WEEE-Recycle India - E-Waste Collection Centers in Bangalore.

INDEX

INTRODUCTION

The **Waste Electrical and Electronic Equipment Directive** (**WEEE Directive**) is the European Community Directive 2012/19/EU on waste electrical and electronic equipment(WEEE) which, together with the RoHs Directive 2011/65/EU, became European Law in February 2003. The WEEE Directive set collection,Recycling and recovery targets for all types of electrical goods, with a minimum rate of 4 kilograms per head of population *per annum* recovered for recycling by 2009. The RoHS Directive set restrictions upon European manufacturers as to the material content of new electronic equipment placed on the market.

The production of electrical and electronic equipment (EEE) is one of the fastest growing global manufacturing activities. Rapid economic growth, urbanization and a growing demand for consumer goods, leads to the consumption and the production of EEE. E-waste comprises of wastes generated from used electronic devices and house hold appliances which are not fit for their original intended use and are destined for recovery, recycling or disposal(MoEF 2008).The Indian information technology(IT) industry has been one of the major drivers of change in the economy in the last decade and has contributed significantly to the digital revolution being experienced by the world(J. Zhang, X- J.Liang,2012et al ,Anwesha Borthakur,2012,S.B Wath,2010,Shalabh Agarwal ,2014). Even though electronic applications have infiltrated every aspect of our daily lives, such as comfort, health ,security ,easy

information, data acquisition, the knowledge society is creating its own toxic footprints. As per D. Sinha- Khetriwal et al,(2005), while we are having some of the world's most advanced high-tech software and hardware developing facilities, India's recycling sector can be called medieval.

As per global report Live science.com World's E-Waste grow to 33% by 2017.As per United Nations University

2013, E-Waste can fill a line of 40-ton trucks end-to-end on a highway straddling three quarters of the equator.

In USA-According to Environment protection act (EPA) in 2008, 3.16 million tones of E-waste were generated and only 13.6% of this amount was recycled. The rest was trashed in landfills or incinerators. Nearly 80% of all the E-waste are exported to Asia (MoEF 2008)

The world has witness a dramatic shift in technology in the past few years. Each and every product which has changed life of Millions has gone through various phases of transformation. The life cycle of computers, printers, television, mobile phones, music systems, refrigerators and others have gone down sharply in the past few years which has resulted in obsolescence of the previous versions and in turn became e-waste.

WEEE recyclers have become a boon for countries worldwide as they help in reducing the carbon footprint by recycling the e-waste in the most environment friendly way .

According to **"India Waste Electrical and Electronic Equipment (WEEE) Recycling Market Forecast & Opportunities, 2017 – E-Waste"** the market is facing major challenges from unorganized sector specially in terms of raw material procurement.

The unorganized sector dominates the WEEE recycling market in India by recycling around 95% of the WEEE generated in India. The market grew at a CAGR of 37.98 % in terms of volume from 2008 till 2011. By the end of 2017, it is expected that 25% of the WEEE generated will be recycled by organized sector.

Increasing Government focus and restricting of policies will force many small players to India is the second largest nation in the world, with a population of 1.21 billion, accounting for nearly 18% of world's human population, but it does not have enough resources or adequate systems in place to treat its solid wastes. Its urban population grew at a rate of 31.8% during the last decade to 377 million, which is greater than the entire population of US, the third largest country in the world according to population (3). India is facing a sharp contrast between its increasing urban population and available services and resources.

All affected producers and distributors of EEE must comply. The objective of the directive is to promote recycling, minimise waste and stimulate the development of more environmentally friendly products for the future. In the UK, it has been transposed into national law by Statutory Instrument 3289: The Waste Electrical and Electronic Equipment Regulations 2006, as amended. It became law on 2nd January 2007.

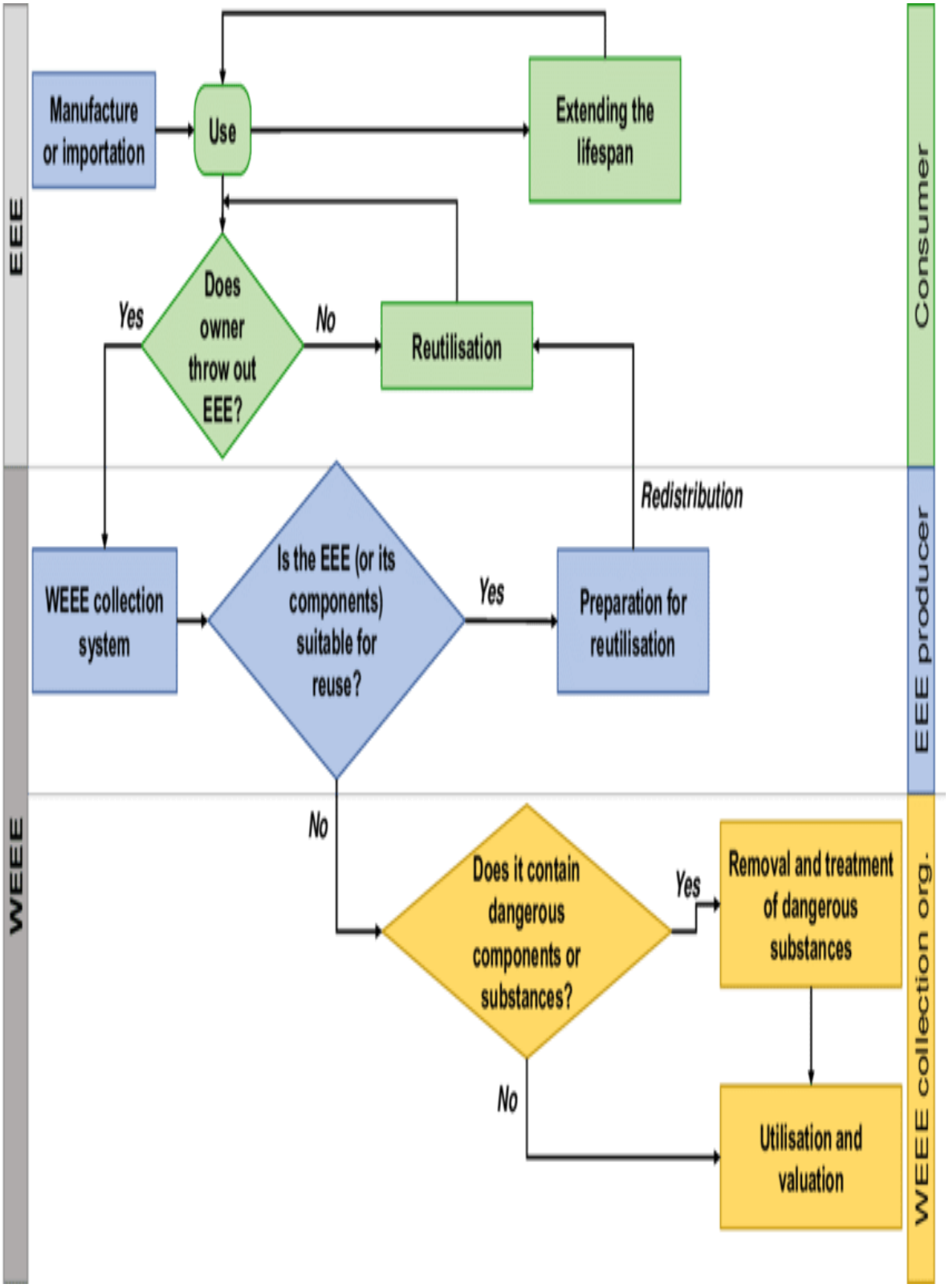
Defra is the lead government department responsible for the WEEE Regulations in the UK and works in partnership with the devolved administrations. The Environment Agencies are the enforcement agencies in relation to producer responsibilities; the VCA on behalf of BIS for distributor (retailer) obligations. The Department of Environment Food and Rural Affairs (DEFRA) is responsible for the permitting of authorised treatment facilities. players to increase their shares.

