ASSESSMENT AND EVALUATION OF WASTE ELECTRIC AND ELECTRONICS DISPOSAL SYSTEM IN THE MIDDLE EAST

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Abstract

Electronic waste has become a challenge to most nations. The e-waste challenge can only be met by combining effective legislation with incentives to develop business and employment opportunities to maximize the lifespan of these valuable finite natural resources. Capacity building and technology transfer from developed countries to developing countries, along with the implementation of international standards, will be a key to reducing waste and pollution, in parallel with the creation of sustainable business models. This paper attempts to review the management of WEEE in the Middle East and propose a guiding framework for the national policies in regards to this growing problem.

Keywords: Electronic Waste, E-Waste, WEEE

Introduction

The Arab region, like the rest of the world, has had to contend with increasing Waste Electrical and Electronic Equipment (WEEE) as more households acquire electronics and electrical products. WEEE represents a small proportion of the aggregate waste generated by any of the 22 Middle East and African Arabic states. WEEE, however, accounts for some of the most potent waste because of the individual and synergistic potential of its components. Glass, plastics, aluminium, and iron account for over 80% of WEEE while the rest are toxic materials and valuable components (El-Nakib, 2012). Some of the ingredients are hazardous while others are of value as recyclables. While most states in the region have some process of waste management, most of them are only just beginning to appreciate the need for proper WEEE waste management systems.

While the prevalence of ICT in the region is slightly below international averages, it has shown tremendous potential to grow in the next few years (Dahroug, 2009). In 2000, for example, the total mobile subscription in Egypt was 1.4 million. This figure rose by more than 100%

by 2002, and reached 25.6 million subscribers in 2007. By 2008, end of life mobile handsets were estimated at 9 million handsets. The 2012 estimates indicated that the subscriptions had risen to over 45 million, while modest estimates of the end of life gadgets are in excess of 14 million handsets (Dahroug, 2009). While Egypt had a very little e-waste at landfills and dumpsites in the first decade of increased EEE use, the proportion is likely to increase sharply. The rapid increase in cell phone subscriptions represents a growth across the electrical products sector where increased demand has led to reduced prices. Most TV sets, personal computers, and other electronic and electrical equipment now have a shorter usable life and are likely to be replaced or upgraded in a few years.

International and Regional WEEE Management

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes came into effect in 1992. The international convention with 172 signatories lists E-waste as a subcategory of the hazardous waste materials. To provide a contextual view, the Basel Convention created regional centres, Basel Convention Regional and Coordinating Centres (BCRCs) as the focal points for implementation and monitoring. The BCRC for Arab States established in 1998 and headquartered in Cairo, Egypt. Among its various functions is the development of information dissemination programs, technology transfer, and training programs for environmentally and sound management and disposal of e-waste. The BCRC is also responsible for spearheading and supporting public-private initiatives to deal with hazard wastes. As of May 2013, the MENA region still had no regional policy document for e-waste in the region. This makes the role of the BCRC the more important to ensure and assist in the implementation of the Basel Convention.

Categorization is an important aspect of WEEE management. The WEEE Regulations (2006) divide WEEE into ten broad categories ranging from large household appliances, consumer equipment, tools, toys and sports equipment, to medical devices and automatic dispensers. These broad categorizations provide a framework on which individual countries can design their own institutional responses to WEEE. In the majority of the Arab countries, for example, consumer equipment, ICT equipment and small household appliances account for the bulk of the waste generated every year (Dahroug, 2009).

