



## SECTOR BACKGROUND NOTE – Electrical and Electronic Equipment

### 1. KEY FACTS AND FIGURES

#### **Global Production**

The production of electric and electronic equipment (EEE) is increasing worldwide. Some 20 to 50 million metric tonnes of e-waste are generated globally every year, comprising more than 5% of all municipal solid waste. In Western Europe, 6 million tonnes of WEEE (waste of electrical and electronic equipment) were generated in 1998 and the amount of WEEE is expected to increase by at least 3-5% per annum. By 2010, the European Union will be producing around 12 millions tons of electrical and electronic waste annually (Churchman-Davies, 2002).

Consumer demand, coupled with rapid technological innovation in the electrical and electronic sector, encourages frequent “upgrades” and production of new models, thus impacting the increase in the volume of WEEE expanding worldwide. The increase in product turnover is directly linked to the increase in the amount of used equipment and waste, which needs to be treated in an environmentally sound manner. E-waste contains substances such as lead, cadmium, beryllium, mercury or brominated flame retardants, which can harm human health and the environment if they are not refurbished, recycled or disposed of in an environmentally-sound manner.

#### **Box 1. Definition: what is waste electrical and electronic equipment (WEEE)?**

According to EU Directive 2002/96/EC, there are, *inter alia*, ten categories of WEEE.

1. Large household appliances
2. Small household appliances
3. IT and telecommunications equipment
4. Consumer equipment
5. Lighting equipment
6. Electrical and electronic tools
7. Toys, leisure and sports equipment
8. Medical devices (with the exception of all implanted and infected products)
9. Monitoring and control equipment
10. Automatic dispensers

#### **Why is e-waste an important waste stream?**

E-waste is becoming an important issue in many countries. In most cases, quantities and quality of the obsolete equipment is unknown. Large quantities are disposed in landfills or incinerated in the open air, leading to the release of potentially hazardous material into the environment. On the other hand, the value of the resources contained in these products is often overlooked: there is an economic value at the end of their life, such as base and precious metals. Unfortunately today, even when these resources are recovered, it is frequently via

transboundary movement to developing countries and countries with economies in transition for reprocessing and recycling.

Developing countries often lack the waste disposal infrastructure, environmental and health regulations, as well as the technical capacity necessary to ensure the safe disposal of hazardous waste. Sub-standard practices need to be replaced by safer and sustainable environmental management system (EMS), while maintaining the economic benefit. Recovery and recycling, when pursued in an environmentally sound manner, can create both trade and development in developing countries, while increasing the amount of sustainable and equally beneficial trade between all countries, and alleviate certain pressures on natural resources.

#### Box 2. Some data on WEEE

- According to a German estimate (EEA, 2003), the composition of a WEEE stream is the following: industrial goods (40%), large household appliances (40%), and electronic consumer goods (20%, including 5% end-of-life computers).
- Of the total amount of WEEE collected, sorted and dismantled in Switzerland in 2004 (almost 75 000 tonnes of devices), about 29% was composed of office equipment, 24% of large household appliances (i.e. white goods), 18% of cooling appliances, 15% of consumer electronics and about 10% of small household appliances (Hischier et al, 2005).

#### The Basel Convention and E-wastes

E-waste falls under the scope of the Basel Convention. Under the Convention, electrical and electronic wastes (e-wastes) are characterized as hazardous wastes<sup>1</sup> when they contain components such as accumulators and other batteries, mercury switches, glass from cathode-ray tubes and other activated glass, Polychlorinated Biphenyls (PCB)-containing capacitors or when contaminated with cadmium, mercury, lead or PCBs. Also, precious-metal ash from the incineration of printed circuit boards, Liquid Crystal Display (LCD) panels and glass waste from cathode-ray tubes and other activated glasses are characterized as hazardous wastes. To address the environmental issues related to the increasing transboundary movements of these wastes, and to ensure that their storage, transport, treatment, reuse, recycling, recovery and disposal is conducted in an environmentally sound manner, a proactive approach is essential.

Importing Region	World	Developed countries	Developing countries				
			All	SE Asia	China	Philippines	Thailand
All EEE	844.6	273.1	528.8	433.7	169.7	30.3	24.8
Large household appliance	41.4	18.1	19.7	11.1	6.7	..	2.1
Small household appliances	25.3	8.9	15.5	13.6	11.2	0.1	0.4
IT and telecom equipment	602.7	194.7	383.8	325.7	98.5	29.5	17.7
Consumer goods	151.8	43.0	96.1	70.9	42.7	1.1	4.4
Other	23.4	8.3	13.7	12.3	10.6	..	0.2

(UNCTAD, 2006)

1. Under the Basel Convention, e-wastes are classified under Annex VIII entries A1010, A1020, A1030, A1090, A1170, A1180, A1190, A1150 and A2010 and also under Annex IX as B1110, B1115. The plastics associated with e-wastes may also be covered, under Annex II of the Basel Convention in addition to Annex IX, B3.

