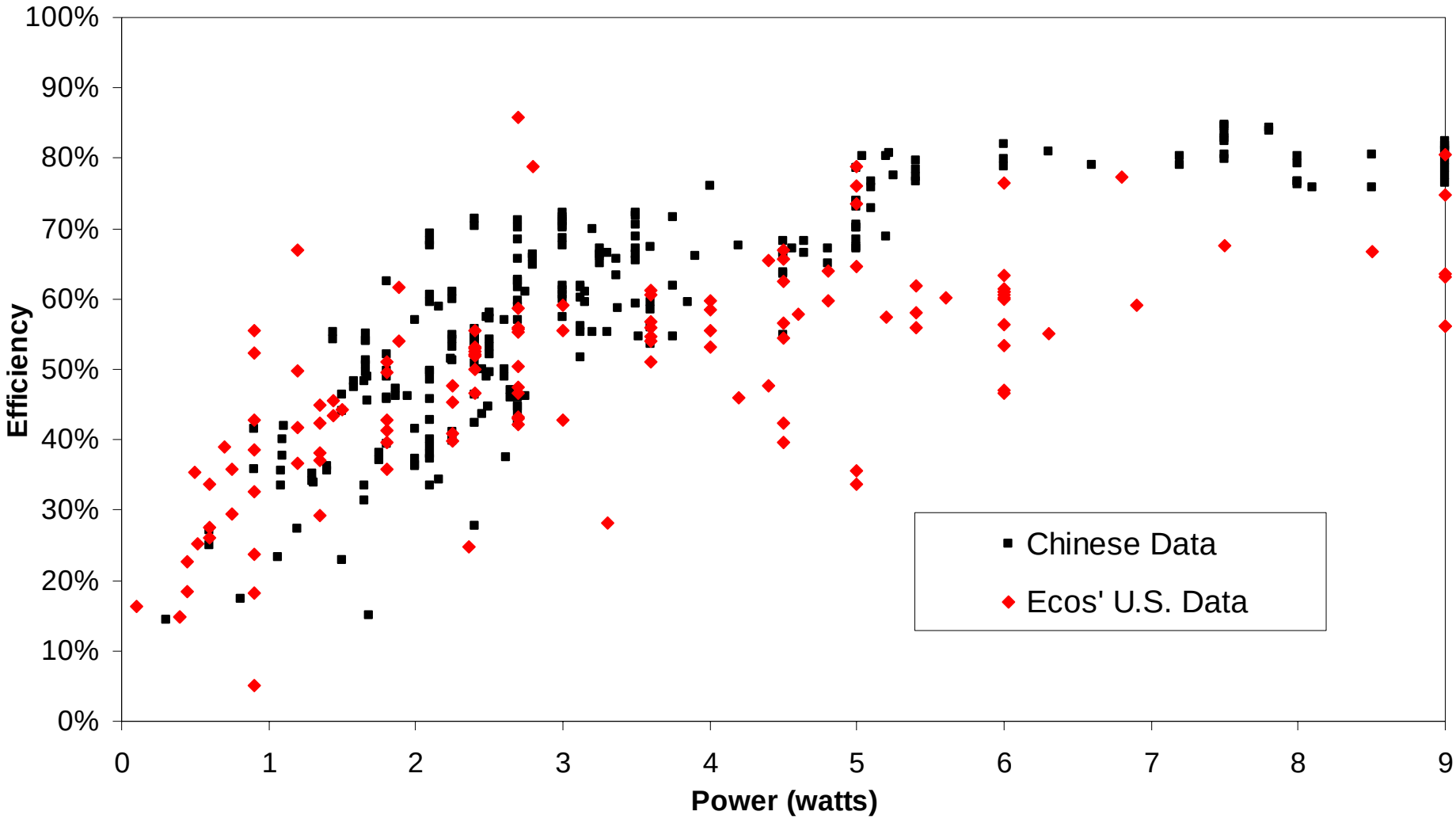


- AC input power and DC output power are measured at no-load, 25%, 50%, 75%, and 100% of nameplate current output at both 115 volts/60 Hz and 230 volts/50 Hz
- Power factor and THD information are also recorded at each load condition to understand power quality impacts
- Efficiency percentages and net power supply consumption are calculated at each load condition
- Data are entered into a standardized Microsoft Access database for collection, distribution, and comparison in a standard report form

