INDUSTRY-MEETS-SCIENCE SERIES

WASTE RDI ROADMAP

2016

WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT (WEEE)

SEEKING ALTERNATIVE SOLUTIONS TO DISPOSAL

WORKSHOP PROCEEDINGS

science & technology
Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

INDUSTRY meets SCIENCE Waste Sector

Document to be referenced as:

Department of Science and Technology (2016). "Industry-meets-Science" Workshop Proceedings. Waste electrical and electronic equipment – Seeking alternative solutions to disposal. Department of Science and Technology: Pretoria

Prepared by Dr Linda Godfrey of the Council for Scientific and Industrial Research (CSIR) on behalf of the Department of Science and Technology (DST).

All documents are available online at *http://www.wasteroadmap.co.za*

Cover photographs courtesy of Dr Linda Godfrey (CSIR)

Date: April 2016

Table of Contents

1 Introduction

This report summarises the findings of a one-day Industry-meets-Science workshop, held at Mintek in Johannesburg on the 8 March 2016. The workshop was aimed at highlighting the key issues facing industry with respect to waste electrical and electronic equipment (WEEE) (or electronic waste), and showcasing current research, development and innovation (RDI) being undertaken by South African Universities and Science Councils.

1.1 Defining the waste stream

The South African government (RSA, 2012) identifies WEEE as consisting of eight sub-categories –

1. Large household appliances
2. Small household appliances
3. Office, information and communication equipment
4. Entertainment and consumer electronics
5. Lighting equipment
6. Electric and electronic tools
7. Security and health care equipment, and
8. Mixed WEEE

Categorizing WEEE as both general and hazardous waste (RSA, 2012; RSA, 2014).

According to European Union (Directive 2012/19/EU) WEEE is defined as "*electrical or electronic equipment*[1] *which is waste within the meaning of Article 3(1) of Directive 2008/98/EC, including all components, sub-assemblies and consumables which are part of the product at the time of discarding.*" A non-exhaustive list of electrical and electronic equipment covered by EU Directive 2012/19/EU, include –

1. Temperature exchange equipment
2. Screens, monitors, and equipment containing screens having a surface greater than 100 cm2
3. Lamps
4. Large equipment
5. Small equipment
6. Small IT and telecommunication equipment

WEEE, once dismantled, may contain metallic and non-metallic fractions (secondary materials), including steel, copper, aluminium, plastics, glass, wood, complex fractions, hazardous fractions, and others.

According to the Electronic Waste Association of South Africa (eWASA), "*the widely accepted international definition of e-waste is 'anything that runs on electricity'*". The draft eWASA Industry Waste Management Plan of 2011, defined 'electronic waste' as "*old, end-of-life or discarded*

[1] Where 'electrical and electronic equipment' (EEE) is defined under the same Directive as "*equipment which is dependent on electric currents or electromagnetic fields in order to work properly and equipment for the generation, transfer and measurement of such currents and fields and designed for use with a voltage rating not exceeding 1 000 volts for alternating current and 1 500 volts for direct current*"

appliances using electricity. e-waste is used as a generic term embracing all types of waste containing electrically powered components."

2 Workshop

2.1 Purpose of the workshop

South African waste policy promotes the waste hierarchy, which requires that waste be reduced, reused, recycled or recovered, before it can be considered for disposal to landfill. WEEE is identified as one of the fastest growing waste streams internationally, as well as in South Africa[2], however, according to the Department of Environmental Affairs (DEA, 2012), only 11% of WEEE is recycled (as at 2011). When it comes to WEEE recycling in South Africa, the focus for industry remains largely on the recovery of printed circuit boards (PCBs), due to the metal content and resultant high value. WEEE plastics and glass remain problematic in terms of recycling. Furthermore, of the fractions that are collected, much of it is exported out of South Africa, for reprocessing in countries such as Belgium, Sweden, Canada, China, due to limited reprocessing facilities in South Africa. As a result, these secondary resources are lost to the South African economy, and with it, the potential for local job creation.