## **Supply chain**

The EEE industry, in general, and the IT industry in particular, is largely based on a global supply chain. Globally implemented supply-chain management will have to ensure adjustment to the new environmental requirements. Small and medium sized enterprises (SMEs) in developing countries that input into export production are often made part of global supply chains.

In addition, governments and companies in developing countries often require assistance and capacity building in order to promote pro-active policies with regard to information gathering and waste management (e.g. better understanding of new market requirements), product engineering/design (to compete successfully in international markets) and to adequately address problems related to growing volumes of their own e-waste.

Frequently, large companies and governments in developing countries are not sufficiently aware of the new environmental requirements in external markets (particularly in developed countries). As a result, the implications and adjustments of such requirements are often not well understood.

It is projected that developing countries themselves are expected to triple their output of e-waste by 2010. Bearing this in mind, the sound management of e-waste will become a key national task.

One way of addressing the end-of-life issues associated with WEEE is to address them at the design stage, where material selection, waste avoidance, waste minimization or easy dismantling (design for recycling) of the equipment are critically influenced (often to an extent of 60% or more). In addition to addressing proper environmentally sound management of e-waste at the design phase, eco-design can contribute to reducing material and energy consumption, thus indirectly contributing to the reduction of greenhouse gas emissions (GFEA, 2005).

Manufacturing consumer electronics is also energy intensive; the fossil fuels used to make one desktop computer, for instance, weigh over 240 kilograms, some 10 times the weight of the computer itself. This is very high compared to many other goods. For an automobile or refrigerator, for example, the weight of fossil fuels used for production is roughly equal to their weights. Also, substantial quantities of chemicals (22 kg) and water (1,500 kg) are also used in the production of computers. The environmental impacts associated with using fossil fuels (e.g. climate change), chemicals (e.g. possible health effects on microchip production workers) and water (e.g. scarcity in some areas) for consumer electronics are significant (Kühr and Williams, 2004).

Through energy efficiency modes of operation (for instance, the suppression of stand-by modes and switch to a low-power state when left inactive), electronic devices can reduce energy consumption by 50-70 per cent. Despite these innovations, aggregate computer-related energy consumption has significantly increased because of enhanced internet and computer-game use. Energy consumption of web-hosting servers in the US, for instance, has doubled since the year 2000. The total energy consumption of web-hosting servers worldwide is estimated to be equivalent to global air traffic.

Given the contribution of electronic equipment production and consumption to waste generation and energy consumption, it is not surprising that this sector is increasingly subject to government regulations that aim to protect human, plant and animal health and the environment.

## **2. Standards and Regulations for Electrical and Electronic Waste: Recent Trends**

### ***Mandatory and voluntary market access and entry requirements***

EEE exports are subject to growing and increasingly strict standards and technical regulations, many arising from private and public origins, whose objectives are to protect human, plant and animal life and health, the natural environment and wildlife; and to promote corporate social responsibility and minimize deceptive practices. As tariff barriers and quantitative restrictions are dismantled, there is concern that product- and process-related requirements, including environmental and health requirements, although well intentioned, are either unwittingly becoming or being perceived as technical barriers to trade in the light of the technical, skill, infrastructural and institutional capacity constraints in developing countries.

These developments will have particular implications for manufacturers and assemblers in developing countries that export or plan to trade with developed countries. With more outsourcing and contract manufacturing moving to East and South-East Asia and other locations, it is envisaged that this will create an effect of increasing requirements for suppliers to become more aware of environmental issues, especially, product-related aspects concerned with material and energy efficiency, reduced toxicity and increased recycling.

The impacts will be primarily through increasingly strict supply chain requirements, e.g. the removal of lead and cadmium. Additional implication for developing countries will relate to the testing and analysis of products and the technologies needed to do this. Moreover, an OECD study (2005) indicates that machinery and electronics are subject to the highest incidence of technical barriers to trade (TBTs). Such TBTs mostly relate to technical regulations and standards affecting in particular electrical apparatus and computers and parts thereof. These products also involve the largest number of complaints about import licensing procedures.

