Energy Policy 70 (2014) 1–13

Contents lists available at ScienceDirect

Energy Policy

journal homepage: www.elsevier.com/locate/enpol

Setting MEPS for electronic products

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H I G H L I G H T S

- For electronic consumer products price does not relate to efficiency.
- Average price decrease of selected electronic products is 26 % per year.
- We give an alternative approach to life cycle cost calculations for setting MEPS.
- The policy action window indicates whether setting MEPS is appropriate.

A R T I C L E I N F O

Article history:
Received 18 October 2013
Received in revised form
15 March 2014
Accepted 17 March 2014
Available online 13 April 2014

Keywords:
Electronic products
Minimum efficiency performance standards
Life cycle costs

A B S T R A C T

When analysing price, performance and efficiency data for 15 consumer electronic and information and communication technology products, we found that in general price did not relate to the efficiency of the product. Prices of electronic products with comparable performance decreased over time. For products where the data allowed fitting the relationship, we found an exponential decrease in price with an average time constant of -0.30 [1/year], meaning that every year the product became 26% cheaper on average.

The results imply that the classical approach of setting minimum efficiency performance standards (MEPS) by means of life cycle cost calculations cannot be applied to electronic products. Therefore, an alternative approach based on the improvement of efficiency over time and the variation in efficiency of products on the market, is presented. The concept of a policy action window can provide guidance for the decision on whether setting MEPS for a certain product is appropriate. If the (formal) procedure for setting MEPS takes longer than the policy action window, this means that the efficiency improvement will also be achieved without setting MEPS. We found short, i.e. less than three years, policy action windows for graphic cards, network attached storage products, network switches and televisions.

1. Introduction

In the last few decades electronic products like televisions, computers, monitors, laptops, tablets, mobile phones, and set-top boxes have invaded our lives. The impact on household and commercial electricity consumption is significant and is expected to grow (Ellis, 2009). (Bertoldi et al. 2012, p. 35) estimate that electronic products use 17% of the residential electricity consumption in the European Union (EU). Therefore, electronic products are increasingly the target of energy efficiency policies. Up to now, policies focused mainly on reducing standby power consumption e.g. to implement the IEA 1 W standby target (Jollands et al., 2010), whereas the current focus is also on the efficiency of the product when in the on-mode. Table 1 provides an overview of current policies for electronic products discussed in this article in the EU, Japan and the United States (US).[1]

Most experience in energy efficiency policies for electronic products has been with the introduction of (voluntary) energy labels, mainly ENERGY STAR in the US and EU. It is only recently that

Abbreviations: BAU, business as usual; CE, consumer electronics; CPU, central processing unit; CRT, cathode ray tube; DOE, Department of Energy (US); DVB, Digital Video Broadcasting; EFF, efficiency; EIC, efficiency improvement coefficient; EU, European Union; fps, frames per second; GLM, generalized linear model; HDD, hard disk drive; HICP, harmonized indices of consumer prices; IC, integrated circuit; ICT, information and communication technology; IEA, International Energy Agency; IEC, International Electrotechnical Commission; IO, input–output; IP, internet protocol; ISO, International Organization for Standardization; LCC, life cycle costs; LCD, liquid crystal display; LLCC, least life cycle costs; MEPS, minimum efficiency performance standards; MFD, multi-function devices; NAS, network attached storage; PAW, policy action window; PC, personal computer; PF, performance; PR, price; SSD, solid state drive; TEC, total energy consumption; US, United States (of America); WLAN, wireless local area network; YR, year

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[1] See http://ec.europa.eu/energy/efficiency/labelling/household_en.htm, www.eccj.or.jp/toprunner/ and www.energystar.gov.

http://dx.doi.org/10.1016/j.enpol.2014.03.024

Table 1
Overview of energy efficiency policies for electronic products.

Product	Efficiency requirements		Energy labels	
	Voluntary	*Mandatory (MEPS)*	*Voluntary*	*Mandatory*
Computer		Ecodesign (EU) Top Runner (Japan)	ENERGY STAR (US, EU) Top Runner (Japan)	
Graphic card		Included in Ecodesign (EU) requirements for computers	Included in ENERGY STAR (US, EU) specifications for computers	
Hard disk		Included in Ecodesign (EU) requirements for computers Top Runner (Japan)	Included in ENERGY STAR (US, EU) specifications for computers Top Runner (Japan)	
Monitor		Proposal revised requirements displays Ecodesign (EU)	ENERGY STAR (US, EU)	Proposal EU energy label
Network attached storage (NAS)				
Notebook		Ecodesign (EU)	ENERGY STAR (US, EU)	
Printer, including Multifunctional devices (MFD)	Voluntary Agreement under Ecodesign (EU)		ENERGY STAR (US, EU)	
Power supply (internal)		Included in Ecodesign (EU) requirements for computers	Included in the ENERGY STAR (US, EU) specifications for computers	
Router, Streaming client, network switch		Top Runner (Japan)	ENERGY STAR (US, EU)	
Set-top box	Voluntary Agreement under Ecodesign (EU)		ENERGY STAR (US) in preparation	
Television		Ecodesign (EU) Top Runner (Japan)	ENERGY STAR (US) Top Runner (Japan)	Energy label (EU, US)