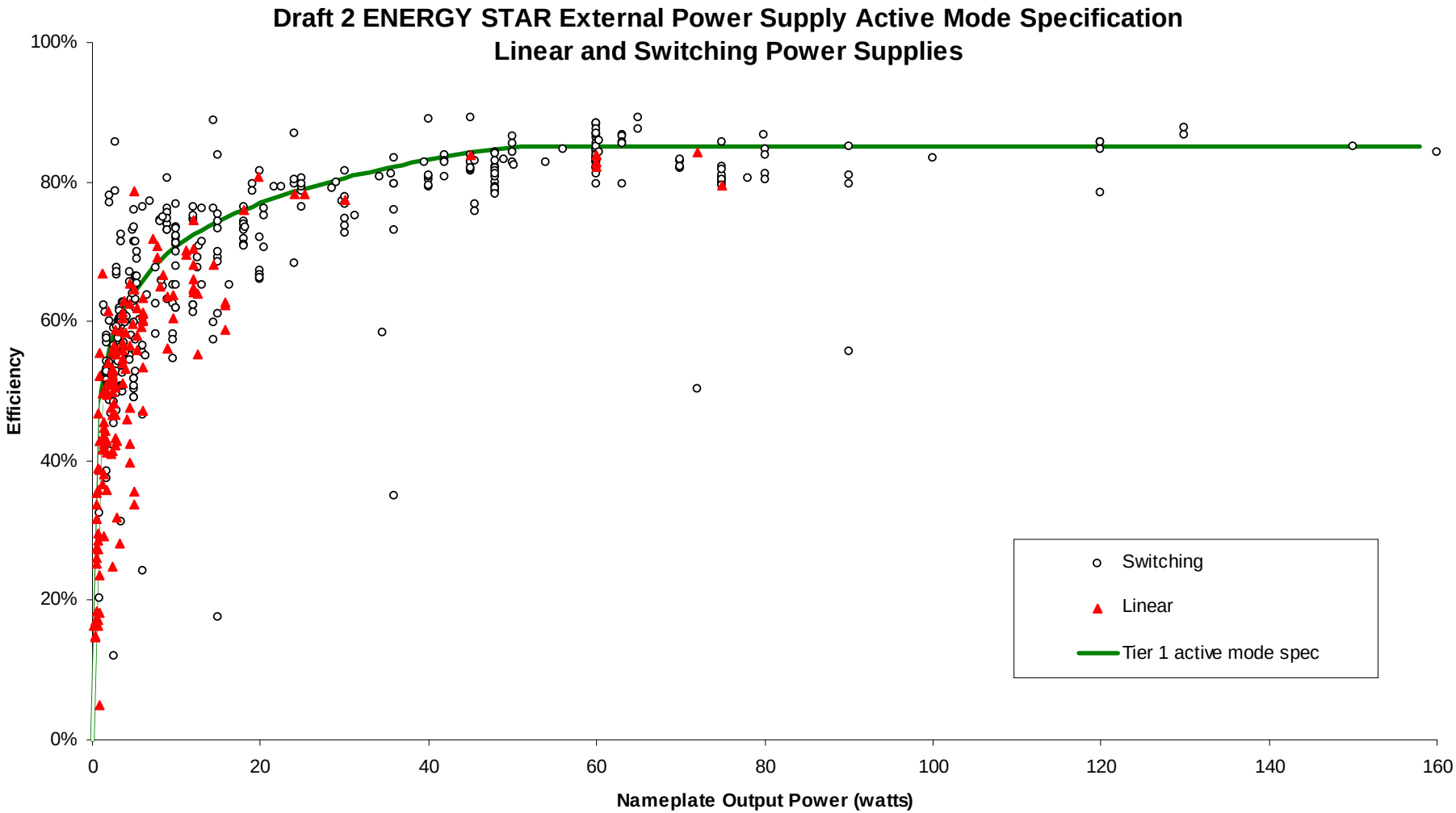
External Power Supply Efficiency Testing

- On behalf of the California Energy Commission, Ecos tested about 250 U.S. units (new and used) between the fall of 2002 and May 2004.
- On behalf of CECP, Chinese laboratory CEPREI tested 500 new Chinese units as part of ongoing safety testing in fall of 2003.
- On behalf of the Australian Greenhouse Office, the University of New South Wales tested 47 new and used Australian units in January 2004.
- The U.S., China, and Australia are also working closely to ensure that measured results in one lab can be replicated in another lab.

