

# Tired of tubes? Fixed your fridges? Check out the energy savings from efficient power supplies!

Presentation to ACEEE Market Transformation Symposium  
March 2, 2004

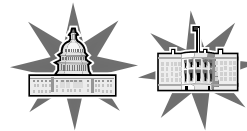
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## Ecos Consulting's Approach to Market Transformation



We build markets for energy efficient consumer products  
through three phases of work with public interest clients:



Research



Programs

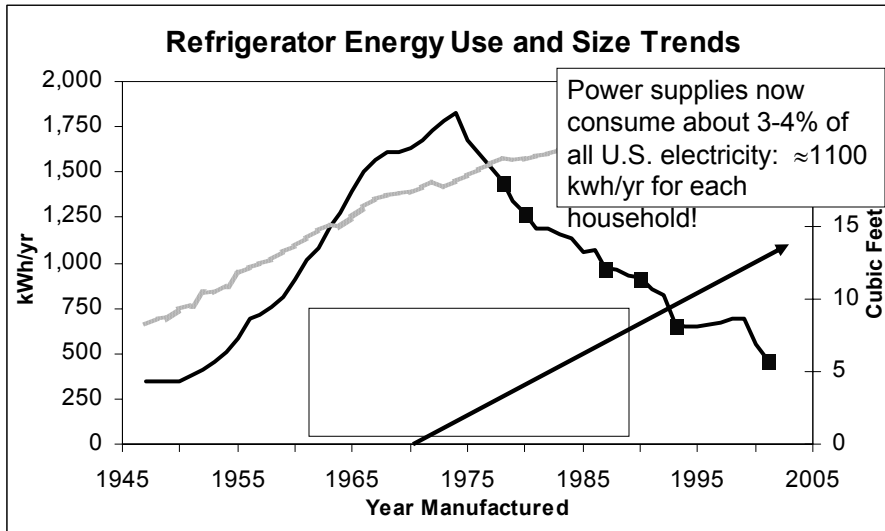


**Policy**  
Identify new  
efficiency  
opportunities,  
create test  
procedures,  
measure products,  
and propose  
labeling

Work with utilities  
to increase sales  
of efficient  
products through  
incentives,  
marketing,  
training, and  
education

Lock in  
savings with  
minimum  
efficiency  
standards and  
procurement  
programs

## Refrigerators: The Prototypical Market Transformation Success Story. But...



## What Is a Power Supply?

A circuit that converts 120 or 230 volt AC power into low voltage DC power

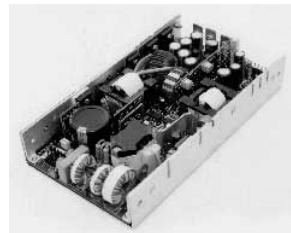
Two styles:

External



(small wattage, but easier to tackle)

Internal



(higher wattage, but harder to tackle)

## How do you know if an electrical product uses a power supply?

### What's Inside Includes:

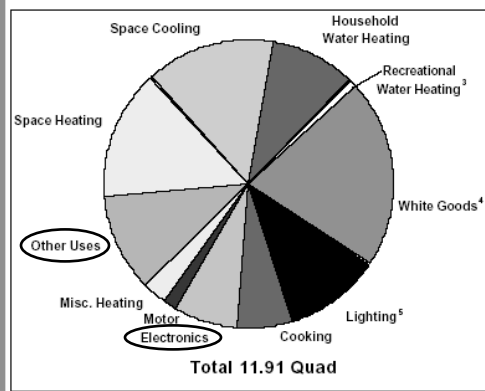
- Integrated circuits (chips)
- Electronic timers, sensors or control circuits
- Rechargeable batteries
- Information storage
- Anything “wireless”

### What's Outside Includes:

- Digital displays or screens
- Keypads or keyboards
- Speakers
- A thin wire leading to an external box that plugs into a wall outlet

Even in 1996, electronics were 7% of home electric use. Today, the electronics category has grown significantly, and power supplies are found in most home electrical products.