WEEE Management in Individual Countries

a. Bahrain

While Bahrain does not have comprehensive laws on e-waste management, they have the most advanced bylaws on related waste policies

within MENA (Hassanin, 2010). Bahrain is placing particular importance to e waste management because of the limited land resources which make landfills uneconomical and too few to be effective. This places both Bahrain and all MENA countries currently adopting e-government and e-commerce policies in a precarious position about how to handle e-waste effectively.

b. Kuwait

Hassanin (2010) claims that Kuwait lacks a comprehensive e-waste management legislation or policy. An Environmental Public Authority (EPA) was established in 1995 and promulgated a new 10-year strategy in 2005. In its new comprehensive strategy, Kuwait did not include electronic waste in any of the components or targets for the future (Hassanin, 2010).
Most of the waste management programs are running by private initiatives such as New Air. The initiatives place a particular focus on collection and recycling at a corporate and individual level. NewAir, for example, trains organizations and institutions on how to manage waste; its representatives design a waste management plan for the consulting organization under a comprehensive green program (Hassanin, 2010).

c. Oman

Oman's initiatives fit into the wider context of programs and realities of the Arabian Gulf. Most of the national initiatives are still under the concept of overall waste management and still have minimum emphasis on e-waste. In 2011, the Omani government established a target of about 65 waste transfer points, 5 treatment plants, and 16 engineer landfills by 2015. The system, based on the marriage between global standards and the country's existing systems prioritizes on household waste, sewage, and waste from the medicine, construction, and oil sectors. Municipal waste, healthcare waste, and Construction and demolition (C & D) waste management programs have elaborate transportation and disposal systems, mostly in landfills.

Under the new waste hierarchy, Oman focuses its waste management processes primarily on waste minimization and reduction/recycling. The reality in the country, however, points towards a pyramid that emphasizes on waste disposal. The country was already handling over 38, 000 tonnes of E-waste by 2008 with no proper standards or systems for recycling and disposal. Healthcare waste, at 22, 753 tonnes in the same year, attracts more attention and investment because of the hazardous nature of most of its elements. Granted, e-waste tonnage fades in comparison to used tyres- 4 million tonnes in 2008- , and C& D waste -753, 341 tonnes in a single Governorate in 2009 (Kindi, 2011).

Overall, Oman's waste management sector employs 6, 575 people and has 1, 284 dedicated vehicles (Kindi, 2011). With its emphasis on landfills/dumpsites, the government controls about 350 landfills across the

country through respective municipalities. Although the country still lacks a dedicated e-waste management program, its overhaul of its waste management protocols is likely to attract investment and interest in e-waste. The 2011 protocol includes, among other things, a privatization transfer in the pre-collection, collection, infrastructure, and innovation processes and phases.

d. Qatar

In terms of national legislation on e-waste management, Qatar has been at the forefront within MENA. In late 2008, Qatar passed a law governing end-of-life mobile phone recycling (Hassanin, 2010). The Ministry of Environment also embarked on a law to govern e-waste management that was made operational in 2010. Hassanin (2010) points that Qtel, Qatar's national telecom operator, designed the law under the auspices of the MoE and was designed to deal with e-waste. The law provided for collection of e-waste in the form of discarded and end-of-life products by EnviroServe and its shipment to Singapore for recycling. The Qatari excursion into e-waste management was the first full e-waste management law among the MENA countries (Hassanin, 2010).

In addition to being the region's largest economy, Qatar has also embarked on building a proper waste management culture. WEEE was included in this drive as a hazardous waste but the 2010 law changed the focus into a comprehensive policy geared towards recycling and proper disposal. Of all the countries in the Arabian Gulf, Qatar has the most advanced systems and the most conducive economic environment for a proper regional WEEE recycling facility (Hassanin, 2010).

e. Saudi Arabia

Saudi Arabia's absorption of ICT in the MENA region is second only to Egypt. Allam & Inauen (2009) estimate that the KSA produces about 3 million tons of e-waste annually. This figure is expected to rise across the region, with some estimates placing the likely growth at 500 percent in the next decade. As of December 2012, the KSA had more than 40 recycling companies working at different levels and with different types of waste. Very few of them were focused primarily on e-waste, and there was no single national response to the e-waste problem.

