Efficiency Standards for External Power Supplies

A Dynamic Regulatory Environment

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The global regulatory environment surrounding the legislation of external power supply efficiency and no-load power draw has rapidly evolved over the past decade since the California Energy Commission (CEC) implemented the first mandatory standard in 2004. Mandating higher average efficiencies in external power supplies has undoubtedly had a real impact on global power consumption. However, with the benefit of a reduced draw on the power grid come challenges and uncertainties for the electronics industry as it tries to keep up with this dynamic regulatory environment. Original Equipment Manufacturers (OEMs) who design external power supplies into their products must continue to monitor the latest regulations to ensure that they are in compliance in each region their product is sold. The goal of this article is to provide an up to date summary of the most current regulations worldwide.

External Power Supply Regulations
– A Brief History

In the early 90's, it was estimated that there were more than one billion external power supplies active in the United States alone. The efficiency of these power supplies, mainly utilizing linear technology, could be as low as 50% and still draw power when the application was turned off or not even connected to the power supply (referred to as "no-load" condition). Experts calculated that without efforts to increase efficiencies and reduce "no-load" power consumption, external power supplies would account for around 30% of total energy consumption in less than 20 years. As early as 1992, the US Environmental Protection Agency started a voluntary program to promote energy efficiency and reduce pollution which eventually became the Energy Star program. However, it wasn't until 2004 that the first mandatory regulation dictating efficiency and no-load power draw minimums was put in place. The following section traces the path from the CEC's 2004 regulation up to the current standards that are in place today.

DECEMBER 2004

California, having a long history of adopting energy standards before the rest of the world, was the first to pass legislation for external power supplies. The CEC passed legislation that defined a schedule for the implementation of their Tier 1 standards in July of 2006 and Tier 2 standards in January of 2008.

This move by California forced manufacturers to quickly adopt higher efficiency power supplies, or forego sales in California and miss out on other regions that would soon follow.

JANUARY 2005

China implements a voluntary program referred to as China Energy Conservation Program (CECP) which allowed Chinese factories to market their power supplies as high efficiency products.

Energy Star implements their voluntary program for efficiency levels referred to as Tier 1.

JULY 2005

Europe approves DIRECTIVE 2005/32/EC establishing a framework for the setting of ecodesign requirements for energy-consuming products. While the directive targeted products that use energy, it did not provide specific targets for external power supplies at this time.

JANUARY 2006

Energy Star, recognizing that California, China and Australia were quickly defining their own standards, defines the "International Efficiency Marking Protocol" to minimize confusion between regions and their similar standards.

The defined markings set minimum efficiency and no-load levels for external power supplies as summarized below:

Level I Power supply does not meet any of the standards defined

Level II Power supply meets minimum efficiencies that were set by China in

November 2005
Level III Power supply meets Energy Star Tier 1, CEC Tier 1 and Australian MEPS standards

Level IV Power supply meets CEC Tier 2 and the Australian MEPS High Efficiency category

Level V Future Energy Star Tier II Level that was TBD at the time

Level VI and Level VII Reserved for future levels

APRIL 2006

Australia implements their Minimum Efficiency Performance Standard (MEPS).

JULY 2006

CEC Tier 1 is implemented in California, and following the "International Efficiency Marking Protocol," is commonly referred to as the Level III efficiency standard.

DECEMBER 2007

US Congress passes the Energy Independence and Security Act of 2007 (EISA 2007), originally called the Clean Energy Act. This act basically mirrors the legislation from California with a release date and harmonized requirements of California's CEC Tier 2 legislation to be implemented in July 2008.

APRIL 2008

Australia updates their MEPS program to include a voluntary "High Efficiency" category (equivalent to CEC Tier II and EISA 2007).

JULY 2008

EISA 2007 and CEC Tier 2 are implemented with the designations defined by the "International Efficiency Marking Protocol" as the Roman numeral IV surrounded by a circle to be clearly represented on each power supply's label.

NOVEMBER 2008

Energy Star harmonizes their specifications with EISA 2007 and CEC Level IV and announces that manufacturers may now use the Energy Star logo on their products and datasheets if they meet Level IV requirements.

APRIL 2009

Europe enacts the ErP Directive 2009/125/EC (Energy Related Products) with scheduled stages of implementation for efficiency and no-load requirements equivalent to Level IV and Level V standards. The schedule defined that the EU would harmonize with Level IV efficiency standards by April 2010 and Level V efficiency standards by April 2011.