Regulations in industrialized countries including the European Union, Japan, and the United States, have addressed the sustainability of the electronic sector, creating production (and lately also design) requirements and designating responsibility for waste collection and management. For example, Japan has passed the Home Appliances Recycling Law (HARL) and the law for the Promotion of Effective Utilisation of Resources (LPEUR) in 2001.

In the European Union, these include, *inter alia*, the Waste Electrical and Electronic Equipment (WEEE) and Restrictions on Hazardous Substances (RoHS) Directives. The WEEE Directive (2002/96/EC) in particular, is an environmental Directive that is based on the principle of producer responsibility to encourage the design and production of EEE in a manner that facilitates their repair, possible upgrading, reuse, disassembly and recycling. The RoHS Directive (2002/95/EC) aims at eliminating hazardous materials from waste streams by prescribing that, as of 1 July 2006, new EEE put on the market should no longer contain lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls or polybrominated diphenyl ethers, with certain exceptions. Other important EU legislation that bears on EEE includes the End of Life Vehicles (ELV) Directive, the Packaging and Packaging Waste Directive, the Registration, Evaluation and Authorisation (Reach) Directive for chemicals and the recently adopted EU Directive for Eco-design of Energy-using Products (EuP). The latter builds on, and complements WEEE and RoHS requirements, but requires a much more sophisticated adjustment approach by producers. At the same time, it offers a multitude of opportunities to reduce the environmental and health impact of EEE, including at national level in developing countries, as well as to enhance material efficiency.

In the United States, there is no national EEE waste legislation. Nevertheless, an increasing number of state and local governments are implementing legislation for managing end of life electronic equipment, e.g. California's Electronic Waste Recycling Act (2003). In the US, there are some 52 electronic waste bills proposed in 26 states during 2003 and 65 related mercury-

restriction bills, ten of which affect electronics. Moreover, in some states, the product coverage is limited to hazardous EEE, but the restriction on the use of hazardous substances can be as stringent as EU's RoHS. The patchwork of state regulations in the US is mirrored in Canada with no national legislation in place, but several Provincial and city programmes in existence.

There are also a number of recent voluntary initiatives in the US that attempt to drastically limit the environmental impact of electronics. For instance, the Electronic Product Environmental Assessment Tool (EPEAT) is a system to help purchasers in the public and private sectors evaluate, compare and select desktop computers, notebooks and monitors based on their environmental attributes. EPEAT also provides a clear and consistent set of performance criteria for the design of products, and provides an opportunity for manufacturers to secure market recognition for efforts to reduce the environmental impact of its products. The White House Executive Order 13423 (issued at the end of January 2007) requires federal agencies to purchase at least 95% EPEAT-registered products in all relevant electronic product categories. Furthermore, on 20 July 2007, the ENERGY STAR programme in the US released a new standard for computers (ENERGY STAR 4.0), which is a more stringent and complex standard than the previous ENERGY STAR 3.0.

A globalised supply chain management plays a significant role in the adjustment to new environmental requirements. SMEs must conform to requirements set by global supply chains or risk being phased out as input providers. For the concerned exporting countries, it is more effective and cost-efficient to combine adjustment to external requirements for exported EEE with adjustment to domestic needs for sound national collection and management of EEE waste. To achieve this, developing countries need not only accurate and timely information, but also assistance in interpreting such information to make it relevant for adjustment strategies.

### **Trends**

The EEE sector provides an example of how product-related legislation and standards that are designed to address national or local environmental concerns in major markets can have significant implications for processes and production methods in other countries. The following important general trends of the EEE sector can be identified:

- Transboundary movement of used refrigerators, other electrical appliances, personal computers and associated hardware, used electronic equipment and used mobile telephones, is forecast to continue to increase significantly. While offering some economic benefits, massive import of e-wastes coupled with the same wastes being generated locally is placing a heavy health and environmental burden, in particular to developing countries.
- While growing volumes of waste from EEE and associated adverse environmental and health problems can be significant in many countries, policy responses have been diverse. Particularly, the choice between government regulations and controls versus reliance on private-sector initiatives to achieve environmental objectives.
- Environmental policies are increasingly based on the principle of *producer responsibility*, in particular in dealing with end-of-life environmental impacts. However, with the intervention at the end of life stage of the product's life, there is indication that EPR schemes can drive upstream changes in the design of the product.
- The EEE sector illustrates the growing interest of regulators in innovation and product design to develop products that are environmentally-friendly at all stages of their life cycle. This raises questions about (a) the respective roles of Government and private-sector initiatives; (b) the planning and design cycle of industry (c) the need to take into account differing conditions and needs of developing countries; and (d) the thus resulting enhanced need for consultation and co-ordination of key environmental policies.