In 2012, the Kingdom of Saudi Arabia (KSA) announced plans by the International Computer Company (ICC) to collaborate with EXITCOM to establish the EXITCOM KSA recycling company (Gazette, 2012). The company was designed to work specifically in WEEE recycling and was the first concerted effort within the Kingdom to respond to increasing and compounding e-waste (Gazette, 2012).

f. United Arab Emirates (UAE)

Small recyclers have thrived in the UAE. Their current operations involve collecting, recycling e-waste manually, and making a small profit from the recycled products (Eldan-Recycling). The low economic incentive and capacity of this operations means that it is largely a selective process. The recyclers focus on the recyclable parts of ICT while disregarding the need to dispose of the other parts. EnviroServe, a regional company based in the UAE, collaborates with national governments on e-waste recycling and management (Eldan-Recycling).

g. Other MENA countries

The complex composition of WEEE means that its management policies and practices must be detailed and well established. In Jordan, a 2011 study showed that there was no established system for collection, storage, transportation, disposal, and recycling of WEEE. The country currently does not have any efficient technologies and methods of recycling the waste. In most scenarios, WEEE is mixed with municipal solid waste or, on a very small scale, managed through informal open dumps and backyard recycling.

Other than the apparent lack of systematic technologies and investment in WEEE management, Jordan also lacks a proper legal framework. Most developed countries, particularly the EU, established a comprehensive legal framework to define and provide a proper background for effective WEEE management. A key component in the latter is the recognition that electronic and electrical waste is complex and should be handled independent of other types of waste. Jordan's regulations are distributed across several laws such as Environmental conservation law 52/2006, Regulation No. 35/2005, Regulation 28/2005 and others (Fraige, et al., 2012, p. 165). Each one of them deals with some aspect of waste management. Perhaps only Regulation 27/2005 comes closest to dealing with WEEE in its scope of hazardous and harmful wastes management. It provides specific instructions for waste management processes, which are further supported by Regulation 28/2005 in its air protection scope.

Another weakness of Jordan's current WEEE management activities is the lack of financial incentives and governmental support. Most of the work is currently done by non-governmental organizations (NGOs), a few private sector initiatives, or voluntary work. Jordan's foremost program after the BCRC assessment in 2006 is the UNEP/Basel-PACE computer recycling program. It is supported by a project by the Jordan Environment Society (JES) that focuses on re-using computers.

Like Jordan, Egypt lacks any serious national programs to handle WEEE. The informal sector handles some of the waste but focuses mostly on circuit boards that are collected and shipped abroad. Most of them use

manual disassembly and recycle some of the plastic and metal components (El-Nakib, 2012). The lack of systematic support and processes for such activities means that it is largely unregulated and the players have little knowledge of the toxic levels and components of such WEEE.

According to El-Nakib (2012, p. 16) the WEEE management system in Egypt is driven by garbage traders and waste collectors. A successful WEEE management system such as Switzerland's is in most cases market-driven and self-organised. Among the key limitations in such a comparison is that although the bulk of E-waste is growing in Egypt and the rest of the Arab countries, it is still not high enough to attract huge investments. Instead, the current system consists of private-private relationships among recycling enterprises, wholesalers, dealers, itinerant buyers and waste pickers. These relationships are driven by financial profit and not social or environmental awareness.

Algeria's 2006 Assessment of E-waste and recycling facilities revealed a missing link between the available waste quantities and the production capacity of existing facilities. Egypt is perhaps the forerunner in WEEE management in the region. The Egyptian Electronic Recycling Co. (EERC) is the first WEEE recycling facility in the country and although its capacity is still low, it represents the growing prominence of E-waste in environmental protection. Another company, Spear Ink, designed toner and inkjet environmentally-friendly remanufacturing and refilling facilities which are now considered as industry models.

Morocco runs its first nationwide assessment of E-waste and E-waste management programs in 2007. It further facilitated the establishment of Managem and CMPP, e-waste treatment plants whose capacity is still compared to peers in high-income economies. Managem, Al-Jisr, and CMPP also run a joint E-waste collection project called 'GREEN CHIP' for used digital equipment. On the other hand, Tunisia has a capacity of 1000 tons per year of E-waste collected and transferred to recycling facilities such as those ran by The National Waste Management Agency, ANGED. It has the most robust and established E-waste recycling and collection systems in the region.