1.ABSTRACT

Improved living standards and the share of services sector to the economy in Asia, and the use of electronic equipment is on the rise and results in increased electronic waste generation. A peculiarity of electronic waste is that it has a ‘significant’ value even after its life time, and to add complication, even after its extended life in its ‘dump’ stage. Thus, in Indian situations, after its life time is over, the e-material changes hands more than once and finally ends up either in the hands of informal recyclers or in the store rooms of urban dwellings. This character makes it extremely difficult to estimate electronic waste generation. The present study attempts to develop a functional model based on a material flow analysis approach by considering all possible end uses of the material, its transformed goods finally arriving at disposal. It considers various degrees of uses derived of the e-goods regarding their primary use (life time), secondary use (first degree extension of life), third-hand use (second degree extension of life), donation, retention at the respective places (without discarding), fraction shifted to scrap vendor, and the components reaching the final dump site from various end points of use. This ‘generic functional model’ named SYE-Waste Model, developed based on a material flow analysis approach, can be used to derive ‘obsolescence factors’ for various degrees of usage of e-goods and also to make a comprehensive estimation of electronic waste in any city/country.

Electronic waste or E-waste is relatively a novel addition to the ever-growing hazardous waste stream. It includes discarded electronic and electrical equipment. Developing countries are facing enormous challenges related to the generation and management of E-waste which are either internally generated or imported illegally; India is no exception to it. However, the existing management practices related to E-waste in India are reasonably poor and have the potential to risk both human health and the environment. Moreover, the policy level initiatives are not being implemented in an appropriate way. The austere problem of E-waste along with its policy level implications is looked upon in the paper. During the course of the study it has been found that there is an urgent need to address the issues related to E-waste in India in order to avoid its detrimental future consequences.

Keywords: E-waste, hazardous waste, risk, management.


EEE
WEEE
Consumer
EEE producer
WEEE collection org.
Manufacture or importation
Use
Extending the lifespan
Does owner throw out EEE?
Yes
No
Reutilisation
Redistribution
WEEE collection system
Is the EEE (or its components) suitable for reuse?
Yes
Preparation for reutilisation
No
Does it contain dangerous components or substances?
Yes
Removal and treatment of dangerous substances
No
Utilisation and valuation

2. Methodology

The study was conducted in the framework of "Waste and Risk" as proposed by Joost Van Loon in "Risk and Technological Culture: Towards a sociology of virulence" (2002). Waste represents uncontrolled matter out-of-place, freely interacting and reacting, cultivating bacteria, fungi and toxins that may pose direct threats to our health (Loon 2002). Waste is regarded as that matter which is to be discarded or made to disappear, often by simple means of removal such as refuse collection, landfill dumps, incineration etc. According to Loon, waste is perhaps the most universal example of ecological risks in everyday life. Nearly all ecological risks relate in one way or another to waste, more specifically to pollution. One can have the example of "solid-waste pollution" in this regards. Whether it is nuclear waste, biomedical waste or electronic waste, risks are always embedded in the materials involved in these waste. Two of the reflections specified by Loon are considered for the purpose of the study. The reflections are Principle of "Out of Sight, Out of Mind" and "Cause and Effect" Relationship. Attempt has been made to connect these reflections to the problem of E-waste.

ELECTRICAL AND A METHODOLOGY TO ESTIMATE BENEFITS FROM WEEE (WASTE OF ELECTRONIC EQUIPMENT) RECYCLING – ECODOM

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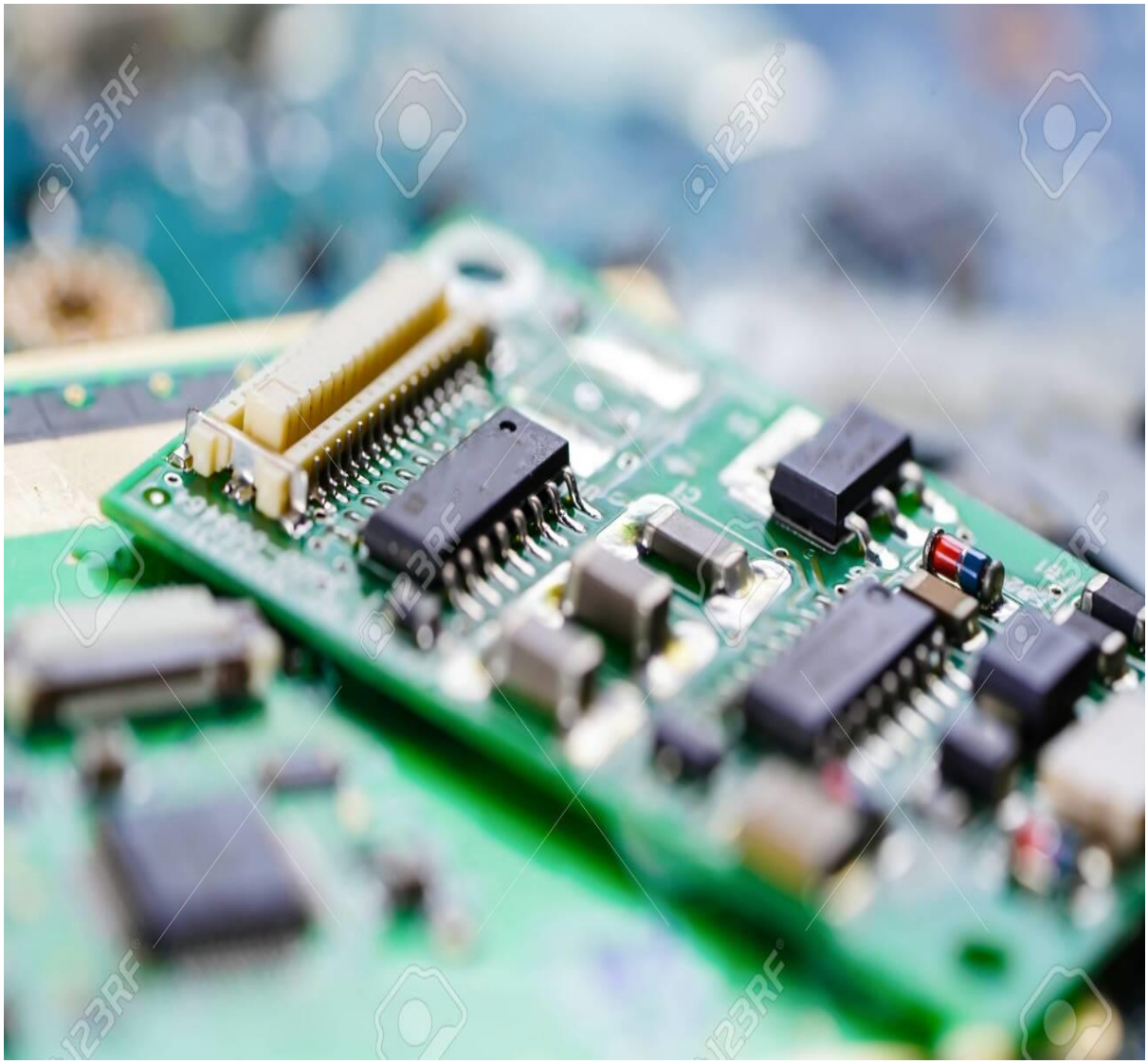
ECODOM, Italy