- Trade issues do not figure prominently in national discussions and consultations on policies concerning WEEE, except for concerns about (a) the functioning of the EU internal market; (b) exports of WEEE to developing countries from developed countries, including used products and donations which can become e-waste within two to three months for the shipment, leaving the developing country to handle the disposal aspect; and (c) voluntary standards on energy efficiency of EEE.

### **3. Work Carried Out by UNCTAD-CTF, UNEP-UNCTAD CBTF, UNEP-DTIE and Basel Convention**

#### ***UNCTAD-CTF***

Over the years, a number of project activities, thematic research, workshops and multi-stakeholder dialogues concerning EEE and market access/requirements have been arranged under UNCTAD's Consultative Task Force on Environmental Requirements and Market Access for Developing Countries (CTF). For instance, in May 2005, UNCTAD and UNESCAP jointly organized a workshop on *Exchanging National Experiences among the Key Exporting Developing Countries - Environmental Requirements and Market Access for Electrical and Electronic Goods*. The meeting focused on China, Malaysia, Philippines and Thailand - the principal exporting countries of EEE that account for more than half of world exports. The workshop brought together differing viewpoints and expertise from officials of Commerce and Environment Ministries, academia, NGOs and managers of public and private enterprises in the electrical and electronic industry from both exporting and importing countries.

Similarly, a sub-regional workshop entitled *Environmental requirements, Market access/entry and Export Competitiveness of Electrical and Electronic Products from China, Philippines and Thailand* was organised in February 2004 in the Philippines. The discussion focused on national experience in China, the Philippines and Thailand that included (i) information gathering and dissemination on new or emerging environmental requirements in key export markets; (ii) the level of awareness on such requirements; (iii) current adjustment strategies to environmental requirements; and (iv) recommendations on a more pro-active policies to respond to environmental requirements in key export markets, including sub-regional co-operation, where appropriate.

Key findings and conclusions of the above-outlined CTF activities on EEE were synthesized in UNCTAD's Trade and Environment Review 2006, entitled *Environmental Requirements and Market Access for Developing Countries: Developing Pro-active Approaches and Strategies* (UNCTAD, 2006)<sup>2</sup>.

#### ***UNEP-UNCTAD CBTF***

In 2001-2002, CBTF funded a 'Pilot Project for the Environmentally-Sound Management of Used Lead Acid Batteries', which was implemented by the Basel Convention in Central America and the Caribbean. The findings of the country assessments carried out in Colombia, Dominican Republic, El Salvador, Mexico, Panama, St Lucia, Trinidad & Tobago, and Venezuela were consolidated in a regional workshop held in November 2002. The Country assessments summarised important information on the problems experienced by these countries in the life cycle of lead acid batteries. Recommendations focused on the use of political and economic instruments to enhance the incentives for regional cooperation and for developing an integrated approach for collecting, storing, transporting, shipping and recycling used acid lead batteries (ULAB).

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<sup>2</sup> For more information on CBTF and CTF activities, please consult: [www.unctad.org/trade\\_env/projectCTF.asp](http://www.unctad.org/trade_env/projectCTF.asp).

### **UNEP-DTIE**

Under the auspices of United Nations University (UNU) the international initiative - Solving the E-Waste Problem - (StEP) was launched in March 2007. Its goals are to extend the life of computers and other electronic equipments as well as markets for their reuse, reducing pollution and improving the salvage of increasingly valuable components in electrical and electronic scrap (E-scrap). UNEP DTIE is coordinating the policy task force of StEP and has started to implement a project on Environment & e-Waste in India with the German GTZ and the Swiss EMPA.

UNEP DTIE has continued to promote a life cycle approach to waste management through its Life Cycle Initiative and has begun to set up the International Panel on Resource Efficiency and Environment<sup>3</sup> whose consultative meetings have resulted in the selection of “globalization of material recycling” as one of two priority areas to look at in its 2008-2010 work plan. Finally UNEP DTIE, together with InWEnt– Capacity Building International and other partners, has started the 4-year project ‘Enabling developing countries to seize eco-label opportunities’ co-funded by the European Commission and the Federal Ministry for Economic Cooperation and Development (Germany). The project, through training and technical assistance to national stakeholders, aims at promoting European eco-labels for key export products in emerging economies; China will specifically focus the project on electronic equipment.