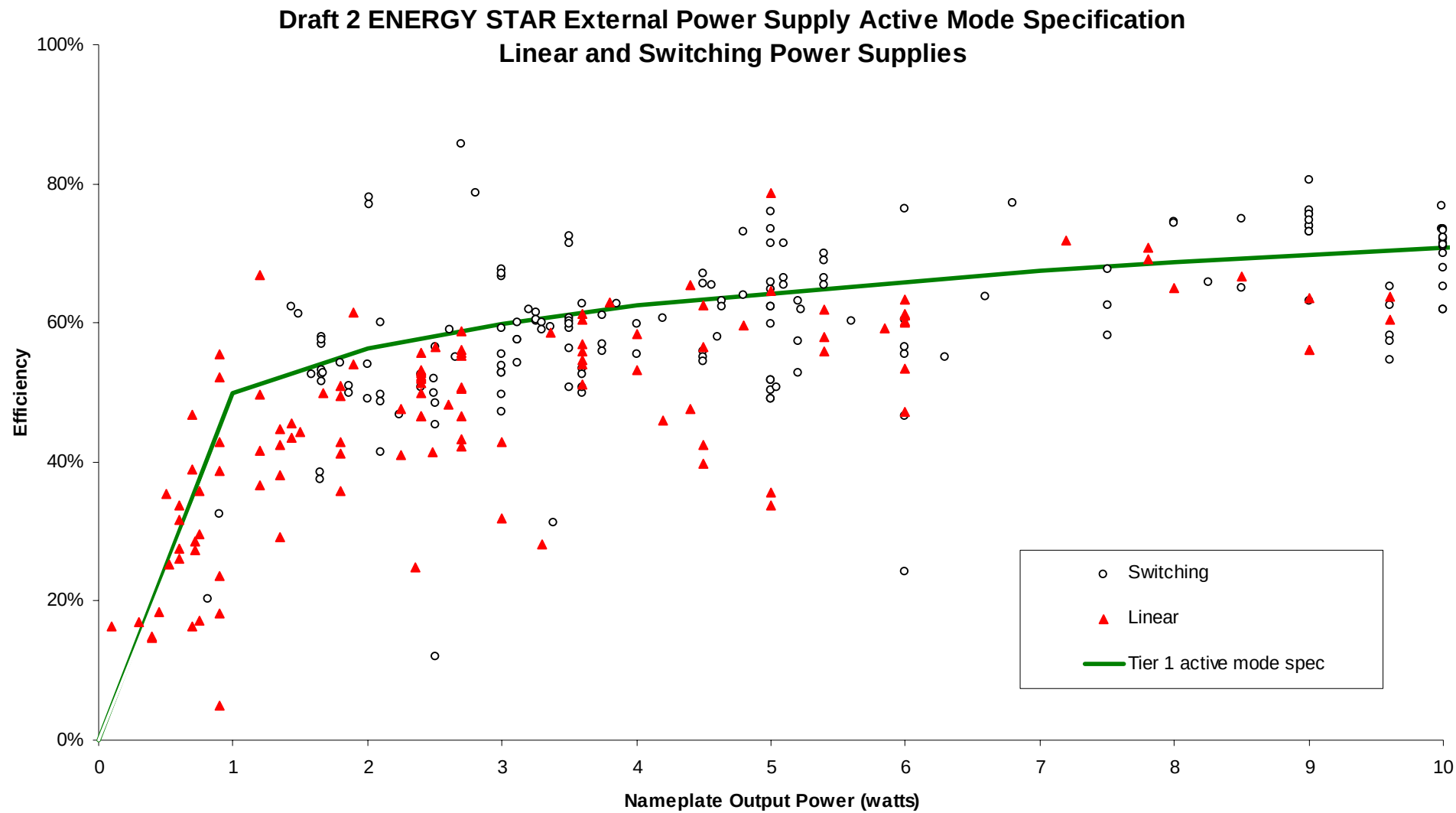
Average Efficiencies for U.S. and Chinese Power Supplies (0 to 9 Watts)



