

# Green Economy in the Electronics Industry

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## Abstract

In middle of century XVIII, the world population passed through a time of transition among the lack of products and services and the arrival of a new posture industrial production of high-speed range and with support for a world-wide. Thus, the Industrial Revolution had allowed a large increase in production leading manufacturers and also small producers such as artisans, able to produce large-scale production to leaking all over the planet, which subsequently led to an industry production that always met the needs of its consumers. One of the segments most recent of industry market is the electronics that come growing with the technological development in areas such as nanotechnology assisting its users in healing of chronic diseases and inventions that it become necessary, or indispensable often in the daily functions, leading to improved of life and optimization of time, each time more valued in contemporary society, creating in some ways, a technological dependence. Waste electronics are made of polymers, chemicals with high toxicity. The most computer components can be recycled. With the consolidation of the growth of this wild production, are unavoidable the environmental impacts arising from the continuous extraction of natural resources in search of raw materials and the improper disposal of waste from the electronics industry. In response to society, the non-governmental organization "Greenpeace" has adopted an alternative, to inform which companies are contributing more to the sustainability of the planet, through the "Guide of greener electronics". It was generated an average according to the 17 versions released to date. However the average obtained was the result of the last five years of evaluation, assuming the first place, as a company that performed services more targeted to the environment, Nokia Company with an average of 7,056, followed by Sony Ericsson (6.294), Samsung (5.841) ; Dell (5.565), Sony (5.359), Motorola (4.906), Toshiba (4.882) Hewlett-Packard (4.876), LGE (4.812) and Acer with mean 4,641. The present paper has as purpose to present an average of ten companies that produce electronics that have adopted best attitudes in the ranking of sustainable electronics.

Key words: green electronics; green economy; industry; sustainability;.

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## 1. Introduction

E-waste or Waste Electrical and Electronic Equipment (WEEE) is all the waste generated by the technological progress in a short time with large scale production and includes any electrical and electronic devices as: computers, computer hardware, mobile phones, televisions, batteries, and others (Cobbing, 2008).

It estimated to be generated annually, an average between 20 and 50 million tonnes of waste electrical and electronic appliance around the world, ranking the electronics market as one of the largest generators of hazardous waste. In Brazil alone, the number reaches 500,000 tons of electronic waste per year (Unep, 2005).

The electronic waste, there are around 30 elements of the periodic table in a single computer that makes manufacturing companies responsible to invest in technologies that require the minimum of these elements in their production. Waste electronics are made of polymers, chemicals with high toxicity such as organic solvents, polybrominated biphenyl ethers (PBDEs), polychlorinated biphenyls (PCBs), components of small plates, metals, in general trace metals such as mercury (Hg), cadmium (Cd), lithium (Li), barium (Ba), zinc (Zn), copper (Cu), cobalt (Co), lead (Pb), aluminum (Al), among other metals and materials considered sufficiently toxic to the life (Robinson, 2009; Carpanez, 2008; Afonso, 2008).

Approximately 94% of computer components can be recycled, plastic, glass and metals can be recovered. With the consolidation of the growth of this wild production, are unavoidable the environmental impacts arising from the continuous extraction of natural resources in search of raw materials and the improper disposal of waste from the electronics industry. A single color monitor, computer or television can contain up around 3 ½ kg of lead. The Lead when ingested goes through a slow process called bioaccumulation, so these trace elements will accumulate in fat cells known as adipocytes, promoting the development of carcinogenic cells in the human body. The accumulation of other heavy metals inside the body can also generate the formation of cancer cells, renal and neurological disorders, and genetic alterations in metabolism, lung problems and rheumatic pains, anemia, vomiting, choking, hyperactivity, insomnia, loss of smell, hearing and vision, to the bone weakness, depending on the chemical (Robinson, 2009).

When discarded in regular trash or landfills, come in contact with the environment by releasing ions which contaminate the soil where subsequently reach the groundwater and river water, therefore unclean animals and plants by water, until reach the man, responsible for their own destabilization of these chemicals in manufacturing new machines. As noted, this is a cycle in which the raw material is extracted, processed and manufactured continuously, in order to attend users to intermediaries which, depend on this demand rotating, regularly updated, which uses new technology concepts in search speed information. In order to euphemize environmental impacts, some environmental management tools such as Reverse Logistics (RL) enables to extend the life of the products, rescuing the electronics materials classified as idle, unused or inoperable, and those who are at the end of its life cycle to include it in the life cycle of the same product or other products (COBBING, 2008). The RL is an organization strategy that can help to slow or to prevent the environmental degradation. Can be defined as a process of planning, implementation, control efficiency, cost effective flow of materials, sales support, information exchange from the point of consumption to the point of origin for the purpose of capturing value or proper disposal of materials, customer support, recovery of components harmful to the environment and human health for reuse, recycling or reuse. Moreover, the operational activities of RL include storage, packing, separation, negotiation and delivery. Currently, both manufacturers of electrical and electronic equipment as the retail market are responsible for establishing mandatory RL products that are obsolete and at the end of its life cycle (Barbieri & Dias, 2002; Robinson, 2009).