Yemen is still lagging behind in recognizing the central position that will be occupied by E-waste in the near future. It first outlines a project proposal for an assessment and inventory in 2011, about four years after most of the other interested countries. Syria established a temporary WEEE disposal facility in 2007. The premises have most likely been closed due to the ongoing civil conflict and very minimum data on its success or effectiveness is available.

Assessment and Analysis

Proper e-waste management is a costly, involving, and complex process. Currently, no Arab country has proper recycling facilities (Hassanin, 2010). The collected waste has to be exported to Asia and Europe for recycling through private companies. The proportion of e-waste that gets to go through this process is only a small fraction of the real waste output within the individual countries.

The Middle East and North Africa (MENA) region is relatively a newcomer to WEEE. While the take-up of computers, mobile phones and household gadgets among the countries has been high, there have been little or no initiatives to handle the ensuing waste. High-income economies such as Saudi Arabia, Qatar and the UAE, and countries with larger populations such as Egypt account for the bulk of the e-waste in the region. Since e-waste is still regarded as a small problem within the larger problem of hazardous wastes, most of the countries do not have a 'take back' and recycling program for used products. The few that do have program that are handled by respective national governments under partnerships with multinational companies such as Hewlett-Packard, Dell, Cisco, Canon, Nokia, and others.

Current WEEE Management Rating

Allam & Inauen (2009) provides a comprehensive assessment of the Arab countries based on their current programs and investment in WEEE management. At the lowest level, Kuwait, Lebanon, Syria, Yemen, and Iraq had no legal framework or strategy as of June 2009 to handle WEEE. Kuwait, Egypt and Jordan had no inventory and no collection while even the UAE lacked a proper recycling or reusing mechanism. The United Arab Emirates (UAE) and Qatar have invested heavily in waste management in general. While there has been some investment in WEEE management, priority is still given to the systems that handle municipal and other common types of waste.

At Level 2, Bahrain, Egypt, Syria and Qatar, the UAE had plans to develop comprehensive legal framework and all of them with the exception of Egypt had an inventory for municipal solid waste. In most of the countries in the region, only recyclable WEEE is well collected by scavengers and local recyclers with no legal or regulatory framework.

At Level 3, only Tunisia had developed effective pilot separation and collection systems by 2010. The local collection mechanism was already working at inculcating a recycling culture and raising awareness about how different types of E-waste should be separated.

At Level 4, the lack of enforcement of the available legal frameworks characterizes the lack of any effective E-waste inventory or collection

systems. Bahrain has implemented a collection system for WEEE with environmentally sound disposal but most of it is still in its initial phases. At Level 5, the highest level in the classification, only Tunisia had a fully operational E-waste recycling facility for all E-waste. None of the other countries had made any meaningful progress from the assessment phase.

Common Themes across the Region

i. Lack of Awareness

There is very low and uncoordinated awareness among Arab countries on the hazards of WEEE and ways to dispose of end-of-life ICT products (Allam & Inauen, 2009, p. 30). Since most of the countries are still in the absorption stage of ICT products, there has been little or no incentive to implement a national policy on proper e-waste management as distinct from waste management in general. However, private companies in individual countries and the regional context run collection and transportation systems to countries such as Switzerland that have a well-developed recycling culture.

Dahroug (2009, p. 15) notes that public awareness is the critical foundation to any successful e-waste management program or policy. National governments tend to hand issues seriously when their negative ramifications or positive outcomes are clear and well-known. As part of a larger unofficial policy against civil activism, the private sector has also been lagging behind in driving e-waste as a major policy issue in the respective countries. The low awareness of WEEE management essentials in countries in the region indicates that most of them are in their starting phase (Allam & Inauen, 2009).