The Waste RDI Roadmap Grant Call of 2015/16, showed that Universities and Science Councils are currently undertaking research on innovative solutions to WEEE beneficiation, although limited, with a focus currently on metal recovery. However, little research is evident in South African research institutions on addressing the problematic fractions of WEEE and the other key challenges facing the sector. Therefore, to inform future investment in WEEE RDI in South Africa, the Department of Science and Technology hosted a small, focussed 'Industry-meets-Science' workshop on the 8 March 2016, in Johannesburg. The aim of the workshop being to bring industry, government and academia together, to –

- highlight the problems that industry face with respect to WEEE recycling/reprocessing
- showcase to industry current research by South African Universities and Science Councils
- jointly identify priority issues that require new directed RDI
- facilitate increased uptake of RDI outputs by local industries

2.2 Workshop programme

Key sector representatives were invited from Government, Industry, Universities and Science Councils to present at the workshop. The morning session focussed on current initiatives of the WEEE recycling sector (industry), while the afternoon session focussed on current R&D initiatives of the research community. The brief given to speakers was to provide an overview of –

- The organisations current activities in WEEE (Status quo)
- Current challenges and obstacles facing WEEE recycling in South Africa (Obstacles)
- Opportunities for increasing WEEE recycling in South Africa (Opportunities)
- Current gaps in knowledge – what don't we know (Gaps)

[2] E-waste from old computers is expected to have increased by 200-400% by 2020 (from 2007 levels) (UNEP, 2009)

The workshop programme, outlining the speakers and presentation topics, is attached as Annexure A. All presentations made during the workshop are available online, on the Waste RDI Roadmap website (*www.wasteroadmap.co.za*).

3 Results

3.1 Presentations

Delegates were invited to present on their organisations activities around WEEE recycling and recovery. In addition, they were asked to reflect on –

- Current challenges and obstacles facing WEEE recycling in South Africa
- Opportunities for increasing WEEE recycling in South Africa
- Current gaps in knowledge

A summary is provided below.

3.1.1 Obstacles facing WEEE recycling

1. Africa e-Waste (Ulze van Wyk)
    - Awareness by public / companies / government
    - Logistics / vast area to cover
    - View on e-waste being valuable
    - Categorization in what is hazardous and what is not
    - E-waste plan not finalized and implemented
    - Licensing
    - Education of officials on administering the law, regulating
    - Cherry picking
    - Currently anyone can collect / dismantle

2. Enviroclaim (Tonie Pieterse)
    - No benefit or incentive for individuals or business to recycle other than their consciousness towards global warming or laws
    - No tax benefit to business, the contrary is true, as business is used to receiving income from waste, declare it in the books and pay taxes
    - E-Waste at big business and Government needs to go through procurement and only big recycling companies land these contracts as they are merchants and pay top dollar for e-waste
    - No penalty if electronic waste is simply dumped in rubbish bins or at landfills

3. SIMS Recycling Solutions (Allan Werth)
    - Non-compliance – single biggest challenge is that people and companies find it cheaper to be non-compliant
    - Cost of compliance – very costly to be compliant (certification and negative revenue items)

- Complications around e-waste – e-waste is over-valued, complicated to recycle; over 200 elements

4. Reclite (Patricia Schröder)
   - Awareness and Education still lacking
   - Changing the waste habits of consumers
   - Landfill still main competitor until July 2016
   - Extended Producer Responsibility Plan implementation very slow
   - Lack of funding for research and development efforts
   - Not enough local capability for processing recovered materials from recycling
   - Lack of local expertise, need to look abroad for research and/or assistance in most cases
   - Perception of a waste and not a resource that can contribute to economy

3.1.2 Opportunities for increasing WEEE recycling

1. Africa e-Waste (Ulze van Wyk)
   - Tonnages
   - Workflow
   - Job creation
   - Informal recyclers
   - Greener SA / "Clean" Landfill sites

2. Enviroclaim (Tonie Pieterse)
   - Educate companies of the benefits associated with Electronic Waste
   - Business / School - create awareness of recycling
   - Zero waste to landfills

3. SIMS Recycling Solutions (Allan Werth)
   - Business to business – existing model with expansion opportunities
   - Tier 3 and 4 – Controlled collection and separation points; and General informal collectors (dependent on format of National e-Waste Plan)
   - Beneficiation to be done compliantly
   - South Africa needs e-waste recycling plants

4. Reclite (Patricia Schröder)
   - Creating local solutions for recovered materials from WEEE recycling
   - Job creation and skills transfer
   - Creating local markets supporting the South African circular economy
   - Other African countries can benefit through IP transfer/sharing