APRIL 2010

Europe implements Phase I of their ErP Directive equivalent to Level IV Standards.

DECEMBER 2010

Energy Star decides to remove the external power supply category as they feel the marking should be part of the final product type. After the end of 2010, compliant external power supply part numbers would no longer be listed on the Energy Star website and the Energy Star logo had to be removed from power supply data sheets.

APRIL 2011

EISA 2007, CEC Tier 3 and ErP Phase 2 go into effect in full harmony of their standards leaving us with what is now simply referred to as the "Level V Efficiency" standard, designated by the roman numeral V surrounded by a circle.

JULY 2012

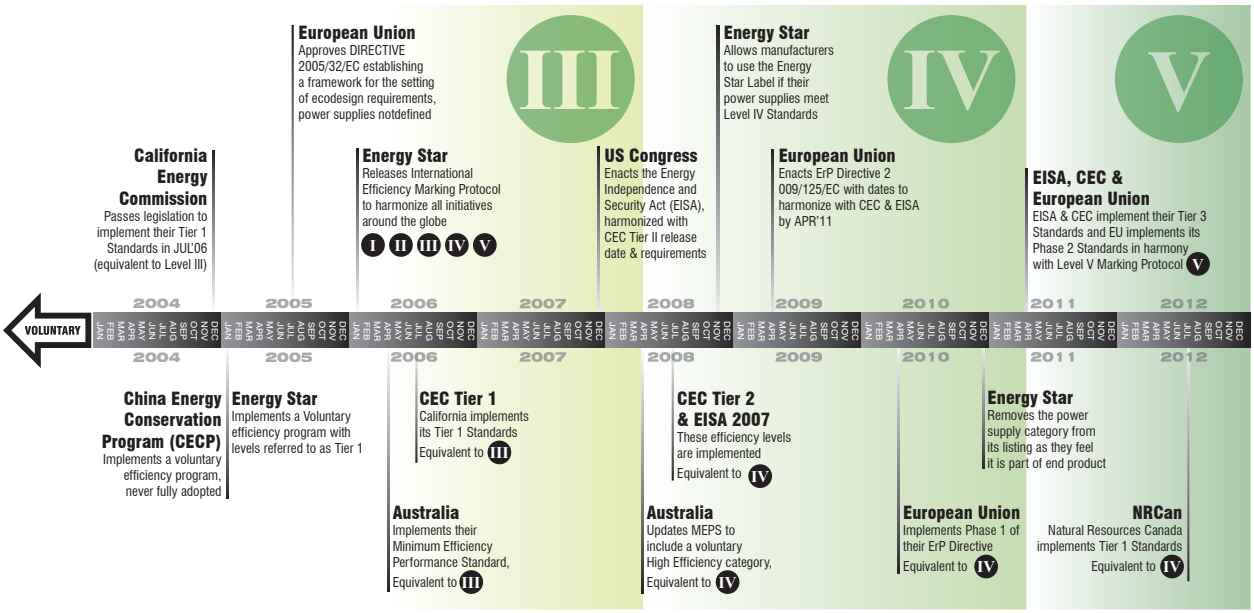
NRCan (Natural Resources Canada) will implement their Tier 1 standards in harmony with Efficiency Level IV Requirements. The agency will mandate that the verification of Tier 1 standards must be certified by a third party agency approved by NRCan.

The table below summarizes the performance thresholds for each efficiency level as they were established over time:

LEVEL	NO-LOAD POWER REQUIREMENT	AVERAGE EFFICIENCY REQUIREMENT
I	used if you do not meet any of the criteria	
II	no criteria was ever established	no criteria was ever established
III	≤10 Watts: ≤0.5W of No Load Power 10~250 Watts: ≤0.75W No Load Power	≤1Watt: ≥ Power x 0.49 1~49 Watts: ≥[0.09 x Ln(Power)] + 0.49 49~250 Watts: ≥84%
IV	0~250 Watts: ≤0.5W No Load Power	≤1Watt: ≥ Power x 0.50 1~51 Watts: ≥[0.09 x Ln(Power)] + 0.5 51~250 Watts: ≥85%
V	Standard Voltage AC-DC Models (>6Vout)	
	0~49 Watts: ≤0.3W of No Load Power 50~250 Watts: ≤0.5W of No Load Power	≤1 Watt: 0.48 x Power +0.140 1~49 Watts: [0.0626 x Ln(Power)] + 0.622 50~250 Watts: ≥87%
	Low Voltage AC-DC Models (<6Vout)	
	0~49 Watts: ≤0.3W of No Load Power 50~250 Watts: ≤0.5W of No Load Power	≤1 Watt: 0.497 x Power + 0.067 1~49 Watts: [0.0750 x Ln(Power)] + 0.561 50~250 Watts: ≥86%

* The term "power" means the power designated on the label of the power supply

The internationally approved test method for determining efficiency has been published by the IEC as AS/NZS 4665 Part 1 and Part 2. The approach taken in order to establish efficiency level is to measure the input and output power at 4 defined points: 25%, 50%, 75% and 100% of rated power output. Data for all 4 points are separately reported as well as an arithmetic average active efficiency across all 4 points.