WEEE is Waste of Electrical and Electronic Equipment and its proper treatment is one of the challenges Europe is facing, due to the recovery of economically essential materials and to the proper treatment of environmentally critical components (CFC, PCB, Lead). Ecodom has developed the methodology presented here, which covers all the phases of the WEEE recycling system and considers the impacts in term of energy used (GJ) and of equivalent CO2 emissions scenario, to calculate the environmental benefits, with complete transparency in hypothesis and calculations applied.

2.1 Principle of "Out of Sight, Out of Mind"

The principle of out of sight, out of mind has for a long time been useful in keeping the lid on the negative side-effects of industrialization (Loon, 2002). During this period, toxicity was allowed to build up in the soil, in the air and in the water. Only periodically the toxic side-effects are noticed in terms of epidemiological anomalies of clusters of chronic illnesses, cancers or miscarriages. Unlike the spectacular examples of accidents and catastrophes, these largely escaped the news media (Loon, 2002). This principle is applied to the issues related to E-waste in Indian context. Most of the people in India do not know how to dispose their obsolete electrical and electronic gadgets. Generally, the obsolete electronic goods lie unattended at the Indian houses and offices because of lack of knowledge about the management of the same. More often than not, the gadgets are sold to the scrap vendors at

certain cost. Otherwise these are discarded with the regular municipal solid waste. Few people practice “extended producer responsibility” and indulge themselves in “take-back” systems. But none of these consumers pay attention to the processes these electronic goods have to go through once these are discarded. The real trouble with electronic goods actually begins once discarded. As soon as the wastes are out of their sight, these are out of



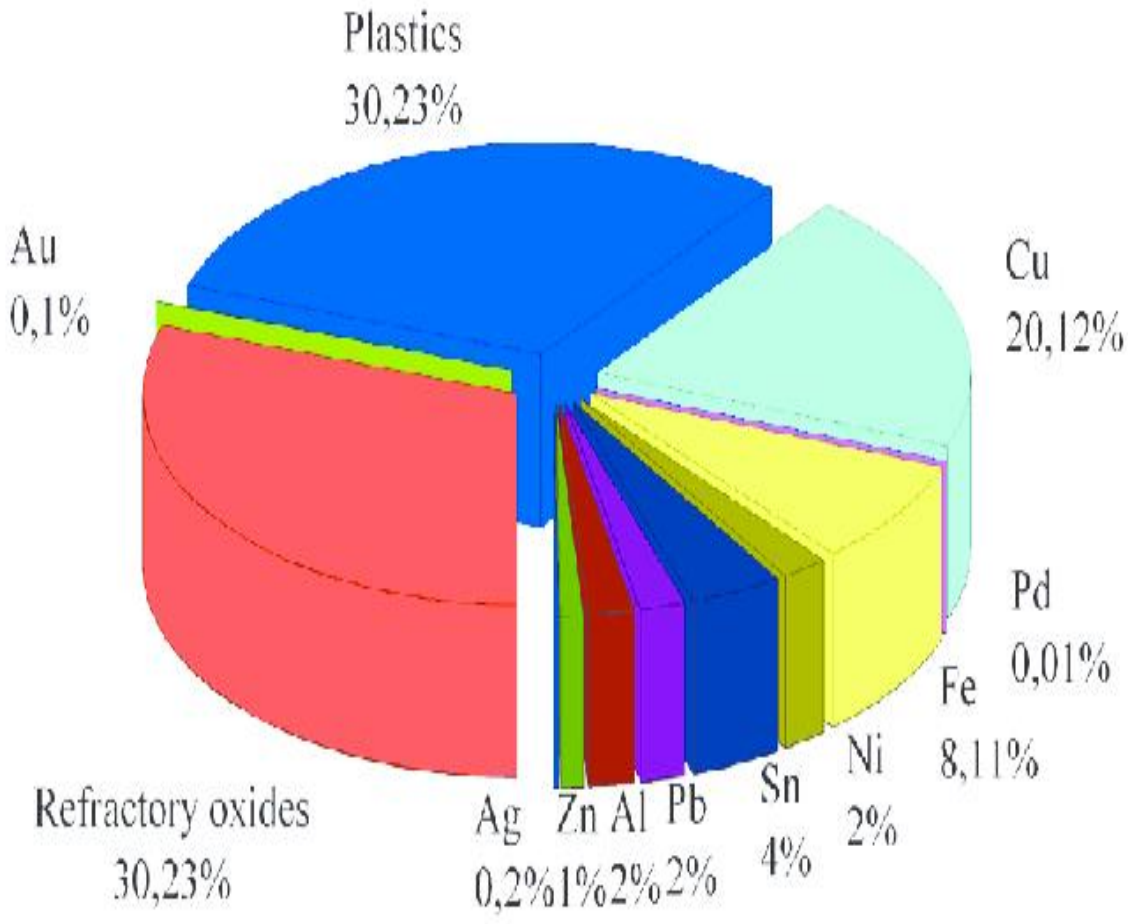
2.2 “Cause and Effect” Relationship

The relationship between cause and effect is important in all kinds of waste. Here the causes may be characterized as the causes for the generation and rapid obsolescence of electrical and electronic equipment. The reasons for prompt generation and obsolesces of E-waste include rapid economic growth, urbanization, industrialization, increased consumerism etc.The effects are the health and environmental risks associated with E-waste. The effects of improper disposal of E-waste are observed relatively after a long period of time. When an electronic gadget is disposed of with all its hazardous elements embedded in it, precarious health and environmental effects are not observed immediately. It takes considerable amount of time to have an outlook of the actual risk from the waste. This intensifies the problem of realization of the hazards from waste.