3.1.3 Current gaps in knowledge (informing future RDI)

1. Africa e-Waste (Ulze van Wyk)
   - Awareness (public / companies / e-waste vendors / government)

- Lack of knowledge of what components consist out off
- Lack of knowledge on enforcement of the law
- Where the bottleneck is regarding the tonnages available to the recyclers?
- Record of tonnages, who is keeping record?
- Light bulbs

2. Reclite (Patricia Schröder)
   - Benefits of diversion from landfill to see the bigger picture
   - Many WEEE recycled products exported – need South African solutions
   - Lack of understanding of the make-up of recycled materials
   - Lack of understanding of the various applications for recycled products

3. Mintek (Mariekie Gericke)
   - Developed e-waste data management system to understand the origins, pathways, immediate and final sinks of e-waste materials along the value chain.
   - Lack of local technologies for e-waste recycling which are linked to end-use markets
   - Processes for the cost-effective recovery of the metals after pyro- or hydrometallurgical treatment; metals often present at low concentrations
   - Solutions for treatment of hazardous fractions such as CRT monitors, printer cartridges, refrigerants, batteries
   - A financing system for negative value products - to avoid "cherry picking"

3. Stellenbosch University (Prof Christie Dorfling)
   - Economics of recycling and waste treatment
     - Techno-economic assessment of different recovery processes
     - Quantify contribution to socio-economic development and sustainability
   - Waste management
     - Waste stream blending to enhance processing
     - Opportunities for mining of existing landfill sites
   - Best available technology
     - Continuously changing WEEE composition and increasing complexity
     - Environmentally benign processes suitable for small scale operation
     - Incorporation in existing primary source treatment facilities

3.2 Group discussions

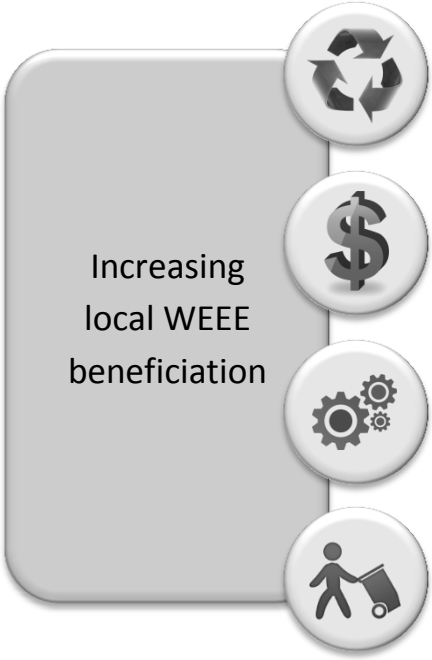
The detailed input from the breakaway groups on (i) the challenges/obstacles currently facing WEEE recycling in South Africa, and (ii) the opportunities for South Africa moving forward, are provided in Annexure 2.

The expectations of the R&D community, in terms of WEEE research, development and innovation needs and the role of universities and the science councils, are summarised below.

3.2.1 How can the R&D community support industry in realising these opportunities

3.2.1.1 What R&D on WEEE is needed for South Africa?

Based on the working group discussions, four key priority themes emerged, where research, development and innovation, can support the increased local beneficiation of waste electrical and electronic equipment –



Developing local ***markets*** (demand)

Correcting the ***economics*** of WEEE recycling (incl. economic instruments)

Appropriate WEEE processing ***technologies***

Increasing WEEE ***collection*** (supply)

The research priorities for improved WEEE management, which emerged from the working group discussions are grouped according to the clusters of the Waste RDI Roadmap:

Strategic Planning

1. Development of local WEEE *markets* (*Roadmap sub-cluster SP2*)
2. Correcting the economics of WEEE management, including opportunities for the implementation of *economic instruments* to support (i) increased WEEE collection and beneficiation in South Africa (incentivise alternative waste treatment), and (ii) influence end-user/legal owner disposal behaviour (penalise disposal to landfill) (*Roadmap sub-cluster SP3*)
3. Value chain analysis – understanding local WEEE recycling costs and benefits (*Roadmap sub-cluster SP2*)

Modelling and Analytics

1. Improved data collection and analysis across the WEEE value chain (e.g. quantifying WEEE generation, transport (including export), refurbishment, reuse, recycling, and recovery) (*Roadmap sub-cluster MA4*)
2. Modelling the thresholds of various WEEE streams that would support the implementation of sustainable, financially viable, local technology (*Roadmap sub-cluster MA1*)
3. Techno-economic studies to determine technical, economic and environmental feasibility of WEEE recycling in South Africa (*Roadmap sub-cluster MA3*)