Awareness is critical in ensuring that individual households separate their waste and know why and where to place different WEEE for collection. It is also important that any awareness program be designed in such a way that it provides each stakeholder with a view of the entire process to make it easier to understand the social and environmental ramifications. Increased awareness even within the industry would be prudent to protect the workers from exposure to hazardous waste products by ensuring that known toxic substances and components are removed. This has the secondary effect of improving the quality of the waste produced because it is not damaged by the hazardous materials. The lack of awareness means that most of end-of-life products are either stored in unsafe places or discarded as municipal waste.

As a fast-growing economic region, the Arab countries would benefit immensely from a proper e-waste management policy culture. Having individual homesteads separate their waste according to its nature would reduce the work of separating e-waste from municipal waste. It would also

make sorting much easier and make the whole process of transportation, recycling and safe disposal much safer and more efficient.

ii. Private Initiatives/ Public-Private Ventures

A regional study by Allam & Inauen, (2009, p. 2) revealed that most of the E-waste activities are collaboration projects between non-governmental organisations, governmental and private institutions. The study identified 18 WEEE management activities in nine of the 22 countries in the Arab region. This low figure indicates low social and environmental governments among the key players. In their responses to Allam & Inauen (2009, p.3), the governments of the UAE, Kuwait, and Bahrain indicated that priority in waste management is given to other streams as E-waste is not considered a pressing issue.

One of the key lessons drawn from high-income economies with successful waste management systems is that the social impact of such a system is quite high. Such a system combines government and industry regulation with different sector relationships which are driven by social, environmental, and financial incentives. The nine programs studied by Allam & Inauen (2009) also lacked proper cost-recovery mechanisms and sustainable business solutions to attract private investors. The WEEE management is an expensive and involving process, which makes it hard for any single sector player to effectively handle the E-waste in a country or municipality.

For any program developed under the Basel Convention to have a sustainable social impact such as a high employment potential, it must be designed in such a way that it is profitable and market driven. Most Arab countries, despite having growing populations and rapid increases in EEE acquisition, have invested very little in developing a recycling culture and an attractive used EEE market. Moreover, there has been little collaboration with NGOs and other such organisations despite their vast potential as partners in solving E-waste problems.

iii. Lack of Reliable Data and Institutional Framework

One of the foremost challenges for WEEE management programs in the Arab countries are the lack of any monitoring system for material flow. Most of the available data is based on industry estimates and projections from growth in income and purchasing power parity (PPP). Lack of reliable data means that the problem of WEEE is not properly understood and thus institutional frameworks are not implemented to respond to the issues. Institutional framework is a key in the wider concept of waste management because it creates the environment necessary for sustainable practices (Allam & Inauen, 2009). A host of policies, legislations, and regulations must be supported by cost-recovery mechanisms, enforcement means, programs for awareness and capacity building, and a recycling culture.

Through the Basel Convention Regional Centre (BCRC), three countries, Jordan, Algeria, and Saudi Arabia initiated the process to design a country-specific WEEE management protocol. The program run by BCRC-Egypt recognizes the central position occupied by information in ensuring that the pilot activities are supported by the public. For example, the Basel Convention recommended the translating of MPPI guidelines on end of life phones into Arabic (Dahroug, 2009). Such a move is critical in enhancing the processes and systems of raising awareness such as media involvement and frequent newsletters.

iv. Poor Implementation of International Protocols

Part of the weakness of the current programs stems from poor enforcement of the Ban Amendment, the Basel Convention, and poor or zero development of a dedicated national e-waste regulation. Sustainability is dependent on the success of such programs and partnerships. For example, El-Nakib (2012, p. 18) compares the employment potential between Switzerland and Egypt. While Egypt has a higher employment potential, the underlying factors indicate that it is not sustainable due to the high occupational hazard risk and the low level of awareness by the workers and their employers. This means that they are constantly exposed to the hazards of the components, chemicals, and processes with minimum safety and protection measures. This is partially the reason why Egypt has higher emissions of toxins than Switzerland.