3.Advantages of recycling

Recycling raw materials from end-of-life electronics is the most effective solution to the growing e-waste problem. Most electronic devices contain a variety of materials, including metals that can be recovered for future uses. By dismantling and providing reuse possibilities, intact natural resources are conserved and air and water pollution caused by hazardous disposal is avoided. Additionally, recycling reduces the amount of greenhouse gas emissions caused by the manufacturing of new products. Another benefit of recycling e-waste is that many of the materials can be recycled and re-used again. Materials that can be recycled include "ferrous (iron-based) and non-ferrous metals, glass, and various types of plastics" “Non-ferrous metals, mainly aluminum and copper can all be re-smelted and re-manufactured. Ferrous metals such as steel and iron also can be re-used." Due to the recent surge in popularity in 3D printing, certain 3D printers have been designed (FDM variety) to produce waste that can be easily recycled which decreases the amount of harmful pollutants in the atmosphere. The excess plastic from these printers that comes out as a byproduct can also be reused to create new 3D printed creations.

Benefits of recycling are extended when responsible recycling methods are used. In the U.S., responsible recycling aims to minimize the dangers to human health and the environment that disposed and dismantled electronics can create. Responsible recycling ensures best management practices of the electronics being recycled, worker health and safety, and consideration for the environment locally and abroad. In Europe, metals that are recycled are returned to companies of origin at a reduced cost. Through a committed recycling system, manufacturers in Japan have been pushed to make their products more sustainable. Since many companies were responsible for the recycling of their own products, this imposed



responsibility on manufacturers requiring many to redesign their infrastructure. As a result, manufacturers in Japan have the added option to sell the recycled metals.

Improper management of e-waste is resulting in a significant loss of scarce and valuable raw materials, such as gold, platinum, cobalt and rare earth elements. As much as 7% of the world's gold may currently be contained in e-waste, with 100 times more gold in a tonne of e-waste than in a tonne of gold ore.

3.1 e-Waste Disposal Methods

There are several practices or methods of e-waste disposal; however, this paper seeks to explain the following methods: landfilling, Acid bath, and Incineration, which are standard practice.

3.2 Landfilling

This is the most popular technique of e-waste disposal. Soil is unearthed, and pits are dogged for burying the a-waste in it. An impervious liner is created of clay or plastic with a leachate basin for assemblage and moving the ex-waste to the treatment plant. However, the landfill is not an environmentally correct process for disposing of the e-waste as toxic substances like cadmium, lead, and mercury are discharged inside the soil and groundwater, which in turn contaminate the water and soil.

3.3 Incineration

This is an organized procedure of predisposing off the e-waste, and it involves the combustion of electronic waste at high temperatures in uniquely devised incinerators. This e-waste disposal approach is somewhat advantageous as the waste quantity is decreased remarkably much, and the energy recovered is likewise exploited separately. Nevertheless, it also not without disadvantages as harmful gases, cadmium, and mercury are emitted into the environment.

3.4 Acid Bath

Acid bath as a technique for e-waste disposal includes dousing of the electronic circuits in the incredible sulphuric, hydrochloric or nitric corrosive solutions that disengage the metals from the electronic pathways. The recouped metal is used in the assembling of different items, while the dangerous corrosive waste discovers its routes in the nearby water sources.

3.5 E-waste recycling techniques

Printed circuit sheets (PCBs) is one of the most noteworthy sections of electronic hardware. These PCBs envelop most of the essential metals and, again, the vast majority of the hurtful/harmful parts in the e-waste. PCB waste recycling includes three significant procedures which are: pre-treatment, physical reusing, and synthetic reusing .

The pre-treatment level includes dismantling of the recyclable or reusable and poisonous parts utilizing destroying or isolation and joined by the physical reusing process. From that point, the material is re-shrouded by a synthetic reusing process that incorporates gasification and pyrolysis . There are different conventional and some contemporary practices to recover the significant metallic and non-metallic divisions from printed circuit boards (PCBs). The following section will subsist of different physical and compound recycling forms for the reusing of metallic and non-metallic divisions from waste PCBs.

3.6 Pyrolysis method

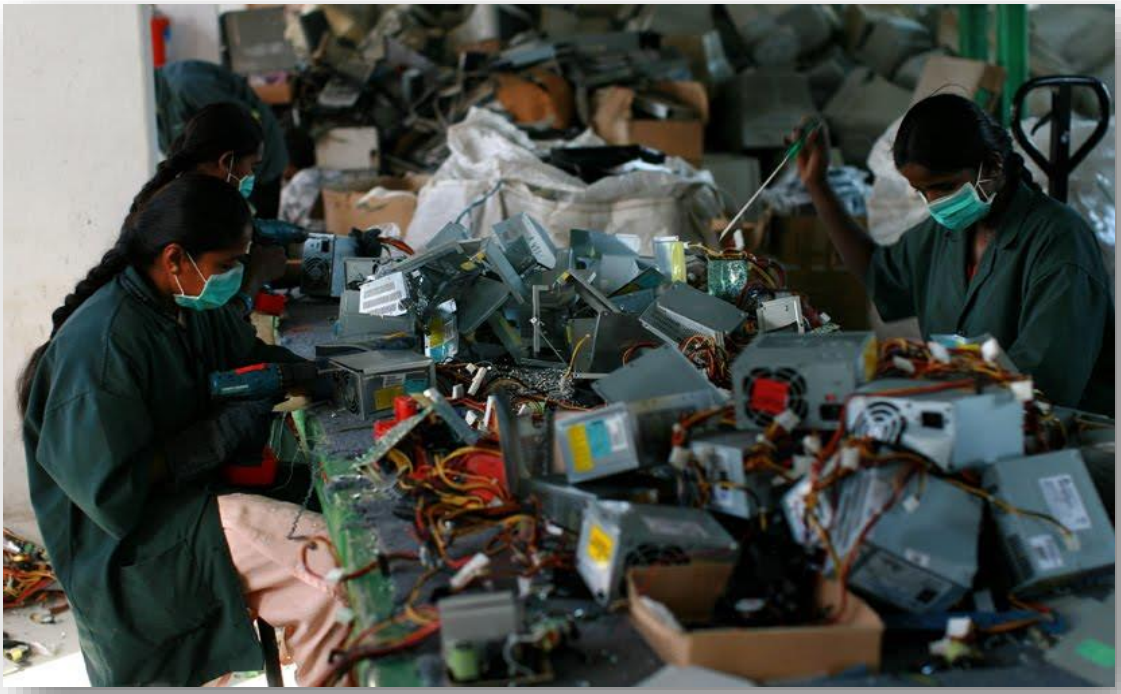
Pyrolysis is a substance recycling framework generally used for recycling engineered polymers, including polymers that are related to glass filaments. Pyrolysis of such polymers gives gases, oils, and burns. These items can additionally be abused as synthetic feedstock or fuels [2]. The printed circuit boards are heated to a condition, sufficiently able to dissolve or melt the solders applied to interface the electrical components to the circuit board.