Technology Solutions

1. Support local beneficiation (in-country reprocessing) of WEEE fractions through (i) development of appropriate technologies (that address volume constraints) (ii) localisation of inbound technologies, and/or (iii) co-processing of WEEE streams/fractions as by-products in other industries (e.g. mining and metallurgical sector) *(Roadmap sub-clusters TS2 and TS4)*
2. That address the following problematic WEEE waste streams –
   - WEEE plastics (in particular brominated flame retardant (BFR) plastics; polycarbonate/ acrylonitrile butadiene styrene (PC/ABS) plastics)
   - cathode ray tube (CRT) glass
   - printed circuit boards (PCBs) (especially low grade metal recovery)
   - chlorofluorocarbons (CFCs)
   - WEEE cabling (light)
   - batteries (particularly Lithium ion, Silver oxide, Nickel-cadmium, NiMH)
   - solar panels

Waste Logistics Performance

1. Modelling a reverse logistics system that would provide a comprehensive national take-back programme for WEEE in South Africa, including economic modelling
2. Appropriate collection infrastructure and logistics for South Africa

Waste and Society

1. Integration of the informal WEEE collectors, refurbishers, etc. into a local WEEE collection and recycling system, in a way that creates decent jobs and improved livelihoods
2. Jobs creation potential of the WEEE sector

3.2.1.2 What should the role of universities and the science councils be in supporting the South African WEEE industry?

Universities and Science Councils are expected, by industry, to play an important role in –

- Transferring knowledge from the R&D community to industry
- Supporting technology transfer
- Collection and dissemination of reliable data on WEEE in South Africa, and
- Capacity development (including WEEE management as part of University curriculum; training courses for the sector; producing skilled graduates)

4 Conclusions

The lack of local, affordable WEEE recycling and reprocessing technology was identified by workshop participants. Furthermore, the need for technologies that could process smaller volumes of WEEE, a priority issue for South Africa, was raised. As with other waste streams, the implementation of alternative waste treatment technology for WEEE is, in most instances, less to do with the availability (or lack thereof) of technology, and more to do with having a sustainable feedstock (supply of waste) to warrant private sector investment in the technology. This is evident in the waste plastic beverage sector for example, where it has taken approximately 10 years to reach a point where a reliable feedstock has been established that reduces the risk to business of investing

in high technology recycling facilities. Until such time as critical thresholds of supply (collection of WEEE streams) is achieved, local beneficiation is not financially viable, or not viable without heavy subsidies by government or producers. Increased local beneficiation of WEEE is therefore heavily dependent on the increased collection of WEEE at end-of-life from households, businesses and government.

For this reason, WEEE recycling is currently focussed largely around the recovery of printed circuit boards, due to the relatively high value of the metals. In most cases, these PCBs are exported for reprocessing in developed countries, with the result that valuable resources and jobs are lost to the South African economy.

The delay in implementation of an Extended Producer Responsibility (EPR) scheme (Industry Waste Management Plan), is seen as having a direct negative impact on increasing collection rates, and addressing the economics of recycling, particularly the low value and problematic fractions, such as WEEE plastics and glass.

Considerable guidance has been provided by workshop participants to help identify and shape the research needs for the WEEE sector, which will further support the implementation of the 10-year Waste RDI Roadmap for South Africa.

5 References

DEA (2012). National Waste Information Baseline Report, 14 November 2012. DEA: Pretoria

European Union (2012). Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE). Official Journal of the European Union, 197/38, 24.7.2012.

RSA (Republic of South Africa) (2012). National Environmental Management: Waste Act (59/2008): National Waste Information Regulations. Government Gazette No. 35583, Vol. 566, 13 August 2012.

RSA (Republic of South Africa) (2014). National Environmental Management: Waste Amendment Act, 2014. Act No. 26 of 2014. Government Gazette No. 37714, Vol. 588, 2 June 2014 .