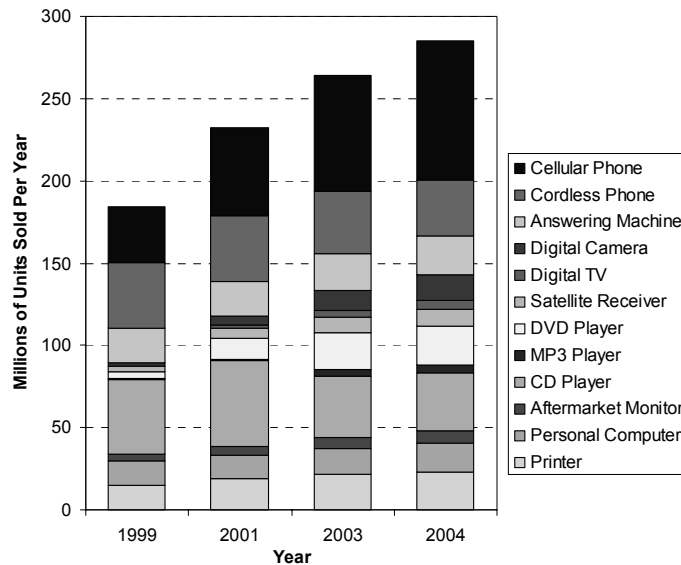
	Category <sup>1</sup>	Primary Electric Consumption <sup>2</sup>	
		Quad	Percent
<input checked="" type="checkbox"/>	Space Heating	1.72	14.4%
<input checked="" type="checkbox"/>	Space Cooling	1.74	14.6%
	Household Water Heating	1.16	9.7%
<input checked="" type="checkbox"/>	Recreational Water Heating <sup>3</sup>	0.11	0.9%
<input checked="" type="checkbox"/>	White Goods <sup>4</sup>	2.53	21.3%
<input checked="" type="checkbox"/>	Lighting <sup>5</sup>	1.27	10.7%
<input checked="" type="checkbox"/>	Cooking	0.74	6.2%
<input checked="" type="checkbox"/>	Electronics	0.87	7.3%
<input checked="" type="checkbox"/>	Motor	0.18	1.5%
<input checked="" type="checkbox"/>	Misc. Heating	0.31	2.6%
<input checked="" type="checkbox"/>	Other Uses	1.29	10.7%
	<b>Totals</b>	<b>11.91</b>	<b>100%</b>



Source: 1996 DOE data from TIAx

## Phenomenal Growth Occurring in U.S. Dealer Sales of

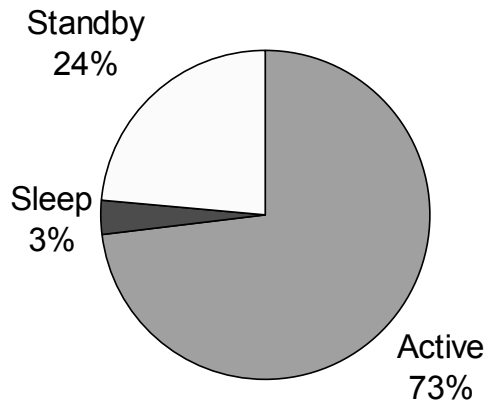
### Key Power Supply-Containing Products



## 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 about 450 to 600 million units (CFLs sell tens of millions of units)
- 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)
- More efficient power supplies could *save* 1 to 2% of all U.S. electricity use: (35 to 70 billion kwh/year worth \$3.4 to \$6.8 billion/year)!