3.7 Hydrometallurgical method

This technique for reusing is significantly utilized for the productive recycling of the metallic part [3]. In this methodology, metal structures are broken up into draining arrangements, for example, acids and soluble bases.

This joined by the electrorefining of required metals. This strategy is accepted to be progressively adaptable and control sparing, which in the end, prompts cost-productive. Generally utilized leachate is water Regia, nitric corrosive, sulfuric corrosive, and cyanide arrangements. In this way, a pure metal recuperated is sold with no further preparing while the staying non-metallic substrates still require to be dealt with thermally prior to recycling or discarding in landfills. The considerable disservice of this procedure is the damaging and harmful nature of the fluid being utilized .

- Protects your surroundings. Safe recycling of outdated electronics promotes sound management of toxic chemicals such as lead and mercury.
- Helps others. Donating your used electronics benefits your community by passing on ready-to-use or refurbished equipment to those who need it.
- Create Jobs. eCycling creates jobs for professional recyclers and refurbishers and creates new markets for the valuable components that are dismantled.
- Saves landfill space. E-waste is a growing waste stream. By recycling these items, landfill space is conserved.



ECLOGICAL ADVANTAGES OF WEEE

With current trend of increasing market of information and communication technologies (e.g. office and household electronics, computers, telecommunication and lighting equipments), the amount of waste electrical and electronic equipment (WEEE) is expected to rise at a rate of at least 3-5% per year in Europe. The identification of the most ecologically suitable treatment option for such specific waste will be crucial for effective environmental protection through sustainable waste management.

According to the European waste strategy, if the waste production is unavoidable, as in the case of the EEE, the choice between recycling/re-use or incineration with adequate emission standards should be based on the evaluation of their respective environmental impacts. With a combined approach of material flow analysis and life cycle assessment (LCA), Swiss researchers calculated the environmental impacts of the full recycling chain - sorting, dismantling, recycling and disposal or further transformation of the fractions into secondary raw materials - for the annual WEEE derived from two main Swiss recycling systems.

The study included the assessment of the environmental impact of each WEEE fraction (e.g. batteries, capacitors, screens, plastics, metals, cables) during a complete WEEE treatment. The results were compared to a scenario assuming no recycling with incineration and energy recovery of all WEEE and primary production of raw materials. The resulting environmental impacts were much smaller for the complete WEEE recycling treatment compared to the respective no-recycling and incineration treatment. Even the toxicity caused by recycling resulted of minor importance compared to the incineration scenario. This is due to the combustion of the organic parts and the resulting air emissions. This study concluded that recycling is more ecologically advantageous over incineration.

It should be noted that the reliability of the results of this study have not been assessed as the study has not been peer-reviewed, as it could be expected within the institutional standards related to LCA comparative studies. Furthermore, this study was focused on a specific Swiss situation. Nevertheless, the authors argue that in order to encourage ecologically sustainable management of WEEE in Europe the goal of 4kg recycled WEEE per inhabitant should be

revised. They suggest that the rate of 11kg per inhabitant obtained in Switzerland proves that higher rates are possible.

The waste electrical and electronic equipment is expected to grow in the coming decades. The study of environmental impacts of the whole recycling chain of such specific waste demonstrated that the recycling option is much more ecologically advantageous than simple incineration and should be encouraged as the most suitable treatment option.

According to the EU WEEE Directive: "The objectives of the Community's environment policy are, in particular, to preserve, protect and improve the quality of the environment, protect human health and utilise natural resources prudently and rationally.

That policy is based on the precautionary principle and principles that preventive action should be taken, that environmental damage should as a priority be rectified at source and that the polluter should pay... the achievement of sustainable development calls for significant changes in current patterns of development, production, consumption and behaviour and advocates, inter alia, the reduction of wasteful consumption of natural resources and the prevention of pollution.

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EEE Producer Responsibility

Decree No. 49/2014 for EEE. It is based on the **Extended Producer**

In Italy, European Directive 2012/19/EU has been implemented by **Legislative Responsibility (EPR) principle** which reduces negative environmental impacts resulting from the design and production of electrical and electronic equipment (EEE) and the management of waste electrical and electronic equipment (WEEE).

The legislation's purposes concern and establish:

- an obligation for producers and distributors to finance a system for the recovery and recycling of products placed on the market ("extended producer responsibility" principle);
- measures aimed primarily at preventing the production of WEEE and their reuse, recycling and other forms of recovery to reduce the disposed waste volume.

The previous 27 January 2003 Directive 2002/96/EC of the European Parliament and Council on WEEE was implemented with Legislative Decree No. 151/05, which was replaced by the 14 March 2014 Legislative Decree No. 49.

Open Scope: Legislative Decree No. 49/2014, starting from 15 August 2018, has provided for an extension of the WEEE legislation which requires producers, importers and those who sell EEE under their own brand to organise and finance the waste (WEEE) collection and recovery system deriving from products placed on the market organise and finance WEEE collection, treatment and recycle.

WEEE regulations are complex. The continuous evolution of policies involves the sometimes yearly modification of the rules, making it difficult to calculate the eco-contribution that supports the collection funding.

For companies that export their products or distribute in other European countries, these difficulties multiply.

ERP ITALIA supports producers with legal management and compliance with WEEE regulations

- comply with WEEE legislation;
- organise and finance WEEE collection, treatment and recycling;
- register with the National Register of EEE producers;
- annually notify the National Register of the quantities and categories of EEE placed on the market in the previous year, as well as those collected, reused, recycled and recovered;
- insert adequate information regarding proper WEEE disposal within the instructions for the use of EEE detailing the environmental and health impact, and the penalties for any illegal disposal.

EEE Distributor obligations

Under Legislative Decree No. 49/2014:

The **Distributor** is "n*atural or legal person registered in the Register of Companies pursuant to law December 29, 1993, no. 580, and subsequent amendments, which, operating in the supply chain, makes an EEE available on the market*".

The **retail Distributor** is: "*natural or legal person as defined in letter h), which makes an EEE available to the end user*".