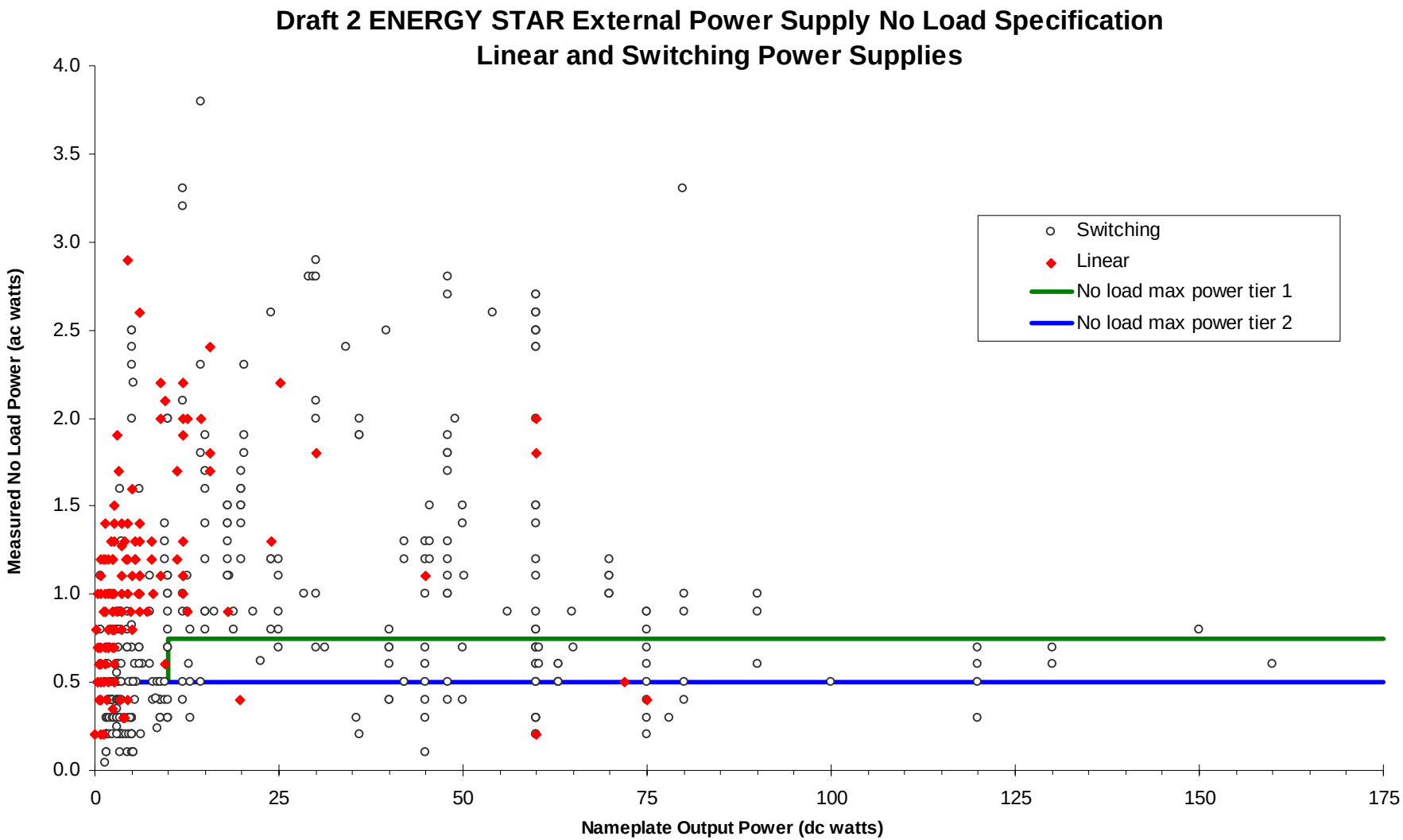
Switching Vs. Linear Power Supplies - Active