## Saving Standby Power Is Important, but the Active Mode Savings Opportunity is Bigger



## Key Power Supply Efficiency Projects Underway

- NRDC/Ecos scoping, market, and technical research for EPA ENERGY STAR (2001-2004)
- NRDC/Ecos work for Energy Foundation on power supply labeling and standards in China (2003-2005)
- E2I/Ecos/EPRI-PEAC research and policy work for the California Energy Commission's PIER program (2003-2005)
- ENERGY STAR spec announced for active power efficiency and no-load power. Closely aligned with CECP in China (2004)
- California will propose mandatory efficiency standards for external power supplies (2004) to take effect later (2006?)
- EU's Code of Conduct will add active power spec (2005)
- Australia will likely announce mandatory standards and labeling (2005-2007)

## Goals of the PIER Power Supply Research

- Facilitate dialogue in power supply community regarding new efficiency technologies and applications
- Conduct market research to determine magnitude of potential energy savings opportunity
- Develop standardized testing protocols for power supply efficiency
- Conduct large-scale testing to determine existing efficiencies of external and internal power supplies
- Co-sponsor international design competition to encourage development and market success of fundamentally more efficient power supply designs

[www.efficientpowersupplies.org](http://www.efficientpowersupplies.org)



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Supply 101

### Efficiency of Power Supplies in the Active Mode

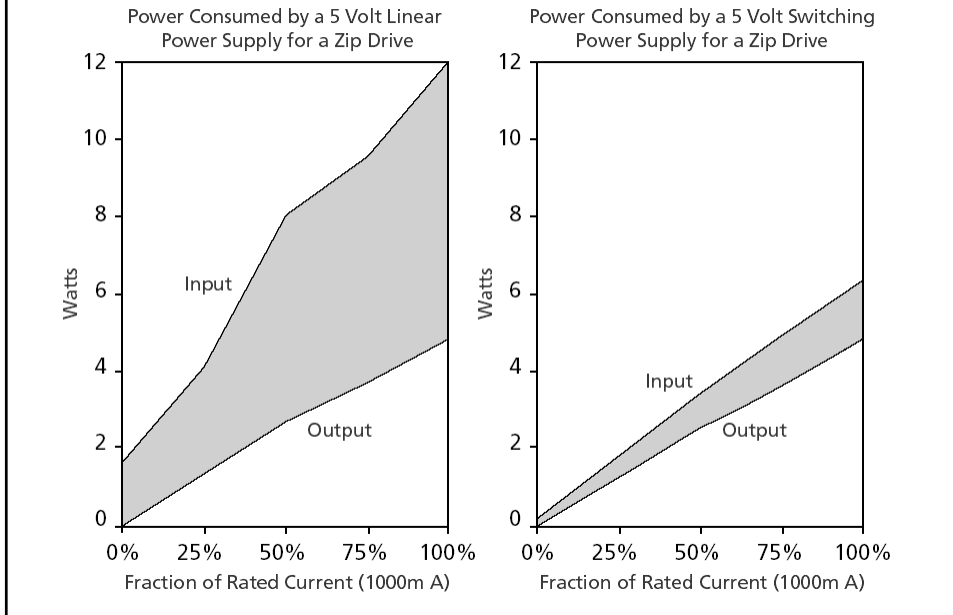
#### The Opportunity

Power supplies are one of the crucial building blocks of a modern society, converting high-voltage alternating current (AC) into low-voltage direct current (DC) for use by the electronic circuits in office equipment, telecommunications, and consumer electronics. Over 2.5 billion AC/DC power supplies are currently in use in the United States alone. About 6 to 10 billion are in use worldwide. While the best power supplies are more than 90% efficient, some are only 20 to 40% efficient, wasting the majority of the electricity that passes through them. As a result, today's power supplies consume at least 2% of all U.S. electricity production. More efficient power supply designs could cut that usage in half, saving nearly \$3 billion and about 24 million tons of carbon dioxide emissions per year.

#### The Purpose of This Web Site

This Web site was created by EPRI PEAC Corporation and Ecos Consulting to initiate a global dialogue about energy efficient power supplies. Our focus here is particularly on the issue of energy consumption in the active or "on" mode of product operation. According to our research so far, nearly 75% of all the energy used by power supplies occurs in active mode. For those interested primarily in standby power consumption or other low-power modes, please visit Lawrence Berkeley National Laboratory's Web site on that topic at <http://standby.lbl.gov>.