Current Situation/Initiatives

Each of the Arab countries has rudimentary recycling systems running on a small scale. Because of the under-investment and low awareness of e-waste among the countries, most WEEE management practices are selective. This beats the economic purpose of waste management because small-scale recyclers choose the recyclable parts of ICT products and discard of the non-recyclable parts as municipal waste. Most of the latter elements are the hazardous non-valuable parts, which end up in landfills and other forms of disposal despite the hazards they pose to the environment.

One of the ideas under consideration under the BCRC is a regional recycling facility. Such an undertaking would complement the advances made by the UAE and Bahrain in driving awareness about proper e-waste disposal. It would also support the individual country's own national and local programs.

While the 2006 WEEE regulations provide for the implementing authority to select which technology to use, some industry standards are more sustainable than others. For example, Eldan Recycling sold a cable waste management plant that has a capacity of about 2.5 tons per hour to the

UAE. Similar aluminium and WEEE management plants and single machines have been sold to Kuwait and Saudi Arabia (Eldan-Recycling, 2012). Such resources might not be sustainable for countries that cover vast land spaces like Egypt due to logistical challenges. In such countries, a decomposed WEEE management program where the government collaborates with different players at different levels is more effective and sustainable.

Since WEEE recycling is an expensive process, a private –public partnership is the most sustainable way for WEEE management. Private for-profit organizations have the necessary incentives to streamline the process of collection, transportation, recycling and re-use, and disposal. In most countries with successful WEEE programs, these processes are handled by different companies to maximize reach and effectiveness. Within countries such as Saudi Arabia and Qatar, private companies account for almost all of the existing e-waste management activities. Most of them have limited scope because they lack a comprehensive policy, which would offer financial incentives such as subsidies for creating awareness and streamlining the collection process by installing distinct e-waste collection points.

Guideline for the Disposal of Used Electronic and Electrical Equipment

Purpose:

This Guideline is directed at government departments and agencies in the Middle East. It aims at:

- Explaining how used and surplus electronic and electrical equipment should be disposed of in a manner that maximizes value ensures disposal in an environmentally sustainable manner.
- provide practical guidance on the availability, selection and use of appropriate disposal mechanisms for electronic and electrical waste
- Identify key roles and responsibilities for departments, agencies and private enterprises they relate to the disposal of electronic and electrical waste.

Scope

This guideline attempts to addresses the environmentally sound disposal of electronic and electrical equipment. For the purpose of this Guideline, *disposal* refers to the process by which departments and companies prepare electronic and electrical equipment for reuse or recycling.

Background

In many parts of the world, e-waste is the fastest growing component of the municipal solid waste stream ranging from 20 to 50 million metric tonnes of e-waste discarded each year. Some substances contained within e-

waste are hazardous and pose a significant threat to human health and the environment when improperly managed.

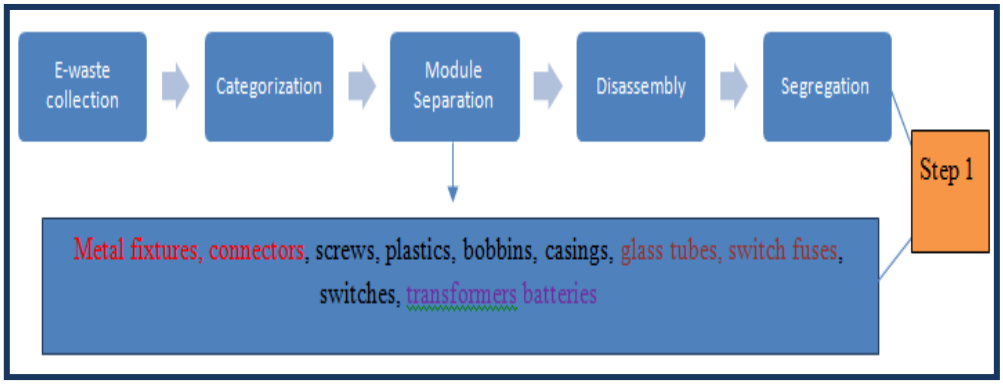
E-waste and Environmentally Sound Management Policy