UNEP (2009). Recycling – From e-waste to resources. Sustainable Innovation and Technology Transfer Industrial Sector Studies.

science & technology
Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

INDUSTRY meets SCIENCE Waste Sector

ANNEXURE 1: INDUSTRY-MEETS-SCIENCE WORKSHOP

"Technology solutions for addressing Waste Electrical and Electronic Equipment"

Date: 8 March 2016, 9:00 am – 4:00 pm
Venue: Mintek, Conference Room G4, 200 Malibongwe Drive, Randburg, Johannesburg

Morning session will be focussed on input from industry/business (WEEE recyclers), including –

- Main obstacles or challenges facing South Africa wrt WEEE recycling
- New opportunities for increasing WEEE recycling in South Africa
- Current gaps in knowledge – what don't we know? (*guide future targeted R&D in support of industry*)

Afternoon session will be focussed on the R&D community and the solutions they are developing.

Time	Name	Organisation	Focus area
9:00 – 9:30	**Arrivals (Tea / Coffee)**		
9:30 – 9:35	Dr Henry Roman	DST (Welcome)	Waste RDI Roadmap
9:35 – 9:45	Anben Pillay	DEA (Opening remarks)	Policy perspective
9:45 – 9:50	Prof Linda Godfrey	CSIR (Background and outcomes)	R&D and Innovation
	INDUSTRY SESSION – "THE SIZE OF THE PROBLEM AND CURRENT INITIATIVES"		
9:50 – 10:05	Ulze van Wyk	Africa e-Waste	Industry
10:10 – 10:25	Jami Nash	Electronic Cemetery	Industry
10:30 – 10:45	Tonie Pieterse (*for Mariska Cloete*)	Enviroclaim	Industry
10:45 – 11:15	**Tea / Coffee Break**		
11:15 – 11:30	Pravashen Naidoo	eWaste Africa	Industry
11:35 – 11:50	Jan Barnard	Desco Electronic Recyclers	Industry
11:55 – 12:10	Allan Werth	SIMS Recycling Solutions	Industry
12:15 – 12:30	Patricia Schröder	Reclite	Industry
12:30 – 12:45	*Questions and Discussion*		
12:45 – 13:15	**Lunch Break**		
	SCIENCE SESSION – "CURRENT RDI TO FIND ALTERNATIVE SOLUTIONS" (TECHNOLOGY FOCUSSED)		
13:15 – 13:30	Mariekie Gericke	Mintek	Academia
13:35 – 13:50	Prof Christie Dorfling	Stellenbosch University	Academia
13:55 – 14:10	Prof Sue Harrison	University of Cape Town	Academia
14:10 – 14:30	*Questions and Discussion*		
14:30 – 15:30	**Breakaway:** • Q1: What are the main challenges/obstacles currently facing WEEE recycling in SA (*technology, policy, economic/market*) (20 min) • Q2: What are the opportunity WEEE products and/or fractions for SA moving forward (20 min) • Q3: And how can the R&D community support industry in realising these opportunities *(What R&D is needed, what technology support is needed, role of universities and science councils)* (20 min)		
15:30 – 15:45	Group feedback		
15:45 – 16:00	Prof Linda Godfrey	Summary and way forward	Waste RDI Roadmap
16:00	End of Day 1		

science & technology
Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

ANNEXURE 2: WORKSHOP BREAKAWAY SESSIONS

INDUSTRY meets SCIENCE Waste Sector

1. Main challenges/obstacles currently facing WEEE recycling in SA (technology, policy, policy /market)?	
Technology	• No knowledge of technologies locally available and their economic viability • Innovation to improve technologies and make applicable to local industry • Financing recycling and lack of funding • Sourcing equipment • End-markets for recycled materials are lacking (e.g. plastics and CRT glass)
	• Processing facilities for metals, plastics (large scale) • White goods, low-value WEE processing • By products: plastics, batteries, capacitors, steer • Identification/ determining composition and classification of waste
	• Affordable technology • Lack of local technology • Need to buy technology in and too expensive • Need technologies for smaller volumes • Need logistics / business processes around the disassembly/ collection, distributed across sites, that create jobs alternatively, select and customise SA • Need a variation of plants e.g. (1) circuit boards; (2) lighting and LCD flat panels; (3) batteries; (4) plastics; (5) low grade materials-polystyrene, steel, low-grade boards → set of intermediate products. Intermediate products must be processed to meet a market • Need an approach to process mixed plastics or need to separate (plastics= 50% mass) • Sustainable solutions for many materials such as CRT glass, brominated plastics, and printed circuit boards (PCB) not yet available in South Africa
	• Glass market-products • Plastic products • CFL waste to valuable product • Rare earth elements • Commercialisation of technologies • Small process flowsheet for waste preparation • Testing kits for product/sample purity • Biodegradable plastics-recyclable plastics
	• High-value components are being exported, low-value components are being dumped
Policy	• Industry waste management plans • Policy to allow transport of e-waste into SA (create economy of scale)
	• Extended Producer Responsibility (EPR) (currently lacking) – basis for creating an economically viable and sustainable WEEE recycling sector • Support from government (e.g. rebates, tax incentives) • Completely stop exporting/ close the loop completely, but be careful in free market system, do not over regulate • Regulation of legislation / policy