## Visualizing Efficiency Differences



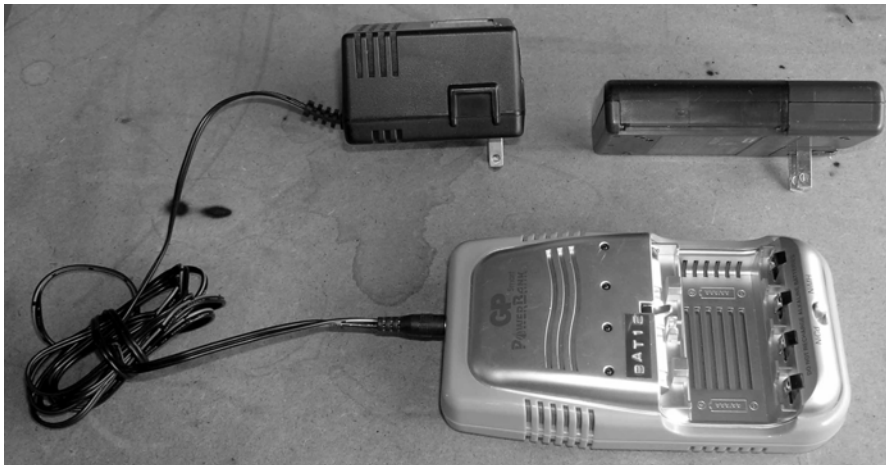
## External Power Supply Efficiency Testing

- On behalf of PIER, Ecos Consulting tested about 225 U.S. units (new and used) between the fall of 2002 and February 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.
- Ecos combined the data and recommended top 25% efficiency levels in active mode and no load to Energy Star and CECP.

Is this the mobile age? How could power supplies become a product feature instead of a hassle?



Internal power supplies can cut product size and cost significantly, but are tougher to measure





Still Big Gains to Be Made with Internal Power Supply Efficiency through Improved Design

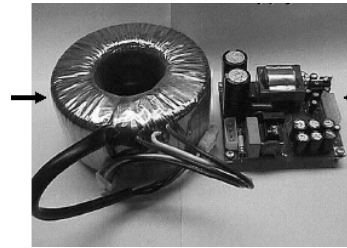


Desktop PCs

Video Game Consoles



XBOX Power Supply



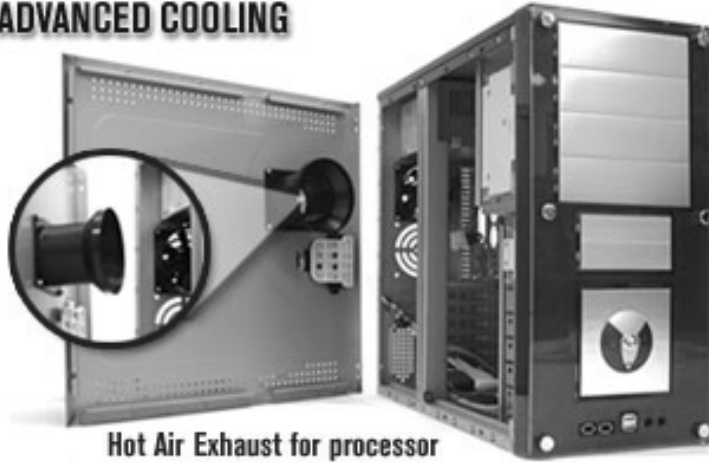
High End Stereos

## Why Focus on PC Power Supplies?

- Ranked as one of the top three national power supply efficiency opportunities in our assessment.
- PC power consumption is rising with faster CPUs, more powerful video cards, and low enabling rates of sleep mode in networked offices. Improving power supply efficiency will save energy across all modes.
- Nice opportunity to leverage Intel's PC Design Guide spec and a 2004 revision to the ENERGY STAR PC spec.
- May be possible to create an active power benchmark for whole-computer efficiency over the longer term, but the power supply opportunity is available now.