EEE Distributors must:

- Register on the Albo Nazionale dei Gestori Ambientali in the 3bis category;
- Display, within your own exercise (collection point) or on the website, a suitable poster that informs public about the possibility of giving these products free of charge;
- Dealing with the preliminary deposit of WEEE and the transport of the same, except in the case in which the transport is entrusted to third parties;
- Report the amount of waste managed to the WEEE Coordination Centre;
- Respect the temporal and traceability obligations;
- Contribute to the achievement of the WEEE separate waste collection targets as established by Legislative Decree 49/2014.

ERP Italia provides distributors with all the necessary support to manage all the activities necessary for the correct collection for recycling of EEE at points of sale.

Waste Minimisation Hierarchy

4. Disadvantages of recycling

1.pollution and energy consumption.

It's contradicting, but the reality is that recycling tons of garbage will require waste to be transported**.**sorted, cleaned and processed in separate factories, all of which need energy and may result in by-products that can pollute air, water or soil. When more trucks are employed to pick up recyclable products, air pollution will also increase. In fact, the exhaust of the 179,000 waste collection vehicles in 2009 contains three dozen toxins that are all airborne.

2. Result in pollutants.

When waste materials break down, pollutants, such as chemical stews, will harm the environment. Toxins and impurities from the original material, such as lead paint or spray cans, could pass through recycling and then carried through the recycled product. Worse, it could take years before we realize that the items we have been using is contaminated. Recycled steel used in buildings in Taiwan, for example, has caused gamma radiation poisoning for the past 12 years.

3. Increased processing cost and low-quality jobs.

Recycling cost can go thrice as much as the cost of putting garbage in landfills. This is why it is often considered cost-inefficient, even if it is eco-friendly. The process is also labor intensive. And even when the manpower requirement is high, the kind of work involved can lead to low morale and poor quality of life, because the pay is also low.

4. Require stricter and more stringent implementation.

Recycling can have an adverse effect on health and the environment when not done properly. Debris and toxic waste that is improperly handled can contaminate land, air and the environment. This is why more stringent implementation must be followed. When recycling companies abandon dump sites, waste left lying around can have environmental effect.

5. Good products are not guaranteed.

Not all recycled items are of high quality or even safe to use. To recycle paper, for example, bleach is used, which is a harsh chemical that is harmful to health and the environment. As previously mentioned, recycled products may contain toxic chemicals that were previously present with the original material.

6. Generally ineffective.

As shown above, recycling results in more pollution, higher energy consumption, and cost-inefficiency, making it less effective than what everyone wants to believe. Moreover, recycling still failed to dent demands. The demands for aluminum, for example, increase about 10% every year, but the amount of recycled aluminum falls short. This means aluminum mining is still necessary.

The number of soda cans that need to be recycled is also many times more than facilities can process. In America alone, the average individual drinks 2.5 can per day, amounting to around 778 million cans that need to be recycled.

Environment

Dangerous chemicals and greenhouse gasses are launched from garbage in landfill websites. Recycling facilitates to reduce the pollutants as a result of waste.

Habitat destruction and worldwide warming are a few of the effects as a result of deforestation.

Recycling reduces the want for raw materials in order that the rainforests may be preserved.

Are Recycling Plants Bad for The Environment

Any contamination inside the **recycle bin** compromises the strength and sturdiness of the recycled **plastic** this is produced…

… **Hindrance of recycling plastic:** every other large environmental problem is the immoderate use of plastic luggage and **different gadgets** all over the international. The sheer variety of plastic gadgets in landfills is scary.

- **Poisonous chemical substances from oil refining:** one of the ways that human beings try to minimize harm to the surroundings is with the aid of recycling used oil. However, this recycling system creates many harmful chemicals that pollute the air.
- **Recycling does now not reduce demand:** there may be continually a huge demand for recyclable products all around the world. The sad reality is that this demand can not be met by way of recycling. You can take aluminum as an example. The call for this fabric will increase by using nearly 10% every 12 months.
- **The inefficiency of all-in-one recycling:** the state-of-the-art fad in recycling is all-in-one recycling and plenty of humans suppose that that is the quality method for recycling waste. Waste materials such as paper, glass, plastic, and steel all move into one bin.

- E-waste means End of life electronic products like computers,printers,tvs, cellphone includes poisnous chemicals. For example lead,mercury. Lead is etc.It is a complex global problem. Electronic products contain hazardous meterials which used in CRTs of computer and telivion monitors. It causes damage to the nurvous system. Mercury is used in flat panel display screens which contains neurotixin. The harmful metal is absorbed by the human body through contaminated drinking

water. The e-waste can effects the environment as well as the people also.

- The main producer of e-waste was US and they send it to some other countries for recycling.Recycling means burning wires to recover metals,melting circuits and also acid stripping. Even the recycling process produce so many problems to the environment. The recycling process can be done by men,women and also little childrens which are not having any protection for health.
- The information is very less to know about the e-waste. Long-term effects on environment is still unknown. so increasing the education about the e-waste is needed.

Life, nowadays has become so fast and luxurious that we can not imagine it without the sophisticated electrical and electronic items.

Again the rapid technological innovations in computing following the doubling of the processing power of chips almost every two year are rendering most of the electrical and electronic items obsolete in the blink of an eye. This coupled with changing life styles with more disposable income in littering the urban scope with the digital detritus of the digital age called E-waste.

E-waste is a generic term encompassing various forms of electrical and electronic equipment that may be old, might have reached end-of-life and most importantly cease to be of any value to their present owners and it has been identified as one of the fastest growing waste steams.
well as organic and inorganic compounds.

Compounds such as brominates flame retardants, metals like lead, mercury, cadmium and chromium compounds found in these appliances are highly dangerous persistent organic pollutants that pose health and environment risks. They bio-accumulate through the food-chain and the hazards are more acute in the event of incorrect disposal and inappropriate recycling techniques.

Landfills used for waste disposal are prone to leaking and also lead to leaching of heavy metals and other toxins into the soil which may contaminate not only the soil but also the water table. Mercury, cadmium and lead are among the most toxic lactates, e.g., lead from broken glass of TV's and monitors can expose lead to leaching.

Landfills are also prone to uncontrolled fires which can release toxic fumes. Disposal through incineration is also dangerous as the residual ash contains toxic metals.

Incorrect recycling process such as open air incineration, acid bath leaching are commonly used for recovery of precious metals from the e-waste. Irreparable damage is done to the environment during these processes when compared to the short term monetary gains.

The matters are not helped further by the fact that public at large remains unaware of their own toxic footprints and as part of its life-style replaces functional electronic gadgets with the latest model with impunity. This lack of awareness is further aggravated by the lack of proper recycling facilities for e-waste in India.

Currently, out of the total e-waste recycled in the country a mere 5% is recycled by the handful of

formal recyclers and this is recycled by the informal recyclers. The e-waste recycled by the formal recyclers is done following environmentally sound practices which ensures that damage is minimized to the environment. They also adopt processes so that the work force is not exposed to toxic and hazardous substances released while recycling the waste.