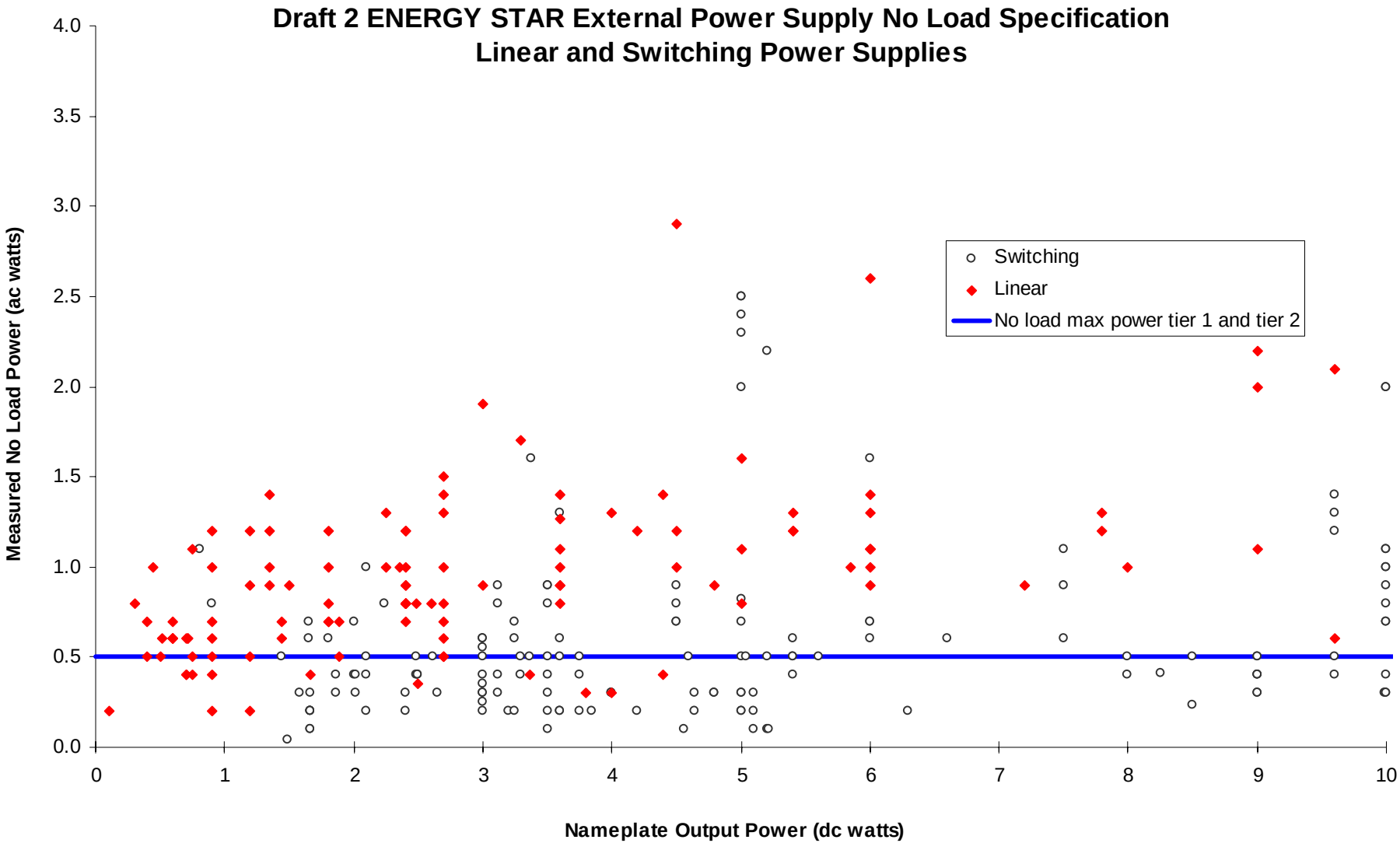
Switching Vs. Linear Power Supplies - Active