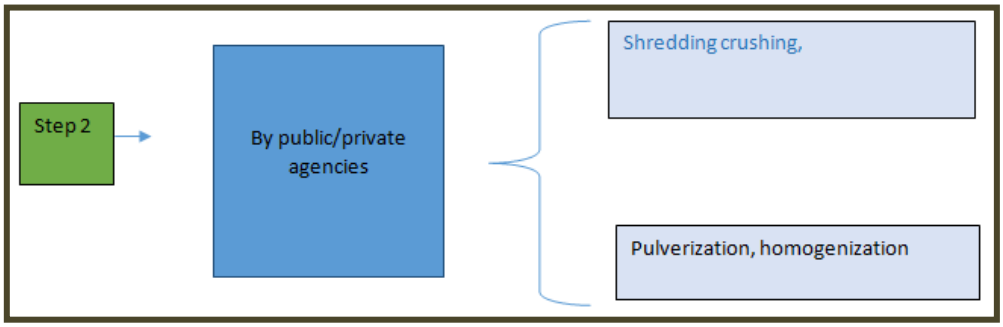
1. **Definition of E-waste**
2. **Environmentally Sound Management**

Environmentally sound management of hazardous wastes or other wastes means "taking all practicable steps to ensure that hazardous wastes or other wastes are managed in a manner which will protect human health and the environment against the adverse effects which may result from such wastes. This approach helps to protect the environment and human health while leading to economic benefit through resource recovery. Reuse is the best option and it extends the useful life of an asset, maximizing its overall value and delaying the consumption of raw materials and energy to produce new assets. Where component reuse is not possible, recycling a certified recycler is the next best option.

Steps for Selecting a Disposal Mechanism for Waste Electronic and Electrical Equipment:

STEP 1 – Address Security Requirements
STEP 2 – Identify the Appropriate Disposal Mechanism
STEP 3 – Package for Safe Transportation
STEP 4 – Organize Transportation
STEP 5 – Collect Data and Report





Step 3 Packaging

There are a few sub steps in the packaging stage:

A. Remove personal data: there is numerous software programmes available. However in case computers are already damaged the best option is to remove and keep the hard drive.
B. Packaging: All eligible equipment must be packaged and labelled prior to arranging for the home pickup mail back service. If original packaging is available should be used.
C. After packaging the official label of the organisation in charge of the removal should be affixed.

Conclusion

Most of the Arab countries, led in part by Qatar and the UAE in the Arabian Gulf and Tunisia in wider MENA, are at the initial stages of implementing comprehensive national policies on e-waste. The BCRC Arab region has been at the forefront in driving a regional approach to raising awareness and boosting the collaboration to handle e-waste in the individual countries. While the BASEL convention has helped raise awareness on the importance of proper e-waste management, very few countries have a national policy specifically for e-waste. This is partly because e-waste accounts for a small proportion of waste produced in the countries and individual households.

The issue of e-waste is particularly important in developing and emerging economies where enhanced socio-economic status and the availability of cheap electronic and electrical products have driven the mounting tonnes of e-waste. Since e-waste falls in the hazardous waste category under the Basel convention, most Arab countries address it under the waste management programs. Such a categorization means that most recyclable waste is discarded as hazardous waste.

With projected proportions indicating a sharp increase in WEEE over the next decade, individual countries will have to implement national policies on the e-waste management system. Such a system, using current private-public partnerships as a reference, has to incorporate a proper

profitable and sustainable business model. Given the complexities of a running a full cycle e-waste recycling plant, it is more economical to implement a regional facility first with plans of country-country and country-specific partnerships.

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