In response to society, the non-governmental organization "Greenpeace" has adopted an alternative, to inform which companies are contributing more to the sustainability of the planet, through the "Guide of greener electronics." These guides are published by the *Greenpeace* in quarterly periods since August 2006, on his official site, with its last released in November 2011 (Greenpeace, 2010).

The Center of discussion is exactly in the attempt to implement these green guides as model for a green economy model which is a management system geared towards improving the social life, increased production and recovery of financial nature. The present paper has as purpose to present an average of ten main companies that produce electric and electronics appliance that have adopted best attitudes in the ranking of sustainable electronics and to serve as an indicator of sustainability of consumer electronics.

**Table 1.** Result of averages generated for electronics companies in the Guide to Greener Electronics.

Scores given to Companies in Guide of Green Electronics																		
Companies	Editions (since 2006)																	Average
	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°	16°	17°	
Nokia	7,0	7,3	7,3	8,0	8,0	6,7	7,3	4,8	7,0	6,9	7,5	7,5	7,5	7,3	7,5	7,5	4,9	7,056
Sony Ericsson	5,3	5,7	7,0	7,0	7,7	7,7	6,7	5,1	5,3	5,9	5,7	6,5	6,5	6,9	6,9	6,9	4,2	6,294
Samsung	5,0	4,0	6,3	6,7	6,7	7,7	7,7	4,5	5,7	5,9	6,9	7,1	6,9	5,1	3,7	5,3	4,1	5,841
Dell	7,0	7,0	7,0	7,3	7,3	7,3	7,3	4,5	4,7	4,7	3,7	3,9	4,7	3,9	4,3	4,9	5,1	5,565
Sony	4,7	5,0	5,6	5,3	7,0	7,3	7,3	5,1	5,3	5,3	5,5	4,5	5,1	5,1	4,9	5,1	3,6	5,394
Motorola	1,7	6,0	6,3	6,7	6,7	5,0	6,3	4,3	3,7	5,3	5,3	5,5	5,3	5,1	5,1	5,1	0,0	4,906
Toshiba	3,0	3,7	4,3	6,0	6,0	7,0	7,7	4,3	4,7	5,9	5,3	5,5	5,7	5,3	3,5	2,3	2,8	4,882
Hewlett-Packard	4,7	5,7	4,0	4,0	5,3	6,7	6,7	4,3	4,7	4,5	2,7	3,5	4,5	4,7	4,9	5,5	5,9	4,841
LGE	4,3	4,0	3,6	4,3	7,0	7,0	6,7	3,3	4,9	5,7	5,5	5,7	4,7	5,1	3,7	3,5	2,8	4,812
Acer	2,3	5,3	5,3	5,7	5,7	5,7	5,7	4,3	4,5	4,7	4,5	4,9	4,7	4,5	4,1	4,1	2,9	4,641
Apple	2,7	2,7	2,7	5,3	5,3	6,0	6,7	4,1	4,1	4,3	4,7	4,7	4,9	5,1	4,9	4,9	4,6	4,571
Panasonic	3,3	4,3	3,6	5,0	5,0	5,0	4,7	4,3	4,5	5,1	4,3	4,9	4,9	4,9	4,9	5,1	3,6	4,553
Lenovo	1,3	5,3	8,0	7,3	7,3	7,3	7,3	3,9	4,1	3,7	3,1	2,5	2,5	2,5	1,9	3,5	3,8	4,429
Fujitsu-Siemens	3,0	6,0	6,0	6,0	7,0	7,0	6,7	3,7	5,5	5,7	0,0	2,4	2,7	3,5	3,5	3,9	0,0	4,271
Phillips	0,0	0,0	0,0	0,0	0,0	2,0	4,3	3,7	4,3	4,1	5,7	5,3	5,9	5,3	5,1	5,5	4,5	3,276
Sharp	0,0	0,0	0,0	0,0	0,0	4,7	5,0	3,9	3,1	4,9	4,9	5,3	5,1	4,5	4,5	4,7	3,0	3,153
Microsoft	0,0	0,0	0,0	0,0	0,0	2,7	4,7	2,2	2,2	2,9	2,7	2,5	2,7	2,4	3,3	1,9	0,0	1,774
Nintendo	0,0	0,0	0,0	0,0	0,0	0,0	0,3	0,8	0,8	0,8	0,8	1,0	1,4	1,4	1,8	1,8	0,0	0,641
Rim	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	1,6	0,094

Table 1 presents a classification of all 17 editions the participation of all manufacturers, including its up and down.

## **2. Material and methods**

The research was shared into two modules: I) survey of secondary data; and II) table construction and analysis of companies participating in the Guide of Greener Electronics. In the first module was made a research in articles, books and specific websites about the industry, composition of electronics, reverse logistics (RL), Life Cycle Analysis (LCA), also has studied the progression of the waste generated by this industry, and corrective actions undertaken by these companies, and was central on research of documents of the organization that created the Guide.