But they cannot match either the reach or the network of the informal recyclers used for sourcing of old electrical and electronics items from businesses as well as individual households. The items are collected, segregated and the ones that cannot be sold 'as it is' are further dismantled by the informal recyclers.

The final step after collection, segregation and dismantling is recycling. Most of the processes used by the informal recyclers are manual using simple tools like hammers, screw drivers etc. and by the use of rudimentary techniques like burning of wires in open, using acid baths for extraction of precious metals.

Furthermore, these activities are carried out without wearing any protective wear like masks, gloves etc. In the absence of suitable processes and protective measures, recycling e-waste results in toxic emission to the air, water, soil and poses a serious environmental and health hazard.

FINDINGS

A “tsunami of e-waste” is **engulfing the world** as demand for cheap TVs, fridges and phones skyrockets, the **United Nations** (UN) has warned.

Last year electronic and electrical waste reached 50 million tonnes, more than the weight of all commercial airliners ever made. This figure is expected to double by the middle of the century.

While a fraction of this waste is recycled, the vast majority ends up on landfill, and a group of UN bodies has come together to call for a “global reboot” to tackle the growing problem.

E-waste often ends up being burned on dumps, often by some of the planet’s poorest people, with harmful consequences for both their health and the environment.

But the report released at the **World Economic Forum in Davos** Switzerland, states that this waste also represents a vast, untapped resource.

Globally, e-waste is worth at least $62.5bn (£48bn) the annual equivalent of **Kenya’**s GDP.

Many devices are full of valuable materials that are ripe for recycling. In a tonne of mobile phones, for example, there is 100 times more gold than can be found in one tonne of gold ore.

Many of these minerals are considered in danger of running out and the environmental and human impact of mining new ones in places like the Democratic Republic of the Congo and China are enormous.

Currently, only around a fifth of all e-waste is formally recycled and while millions of people are thought to work informally recycling these materials, they are often exposed to dangerous working environments.

While a shift towards cloud computing and the "internet of things" is expected to result in fewer new materials being required, experts say there is also a need for more circular supply chains.

-]'Endangered' elements used to make mobile phones 'running out fast'

"Our planet's survival will depend on how well we retain the value of products within the system by extending their life," said Joyce Msuya, acting executive director of UN Environment

To do this, the coalition of groups behind the new report – which also includes representatives from business – called for industry, academia and civil society to unite to create new recycling infrastructure and boost the quantity of e-waste that is re-used.

The information technology age might seem spotlessly clean compared to the smokestacks of the industrial economy. But there is a dirty side to the pristine devices that drive modern businesses. Electronic waste from discarded computers, mobile phones and other electronic goods, known as e-waste, has become the fastest growing global refuse stream in recent years. In 2016, 44.7 million metric tonnes of e-waste were generated, equivalent to roughly 4,500 Eiffel Towers, and this is expected to grow to 52.2 million tonnes by 2021, according to the Global E-Waste Monitor 2017 report. Minimising damage

One such firm is Sage Sustainable Electronics in Ohio, US, which counts two of the US's five largest banks among its clients. CEO Robert Houghton believes there are various steps that companies can take to minimise environmental damage from the churn of tech devices. The first is to more effectively redeploy older devices within the company. 'The best ecological outcome results from simply extending the life of technology and resisting the temptation to always have the latest model for all staff,' he says. 'Loan officers at banks, for example, might only use laptops to fill in forms, which is a very undemanding IT process. Any three- or four-year-old computer can do this.' Providing such employees with the most powerful new device can be compared to picking up your groceries in a 40-tonne articulated lorry. And the life of a device can be extended by several years with a few simple tests and repairs, and some cosmetic improvement.

Ecologically friendly sourcing of equipment can play a role, too, says Ann Starodaj, director of sustainability at Optoro, a technology company that helps retailers and brands manage returned goods, including IT devices. 'Technology is a lifecycle issue,' she says. 'Companies can choose devices that last longer and meet higher energy-efficiency standards. They can also buy refurbished computers that look brand new from e-commerce sites like those run by our firm and our peers.'

One important function of such e-Steward firms is to provide companies with the tools to calculate the resulting ecological benefits for their CSR reports. 'Clients can promote the benefits of each laptop or mobile device they reuse or recycle properly in terms of volume waste diverted from landfills and also of greenhouse emissions averted,' says Neil Peters-Michaud, CEO of Cascade Asset Management, an e-Stewards certified firm. 'This data can then feed into their annual reports and is something they can trumpet both within their companies and outside.' For example, drug developer Covance was able to publish that the

refurbishment and recycling with Cascade of 5,900 devices, from computers to mobile phones, had prevented the release of more than 662 tons of carbon emissions – equivalent to removing 403 passenger cars from the road annually. or electronic devices are called as ‘e-waste (Electronic waste)’.

- E-waste is also called as e-scrap, or Waste Electrical and Electronic Equipment (WEEE).
- The electronic industry is the world’s largest and fastest growing manufacturing industry and so does e-waste.
- The fraction of iron, aluminium, gold, copper in e-waste is over 60%, plastic is about 30%, hazardous substances is about 2.70%, and remaining is wastage.

- The rapid growth of users of computers and other technology devices.
- Disposal of technology devices is not an easy task, as they contain hazardous materials.
- Average life span of electronic devices is decreasing as people are updating their houses with new electronic devices always.
- Transferring e-waste from developed countries to developing countries in the name of donations.
- Less life time of electronic goods.
- Nobody is interested to reuse and repair the electronic goods as there are new products available in attractive prices.

- Resources are wasted as valuable materials in e-waste are being dumped in normal wastage.
- Toxic materials in e-waste cause severe health risk.
- Environmental damage.

- Land filling of e-wastes can lead to the launching of lead into the ground water.
- When CRT (cathode ray tube) is burned, it emits toxic fumes into the air.
- The cadmium from one mobile battery can pollute 600 m3 of water.
- Informal recyclers are attracting the poor people in the name of employment and making them disassemble the components with bare hands and without any precautions, which is highly dangerous for their health.

DISCUSSION

- Collection centers of expired electronic and electrical goods must be there. So that e-waste will not be mixed and burned along with normal wastage.

- Public awareness programs must be conducted because the role consumers is very high in this issue.
- *Waste360* recently spoke with Jason Linnell, executive director for the National Center for Electronics Recycling, and Eugene Niuh, business development director for Omnisource Electronics Recycling, about the latest e-waste recycling trends and challenges and the future of the e-waste recycling industry. The duo will lead a discussion on electronics recycling trends and markets at **WasteExpo in Las Vegas on Wednesday, June 8, 2016.**
- ***Waste360*: What are the current e-waste recycling trends?**
- ADVERTISING
- **Jason Linnell:** Within the industry itself, it has been a very challenging time for the past couple of years with the **decline in commodities prices.** It affects everybody, but it has really come at an unfortunate time for the e-waste recycling industry because it coincides with the increase of CRTs (Cathode Ray Tubes) coming into recycling streams.
- We have also seen some recyclers go out of business, and we have seen cutbacks in different local colletion programs due to the increase in costs. Overall, it's been a pretty challenging time for the electronics recycling industry.
- ***Waste360*: What are some of the challenges that the e-waste recycling industry is facing?**

- **Eugene Niuh:** The lack of comprehensive legislation on the federal level in regards to recycling e-waste in the U.S. continues to be a challenge for recyclers. There are currently 25 states that have some kind of e-waste legislation, and to make matter worse, they are not all consistent, focusing on different aspects of e-waste commodities and recycling requirements.

