



An energy-aware survey on ICT device power supplies

Executive summary



GeSI
GLOBAL e-SUSTAINABILITY
INITIATIVE



UNIVERSITÀ DEGLI STUDI DI
GENOVA



1. Introduction

This report presents the results of a study commissioned by the International Telecommunication Union (ITU) and the Global e-Sustainability Initiative (GeSI). The study analysed over 300 commercially available External Power Supplies (EPSs) – devices both within and outside the ambit of information and communication technology (ICT) – with a view to providing input to the standardization activity of ITU-T Study Group 5 (Environment and climate change).

Decreasing the life-cycle environmental impact of EPSs is an exceptionally important part of efforts to ‘green’ the ICT sector, and the results of this study will inform work taking place within ITU-T Study Group 5 on phase two of the very successful ITU Universal Charging Solution – Recommendation ITU-T L.1000: *Universal power adapter and charger solution for mobile terminals and other hand-held ICT devices*.

Considering only the EPSs within the scope of this study, four billion new EPSs will be sold in 2012; a figure predicted to increase by 12 per cent annually. If not reasonably energy-efficient, they will consume unnecessarily large quantities of energy; and if not repairable in the case of failure, not (at least partially) recyclable, or not designed to be used with more than one type of device, large volumes of EPSs will find their way to landfill and become part of an escalating e-waste challenge.

Looking at 2014’s projected EPS sales, enhancing the energy efficiency of each EPS by as little as 1 Watt would achieve energy savings in the region of 1.8 Tera-Watts per hour (assuming an average usage of one hour per day). Additionally, the average weight of an EPS is around 250 grammes, if half of the EPSs sold in 2014 replace those disposed of, EPSs will in that year be responsible for 600,000 tons of e-waste.

2. Report structure and main outcomes

The report is composed of two main sections:

- 1) *In chapters 2 and 3, EPSs are classified, analysed and compared on the basis of their electrical (voltage, power, current, efficiency class, etc.) and physical characteristics (e.g., weight, volumes, mains and DC voltage connector type). The results of this analysis give clear indications of a tendency towards “de facto” standards (e.g. output voltages, connector types), and highlight significant opportunities to improve EPSs’ eco-efficiency through, for instance, large weight-reduction opportunities associated with the majority of EPSs analysed.*
- 2) *Chapters 4 and 5 analyse the energy efficiency of surveyed EPSs. The results strongly indicate that the efficiency of many EPSs is well below the optimum level, both in terms of dynamic behaviour (i.e., when providing electrical current to the attached devices) and in terms of the “no load condition” (i.e., when EPSs are connected to the energy grid, but not providing energy to the attached devices).*

The study's findings can be summarized as follows:

a. Optional energy-efficiency regulations are neglected

The Energy Star Program (www.eu-energystar.org/en/index.html), sponsored by the US Government and the European Union (EU), defines energy-efficiency classes and the associated labelling for consumer products. However, only 47 per cent of the analysed EPSs are marked with the Energy Star label and this label is rarely present in low-power adapters (<40 Watts); suggesting efficiency shortfalls in many of the EPSs analysed.

b. Common practices signify the existence of *de facto* standards

Voltage, current and power values tend towards common ratings, signifying partial *de facto* standardization. This condition is particularly evident in two specific aspects:

- ▶ Low-voltage connectors: the five most used connector types represent 86 per cent of the total
- ▶ Output voltage: 81 per cent of the devices have an output voltage equal to 5 V, 12 V or 19 V.

c. Potential improvements: Possible benefits of standardization

❖ ***Improving usability***

▪ ***Different connectors for different output voltages***

Power supplies with very different output voltages often make use of the same type of connector. This situation creates confusion and implies a risk to consumers attempting to use the same EPS to charge products with different input-voltage requirements. The standardization of a set of connectors and output voltages, as well as of the constraints linking these items, should be considered.

▪ ***Replaceable cables***

The main cause of failure in all power supplies is a weak point where the low-voltage cable is connected to the power supply. This weak point confirms the need for connectors standardized according to different voltage and current requirements, and it is highly recommended that EPSs provide a detachable, replaceable cable on the low-voltage side of the device.

▪ ***Accuracy of tag information***

Certain adapters were found to produce an output voltage higher than that declared by the supplier and reported on their nameplate. This would understandably lead to difficulties when using the same EPS to charge devices with different requirements.

Design optimization to improve eco-sustainability

▪ *Reduce EPS size*

Despite having the same electrical characteristics (voltage and power), EPSs produced by different vendors often possess very different physical dimensions (weight and volume). In most EPS categories, a large proportion of EPSs weigh over 20 per cent more than the category's lightest EPS. Weight is directly linked to environmental impact, and manufacturers should be urged to align their products with "best-practice" EPS dimensions.

▪ *Increase power efficiency*

Measurements taken in the study uncover large power-efficiency variations among items with comparable electrical characteristics; underlining a key opportunity to improve average efficiency. Comparable EPSs display varying power-efficiency levels in "low-load" and "no-load" conditions (i.e., when the supplied device requires 10-30 per cent of the maximum power, or when it is switched-off while the power supply is still connected to the electricity grid). Standards aligning the low-load power efficiencies of EPSs would therefore translate into significant energy savings.

▪ *Standardized design rules*

The study considers items from two different "safety classes": Class 1 (grounded, 3-pronged mains connector) and Class 2 (2-pronged mains connector). Roughly 65 per cent of the surveyed EPSs belong to Class 2, which is the more stringent of the two classes. Measurements taken in the study indicate that devices belonging to Class 2 are superior to devices in Class 1 with regard to their power efficiency and ratio of weight to supplied power. Class 2 devices also guarantee greater protection from energy grid overvoltages, and a strong case can be made for the adoption of Class 2 as the standardized solution for external power supplies as its 2-prong mains connector would allow compatibility with most country-specific mains receptacles located where ground is not available.

3. Conclusions summary

Within each EPS category, it is always possible to identify examples of EPSs coupling good-use performance with good environmental and energy efficiency, demonstrating the technical feasibility of pursuing the co-existence of these features, as well as the need for international standards outlining the means of achieving this.

If you would like to provide any additional information, please contact:

Cristina Bueti at greenstandard@itu.int

Alice Valvodova at alice.valvodova@gesi.org