mandatory minimum efficiency performance standards (MEPS) have emerged, notably within the framework of EU Ecodesign Directive 2009/125/EC (European Parliament, 2009), but also in the Top Runner programme in Japan. These first experiences have highlighted some problems that seem typical for electronics, e.g. how to deal with the high speed of market development, the ongoing introduction of new features and functionalities, the merging of products, and the disappearance of products from the market. Moreover, the question arises as to whether the life cycle cost methodology for setting MEPS that is used for household appliances, such as cold appliances, washing machines, dishwashers, and dryers, is also suitable for electronic products.

The classical method of setting MEPS is straightforward and the main steps can be summarised as follows. First, the energy efficiency of one or more representative products on the market is assessed. Second, the technical options to improve the energy efficiency and thereby – *ceteris paribus* – lower the energy consumption are explored and for these options the life cycle costs (LCC) for consumers are calculated. The LCC include the price of the product, the running costs over the lifetime of the product, e.g. the cost of energy, consumables and maintenance, and the cost at the end-of-life of the product. Third, the MEPS are set at a certain level, e.g. at the lowest or least life cycle costs (LLCC), and come into force at a certain date. This approach is used by the Department of Energy (DOE) in the US for setting appliance standards (US DOE, 2006, p. 20) and by the European Commission in the EU to set ecodesign requirements (Kemna et al., 2005). The rationale for this approach is that the MEPS should deliver both energy savings and net cost savings for consumers.

Using LCC for setting MEPS assumes that the cost for improving the energy efficiency of the product is related to the price of the product: the price increases due to the cost for changing the product to improve the efficiency. If this is correct, the LCC covers the impact of the measure on manufacturers and on consumers. However, the relation between the costs and the price of a product is not straightforward. Although in the long run the price for a product needs to be higher than its costs for the manufacturer to stay in business, the price is determined by factors other than the costs alone. Costs for manufacturers are costs of materials and components, design and production costs, and overhead costs, including research and development, marketing, and sales. The price is determined by the competition on the market, the sales channels used, brand, design (aesthetics), and features that consumers are willing to pay (extra) for. Another difference is that the price of a (consumer) product is made publicly available whereas costs for manufacturers are rarely declared because these are regarded as competition sensitive data and therefore confidential. The costs can be estimated by independent engineering analysis, but this is more difficult for future developments, new features, and functionalities.

In general the assumption that the price of a product is related to the energy efficiency holds true for household appliances and lighting, and also for industrial products like electrical motors, pumps and fans. However, (Siderius, 2013, p. 770) found for televisions that price did not correlate with the energy efficiency classes of the EU energy label. In that case LCC cannot guide MEPS and indeed the Ecodesign preparatory study for televisions only made a general remark on decreasing costs and assumed that all options for improving energy efficiency would be cost neutral (Stobbe, 2007, p. T7-25).

The aim of this article is first to review for 15 consumer electronic (CE) and information and communication technology (ICT) products the assumption that is the basis for applying life cycle cost analysis, i.e. that energy efficiency is related to the price of the product. The second aim is to provide an alternative in case this assumption is challenged and to provide input to the development of a methodology that can be used for development of efficiency policies for electronic products in general. Literature on appliance prices is mostly concerned with development of prices or efficiencies over time for household appliances (Dale et al., 2009; Desroches et al., 2013). Literature on energy efficiency policy for electronic products is scarce and mostly relates to ENERGY STAR and the energy savings of the ENERGY STAR program (Webber and Brown, 2000; Sanchez et al., 2008), or the development of criteria for computers (Lim and Schoenung, 2011).

This article is organized as follows. Section 2 describes the data of 15 electronic products and the methods used to analyse this data. In Section 3 we present both the results of the analysis, regarding the relation between efficiency and price, and our alternative for setting MEPS for products where the traditional LCC approach is not suitable. In Section 4 we discuss the findings, and Section 5 considers conclusions and policy implications.