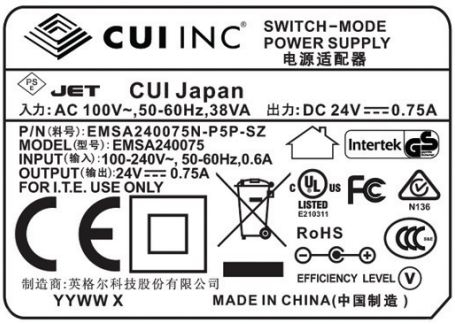
The Current Regulatory Environment

The preceding timeline demonstrates just how dynamic the regulatory environment has been over the past 8 years. As different countries and regions enact stricter requirements and move from voluntary to mandatory programs, it has become vital that OEMs continually track the most recent developments to ensure compliance and avoid costly delays or fines. While many countries are establishing voluntary programs harmonized to the international efficiency marking protocol system first established by Energy Star, the following counties and regions now have regulations in place mandating that all external power supplies shipped across their borders meet the specified efficiency level:

United States	Level IV
Canada	Level IV
European Union	Level V

Today, Level V will meet or exceed the requirements of any governing body around the globe. Power supply manufacturers indicate compliance by placing a Roman Numeral V on the power supply label.

Although the European Union is currently the only governing body to enforce compliance to the Level V standard, most external power supply manufactures are adjusting their product portfolios to meet these requirements. The adjustments are a direct response to the needs of OEM's to have a universal power supply platform for their products that ship globally.



Exemptions

Not all external power supplies are treated the same and exemptions exist in both the United States and the European Union.

In the US, Congress has written provisions into section 301 of EISA 2007 that exclude some types of external power supplies. These are devices that:

- Require Federal Food and Drug Administration listing and approval as a medical device in accordance with section 513 of the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 360c).
- Power the charger of a detachable battery pack or charges the battery of a product that is fully or primarily motor operated.
- Are made available as a service part or spare part by the manufacturer of an end-product that was produced before July 1, 2008 for which the external power supply was the primary load. Power supplies used for this purpose can be manufactured after July 1, 2008.

The European Union has instituted similar exemptions to the United States. External power supplies for medical devices, battery chargers, and service products are exempt. In addition, an exemption exists for low voltage EPS devices. Low voltage external power supply means a unit with a nameplate output voltage of less than 6 volts and a nameplate output current greater than or equal to 550 mA.

Moving Forward

As rapidly as regulations have changed over the past 8 years, it is almost certain that they will continue to evolve as power technologies improve and the price of energy continues to rise. The U.S. Department of Energy (DOE), for example, has issued a Notice of Proposed Rulemaking (NOPR) that would lay out the first mandatory regulations for external battery chargers and further tighten regulations on external power supplies. In what would effectively become the "Level VI" efficiency standard, the proposal on the table would mandate no-load efficiencies down to 0.1 W for external power supplies ranging from 1 W ~ 49 W, boost mandatory average efficiency by about 1%, and set standards for models with power ratings above 250 W for the first time.

The EPA estimates that external power supply efficiency regulations implemented over the past decade have reduced energy consumption by 32 billion kilowatts, saving $2.5 billion annually and reducing CO2 emissions by more than 24 million tons per year. Moving beyond the mandated government regulations, many OEMs are now starting to demand "greener" power supplies as a way to differentiate their end-products, driving efficiencies continually higher and even pushing the implementation of control technologies that in some cases eliminates no-load power consumption altogether. In early 2010, CUI Inc began exclusively manufacturing Level V external power supplies across their 2.5 ~ 250 W external power supply product line. Today, CUI continues to look for ways to implement the latest energy saving technologies into their external power supplies in order to address market demands and stay one step ahead of current and future regulations. View all Level V compliant power supplies at *www.cui.com/Catalog/Power/AC-DC_Power_Supplies/External.*

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