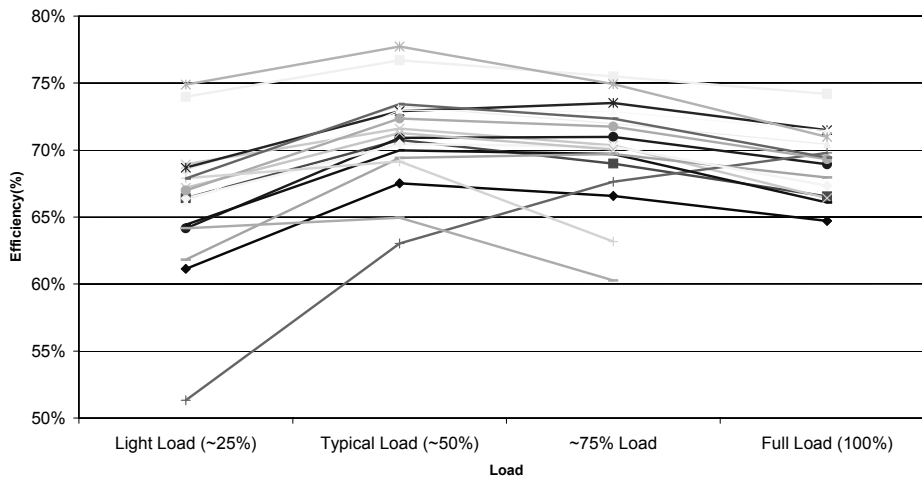
## New Reasons to Improve Desktop Computer Efficiency

### ADVANCED COOLING



## Results of ATX Computer Power Supply Efficiency Testing by EPRI-PEAC, in Cooperation with Intel

Efficiency Curves of Various Computer Power Supplies



## Labeling Programs and Incentives Could Save Large Amounts of Energy by Encouraging Use of Better PC Power Supplies

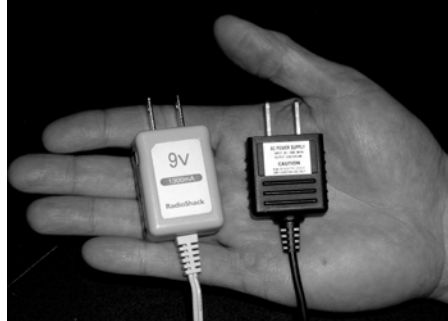
Specification	20% Load	50% Load	100% Load	Heat output in 300 watt power supply
2001 initial measurements	45%	55%	67%	148 watts
2001 Intel required spec	NA	NA	68%	141 watts
2003 Intel required spec	50%	60%	70%	129 watts
2003 measured average	65%	71%	69%	135 watts
2004 Intel required spec	60%	70%	70%	129 watts
2004 Intel recommended spec	67%	80%	75%	100 watts
Best current design	≈82%	≈87%	≈85%	53 watts

### Utilities & MT Organizations Can Do Something Right Now: A Manufacturer Buy Down for More Efficient Desktop PC Power Supplies

- Ecos is asking major PC manufacturers to offer optional, highly efficient power supplies and will create a national opt-in infrastructure for tracking and incentive payment
- Incremental cost will be about \$5, yielding annual savings of 90 to 156 kwh/unit for at least 3 years of computer lifetime
- Program will buy down this extra cost for all qualifying PCs shipped to the service territories of interested utilities
- Total program cost of about \$0.03-\$0.04 per saved lifetime kwh
- Program will launch in summer of 2004 with interested utilities to catch the back-to-school and Christmas purchase peaks
- Program success increases the likelihood of a more stringent

We have the technology and tools to do better.  
Our ultimate goals:

Give consumers a better product  
that saves energy & money



Recognize and reward  
continuous manufacturer  
innovation in power supply  
performance and efficiency