### **Basel Convention**

To address the mounting problems with the environmentally sound management of mobile phones, the Mobile Phone Partnership Initiative was launched in 2002, during the sixth meeting of the Conference of the Parties to the Basel Convention. Since the start of this public-private partnership, the Mobile Phone Working Group has successfully finalized five guidelines that address the refurbishment of used mobile phones; the collection of used mobile phones; the material recovery and recycling of end-of-life mobile phones; raising awareness on design considerations; and on the transboundary movement of collected mobile phones. The second phase of the work under the Mobile Phone Partnership Initiative work programme focuses on pilot projects and dissemination of information through training workshops globally.

At the regional level, the Basel Convention Partnership on the Environmentally Sound Management of Electrical and Electronic Wastes for the Asia-Pacific Region was officially launched in November 2005. The following Asian countries have supported and are participating in the project activities: Cambodia, China, India, Indonesia, Malaysia, the Philippines, Singapore, Sri Lanka, Thailand and Viet Nam. In early 2007, two sets of technical guidelines were completed under the leadership of the Basel Convention Regional Centre for South East Asia on the methodology of e-waste inventory and environmentally sound management and “3R” (reduce, reuses, recycle) of end-of-life e-products.

On 30 November 2006, the World Forum on E-waste was organised as part of the 8<sup>th</sup> meeting of the Conference of the Parties of the Basel Convention in Nairobi. The Forum was chaired by UNEP’s Executive Director Achim Steiner. The COP adopted the Nairobi ministerial declaration on the environmentally sound management of electronic and electrical waste and a decision on the future work of the Basel Convention in the area of e-waste. At the September 2007 meeting of the Open-ended Working Group to the Basel Convention, a work plan for the ESM of e-waste for 2009-2010 was adopted, as a follow-up to the Nairobi Declaration that included among others programmes and capacity-building activities for the ESM of e-waste in Asia Pacific, Africa and the Latin American countries (Basel Convention, 2007).

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<sup>3</sup> This is a working title and is subject to confirmation by the Steering Committee. This international panel is one of the initiatives mentioned in the European Commission’s Thematic Strategy on the Sustainable Use of Natural Resources.

#### 4. Key Issues and Points for Discussion

The main points for discussion suggested below aim to address key issues relevant to the objectives of symposium, namely:

- To address the challenges and constraints facing developing countries' access to markets with a particular focus on environmental requirements;
  - To identify market opportunities created by new environmental requirements in key export markets of developing countries.
- (i) What are the implications of environmental requirements in the EEE sector for exports from developing countries?
  - (ii) What lessons can be learned from stakeholder consultation in countries introducing new environmental regulations, as well as from consultation with third countries?
  - (iii) What is the degree of awareness and understanding of these new environmental requirements and adjustment approaches in concerned developing countries?
  - (iv) What pro-active strategies can developing countries apply to simultaneously adjust to external requirements and address problems related to growing volume of EEE-waste and energy and material efficiency problems and related pollution at home?
  - (v) What type of technical assistance and capacity development is needed to best help affected countries and exporters comply with new requirements while developing their own domestic measures?

#### Challenges and Constraints Faced by Developing Countries for the Production and Trade of Electrical and Electronic Goods

Key issues in this regard include:

- The lack of awareness of new environmental requirements in different segments of the EEE sector in rapidly industrializing countries.
- The need for greater cooperation in information sharing and consultations among developed and developing countries, and with respect to adjustment approaches in concerned developing countries.
- The need for consultation with, and involvement of developing countries in the further development of EU legislations on EuP, WEEE and RoHS.
- The need to continue to identify possible market access implications for developing countries in the process of developing new environmental regulations and voluntary standards, as well as intensify efforts towards increased dialogue with these countries.
- The need to provide more effective capacity building to assist governments and companies in developing countries in making timely and pro-active adjustments to external environmental requirements.
- The importance of creating more efficient and effective refurbishment and recycling markets, taking into account transaction costs for buyers searching sellers and vice versa, market failures and barriers which can be costly especially in developing countries in which prices can be volatile.

#### 5. List of Useful References

This sector background note was developed using the following materials and documents:

- Analysis of Non-Tariff Barriers of Concern to developing countries. OECD, 2005
- Background paper: Environmental Requirements and Market Access for Developing Countries: The Case of Electrical and Electronic Equipment (EEE). UNCTAD, 2005
- Computers and the Environment - Understanding and Managing their Impacts. Kühr, R. and R. Williams, 2004.

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