In the second module, to rank the companies, it was used a simple statistical analysis using an arithmetic average, in which the process adopted for the analysis of data was done by drawing up a table on which were listed the names of the 19 participating companies of Guide to greener Electronics of Greenpeace, where each company had obtained their scores from Guide in its editions (Greenpeace, 2010). This points were after added and shared by the number of editions of Greenpeace's Guide, then it were generated the averages of ten brands of electronics sector that most contribute to environmental responsibility, which ordered, completes the process.

## **3. Results and discussion**

The average of the last five years of assessment shows that in the first place, the company that developed more targeted actions to the environment was the Nokia Company with an average of 7,056, followed by Sony Ericsson (6,294), Samsung (5,841), Dell (5,565), Sony (5,395), Motorola (4,906), Toshiba (4,882), Hewlett-Packard (4,841), LGE (4,812), and last place the company Acer 4,641.

In the classification presented in Table 1, some companies did not obtain satisfactory results, having been inserted later in the green race, others because they have been penalized for a lapse in its production, where declare absence of certain dangerous chemicals, which later analysis showed the absence of extinction of these substances. The analysis reflects the construction of average according to participation in all editions.

For the classification of companies were established ecological criteria for the assessment which includes: i) use of a smaller amount of trace metals harmful to the environment and health of living beings, ii) reducing the use of metals in the physic-chemical process of production and the components of this product, iii) frequency as the realization of the reverse logistics of materials that are at the end of life cycle by manufacturers iv) manufacturing equipment with lower power consumption, reduced use of plastics known as "anti-fire, "considered not eligible for recycling, as well as other non-recycled materials (Greenpeace, 2010).

Analyzing the guides, it observes that in the first Green Guide 14 manufacturers of computers and mobile phones made up the green guide, according with its policies in the management of toxic chemicals and recycling. Basically three groups stand out: Nokia and Dell were, respectively, first and second place. In the second block, companies: Samsung, Hewlett-Packard, Sony Ericsson, Sony and LGE, and the last: Toshiba, Acer and Motorola (Greenpeace, 2010).

The manufacturer Nokia stood by to extinguish the use of polyvinyl chloride (PVC) on their mobile phones as well as Flame Retardants (PFRs) of its components. Dell has a strong definition of the precautionary principle and reasonable schedule for eliminating PVC and BFRs.

After the release of the first guide, in September 2006, the Greenpeace found a type of flame retardant (decaBDE) in HP laptops, after his statement about the total elimination of the substance in their products.

In the fifth edition (Microsoft, Sharp and Phillips), three new companies incorporate the fight for sustainability in the electronics devices, the last two TV manufacturers. On the sixth green guide, the company's games Nintendo get in the quarrel. In the eighth edition, there was a drastic reduction in the final results of the companies with the implementation and refinement of criteria. Some of these were already previously adopted by some companies, they are: i) criteria for climate change, ii) gradual elimination of certain toxic chemicals already identified as dangerous by the marks, which are: phthalates, beryllium and antimony, including alloys and derived compounds, as well as PVC and BFRs, which it has forced companies to declaring a timeline for such extinction; iii) energy criteria, they are: i) Support for global mandatory reduction of greenhouse gas (GHG) emissions; ii) Disclosure of the company's own (GHG) emissions plus emissions from two stages of the supply chain; iii) Commitment to reduce the company's own GHG emissions with timelines; iv) Amount of renewable energy used; v) Energy efficiency of new models (Greenpeace, 2010).

This publication it has had generalized low scores (8th), and Sony-Ericsson got the lead along like Sony. Nokia was again penalized by the same attitude of the last edition, as well as Phillips to establish partnership in the absence of criteria establishing individual responsibility for collection and recycling.

#### **4. Conclusions**

Several companies continue competing for better position in the ranking of the greenest electronics guide, others only seek to enter the list. To achieve the most satisfying positions that aim a sharemarket, the largest international market share in electronics, as well as benchmarking, the development of this indicator of environmental sustainability presents a preview of an economic alternative in a preference for purchasing products from companies that maintain a greater environmental responsibility.

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Obtaining the standardization of the criteria of the Greenpeace Guide requires much commitment of the company and changes in previously established standards and adoption of new models. Whereas obtaining of the required standards by Greenpeace is neither easy nor quick to achieve, benchmarking allows smaller vendors can use their environmental policies in pursuit of a greener economy.

There are two models to read the table of the evolution: considers all editions of the guide, which allows more justice upon those who are in contention for best places since the beginning of the program or consider the manufacturers have entered the race later and had their averages from their participation in the guide, which consequently increased the overall averages of these companies.

Thus, this article presents the evolutionary graphics from the beginning of the guides and the oscillations of the participating companies older. It becomes essential a creation of a specific and global policy with determination and quantity of heavy metals and hazardous chemicals in the manufacturing process of electronics, when the Greenpeace guide just presents updated data from electronics manufacturers.

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