- **Jason Linnell:** When people hold onto old devices for too long after they no longer use them, it can hurt the industry. Whether it's a TV, computer or cell phone, people

often hold onto old devices because they think that they may use it in the future, but most of the time these devices just end up sitting in a closet or basement until they're discarded. It's best for people to recycle or turn in these devices as soon as they are done using them because that provides the best reuse potential and value for the device. If people wait too long, the device may become too obsolete, not as valuable or even too hard to extrude the components that can be resold or refurbished. By properly reusing or recycling these items, people will be able to save on some of the costs and return some of the value to that device back into the recycling stream.

- There also is a need for new innovation for recycling devices. I am not sure if it will be something like the **Apple robot,** but there needs to be new innovation for processing items more efficiently and capturing some of the more valuable components and critical materials from the devices.
- There are many materials that are used in electronics and once they are put together, they are hard to extract. There are better ways to extract the valuable metals and precious materials that are in the devices and right now, the industry needs to invest in longer-term technologies to make the process more efficient overall.
- ***Waste360*: What's in store for the future of e-waste recycling?**
- **Eugene Niuh:** The industry is a rapidly evolving and developing space. The lifecycle of an e-waste product is extremely short. Your vehicle, for example, is typically possessed for 10 to 12 years, but your cell phone or other electronic devices have a two to five year life span. Recyclers; therefore, must adapt quickly and adjust their business model according to these changes.
- The industry itself needs to constantly be aggressive in addressing new items that are coming on board and advancing new technologies for recycling. The products are getting more complex and smaller, which can be more challenging to recycle.

Additionally, the skill set required to test, refurbish or repair newer devices becomes more complex and cost prohibitive for recyclers.

- **Jason Linnell:** The retailer recycling options are very effective because it's convenient for people to drop off recycled items at a place they shop at regularly.
- Earlier this year, Best Buy changed its free e-waste recycling program to institute a fee for the TVs and monitors that are brought in. The company still offers free recycling for a lot of other items, and it's a very popular program.

CONCLUSION

As indicated in the literature (European Commission, 2000), the risks relating to placing discarded electrical equipment in landfill are due to the variety of substances they contain. Due to the range of different substances in WEEE, unpredictable toxic hazards are potentially created by landfilling. Co-disposal with municipal waste adds to the unpredictability, and spreads the problem. While licensed, controlled landfills with liners do not eliminate risks of pollution, the potential amounts and concentrations - and resulting environmental impacts - are considerably higher when WEEE is put in uncontrolled landfills.

In the EU, the 'Precautionary Principle' has been applied in requirements to remove 'substances of concern', pending clarification on their hazardousness and appropriate treatment. Furthermore, some other components that are not specified in Annex II may be hazardous, and may need to be removed to render the WEEE item non-hazardous, for example, substances containing phthalate plasticizers or lead stabilisers, lithium batteries, and components containing mineral wools that are classified as category 3 carcinogens (AEA, 2004).

Notwithstanding, there is good (although not perfect) information about the toxicity of many WEEE components and the likelihood of damage to human health and the environment. Lead has well-known toxicity and is used widely in soldering, CRT screens and other EEE components. While the literature is less conclusive about the rate of leaching of lead from landfills, and further monitoring is required, it is well-established that lead leaches from landfill and evidence indicates that even low concentrations of lead can cause serious developmental effects on the brains of children. Mercury is used in smaller amounts in EEE, however, leaching of elemental mercury and the vaporisation of metallic mercury and

dimethylene mercury, both contained in WEEE, are of concern. While leaching of mercury in large concentrations from well-managed landfills is unlikely, mercury is highly persistent in the environment and so causes long-term effects.

BFRs are a major problem facing risk assessment, as they offer health benefits in reducing the risk of EEE catching fire during use, yet they are also toxic to both humans and the environment. Different BFRs provide different toxicity but the whole substance group of BFRs is listed on the Danish list of unwanted substances. Of the main groups, PBBs, Penta-BDE and Octa-BDE are banned under the RoHS Directive from July 2006, and, while Deca-BDE has been exempted from this ban, it is currently the subject of legal challenges from both the European Parliament and Denmark. With the current literature incomplete, there is enough evidence to warrant consideration of a precautionary ban on these BFRs, pending the development of alternatives which are already appearing on the market.

PVC is mainly a concern due to the risk of the release of chlorine, heavy metals used as stabilisers and phthalate plasticizers. The PVC industry is committed to tackling lead stabilisers within a decade, but this leaves other issues unresolved. A precautionary approach would therefore be to assume that the potential for leaching of chlorine, heavy metals and phthalates is possible. Similarly with phosphors, additives such zinc, terbium and arsenic are the main areas of concern regarding toxicity and pollution risk, although less-publicised and less well understood than PVC.

A major issue for policy formulation in New Zealand is the effect of policies and regulations elsewhere. The EU WEEE and RoHS Directives are already creating considerable industry transformation, and will bring new materials to the market, as well as new industries and techniques for effectively managing the product stewardship and end-of-life implications of the Directives. They can also be expected to have effects outside Europe, with more toxic EEE being 'dumped' onto markets in countries with less developed policy and regulations.

Of the substances reviewed in this study, lead poses major risks because of the amounts occurring in WEEE and the toxicity potential. Mercury, cadmium and chromium VI (hexavalent chromium) are also of concern both because of their toxicity and leaching potential, and their persistence in the environment. BFRs are a complex issue, with proven potential human health effects associated with some compounds, and documented suspicions

REFERENCE

1]"The Emerging Environmental and Public Health Problem of Electronic Waste in India".

2]"India fifth largest producer of e-waste: study - The Hindu".

3]"Electronic waste is recycled in appalling conditions in India".

4]"E-Waste Disposal Methods And How To Do It? [Complete Guide]".

5]"India's e-waste to touch 5.2 MMT by 2020: ASSOCHAM-EY study - Times of India".

6]"India to generate over 5 million tonnes of e-waste next year: ASSOCHAM-EY study".

7]India likely to generate 5.2 million tonnes of e-waste by 2020: Study - Business Line".

8] http://www.ecoraksha.com/index.php?page=complete_rules.

9]*"E-waste Management Rules, 2016".*