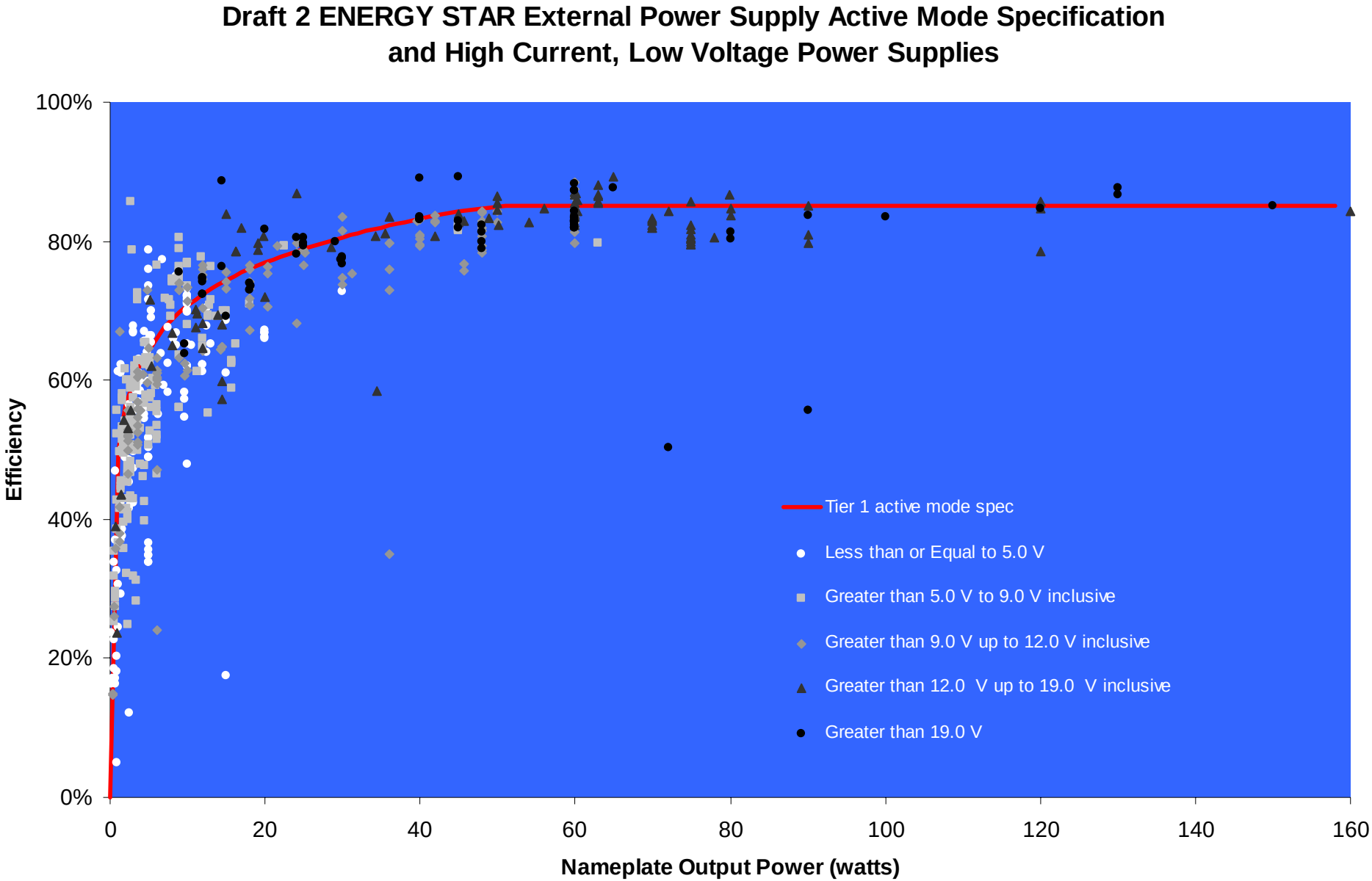


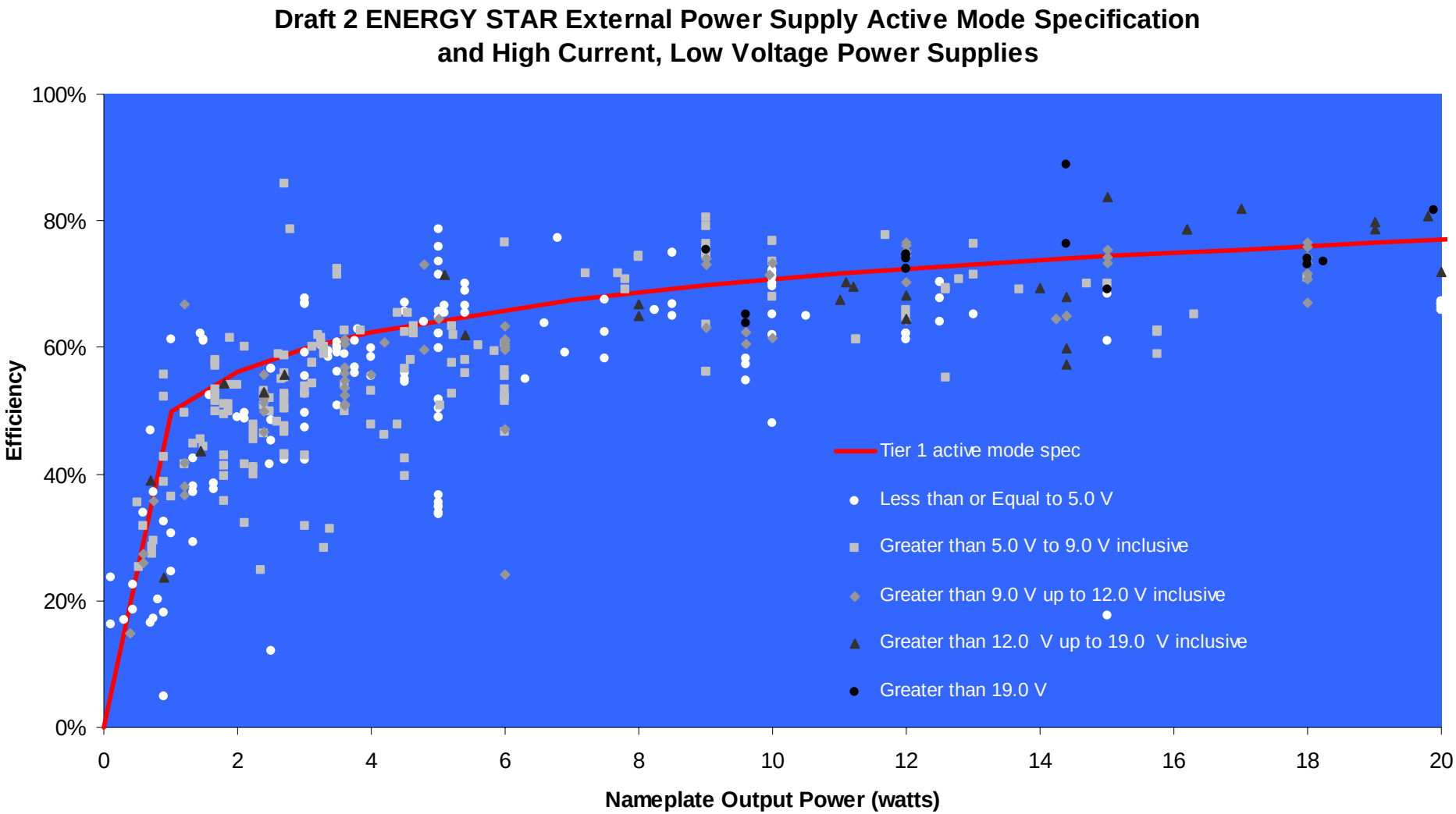
Switching vs. Linear Power Supplies – No Load



Linear Vs. Switching Power Supplies – No Load




Draft 2 ENERGY STAR External Power Supply Active Mode Specification and High Current, Low Voltage Power Supplies
100%
80%
60%
40%
20%
0%
Efficiency
0
20
40
60
80
100
120
140
160
Nameplate Output Power (watts)
Tier 1 active mode spec
Less than or Equal to 5.0 V
Greater than 5.0 V to 9.0 V inclusive
Greater than 9.0 V up to 12.0 V inclusive
Greater than 12.0 V up to 19.0 V inclusive
Greater than 19.0 V


Draft 2 ENERGY STAR External Power Supply Active Mode Specification and High Current, Low Voltage Power Supplies
Efficiency
100%
80%
60%
40%
20%
0%
0
2
4
6
8
10
12
14
16
18
20
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Greater than 19.0 V

California Power Supply Activities

- The California Energy Commission has proposed mandatory efficiency standards at the top 40% of the current set of test data for active mode. In addition, power supplies could draw no more than 0.5 to 0.75 watts in the no-load condition.
- These standards are likely to be approved before September, and would take effect on January 1, 2006.
- The CEC is considering a Tier 2 standard for 2008 at the same levels as the current Energy Star/CECP proposal.
- The CEC and Energy Star are also co-sponsoring an international design competition for efficient power supplies. We encourage Chinese companies and universities to participate. See www.efficientpowersupplies.org/competition.html.