1. Main challenges/obstacles currently facing WEEE recycling in SA (technology, policy, policy /market)?	
	• Dumps not to accept e-waste • Non- compliance products should not be imported/ accepted • Policies to support local suppliers/ clients • Management of metal licenses encourage business with overseas companies
	• Can we convert plastics into oil (pyrolysis) or energy (emissions!) • Can we develop our own plastic separate plant • Suggesting we can lead the global space in other than PCB materials – cables, fibre optics • Job creation - collection in rural and townships areas to create sustainable jobs. • Training of staff to separate with sufficient knowledge. Are short training courses needed? • Batteries cannot be exported → need recycling technology in SA • CRT glass - could buy an old plant
	• Legislation of recycled plastic and glass products • Monitoring • Collection schemes • Government to prevent export of WEEE fractions
	• Collection systems and drop-off facilities lacking • Asset disposal policies - Government departments need one policy nationally regarding e-waste • IndWMP for e-waste still not established, defining roles and responsibilities of the Industry associations, and who audits them?
Economics/Markets	• No rules in place to support recycling for creating markets
	• Lack of tax incentives • Fines for non-compliance
	• Lack of local market for glass and plastic recycling • Cost benefit for recycling • Lack of incentives for business
	• Barriers to entry for enterprise development
Other	• Why not refurbishing? Waste minimisation • Lack of data on the amount of EEE placed onto the South African market annually, correlated to the average life-span of EEE (get better estimates of the quantity of e-waste in South Africa) • e-waste is fastest-growing waste stream in the world and is growing at between 3-4 times the rate of growth in municipal solid waste – access to waste stream • Lack of technology and skills limits e-waste processing and recycling

2. Opportunity WEEE products and/or fractions for SA moving forward
• CRT glass, plastics, toner cartridges • Jobs, small businesses - skills development in dismantling • Establishing regional markets
• Secondary use printers - 3D printers to reuse, products, and functions • Reuse products worth much more • Plastics - more value in it • The more recycling the more the new material • For certain plastics you need volume • Need to consolidate volumes - price driven • Tax incentive to keep product local • Local beneficiation • Keep recycle material to export - not enough reuse material • Local demand exceeding supply on reuse (precious base metals, plastics, rare earths)

• Non-recyclable plastic to energy (oil, heat, electricity)
• Recycle plastic e.g.
  ○ separate nylan → nylan bolts
  ○ engineered plastics
  ○ Teflon from fluorescent tubes →pellets
• A database of collected fractions such that integrated processing can happen
• An engineer on call to assist in classifying unusual materials
• Need opportunities for processing of metals – expect to need to export, therefore, no electronic industry
• Levy on lights and batteries opens up potential for products from them
• Glass products are possible
• Opportunity for manufacturing
• Buy a second-hand CRT plant
• Enable industry that will add value to our products e.g. sheet metal, but will need to augment demand for these products from the manufacturers.
• Major development required for processing of hazardous and complex/specific fractions, beneficiation potential – printed circuit boards (PCBs), Polycarbonate/Acrylonitrile butadiene styrene (PC/ABS) plastics, chlorofluorocarbon (CFCs), cabling, batteries (Lithium ion, Silver oxide, Nickel-cadmium, NiMH), CRT glass (temporary), solar panels etc.

• Refurbishment • Potential in art/crafts • Waste exchange initiative • Rare Earth Metals recovery and beneficiation and export requires larger collection • Plastic products of value • Glass products
• Develop SMME-friendly policies on e-waste disposal and bring in line with green procurement policies • Government to lead by example • Close the loop – products made from recycled material need to be promoted into green procurement strategies to drive market demand • Develop local processing systems for CRT's and PCB's

3. How can the R&D community support industry in realising these opportunities	
What technology support is needed by the WEEE sector (business/industry)?	• Technology to re-use CRT glass for road construction, etc. • Transfer the knowledge from R&D communities to industry • Universities' R&D - viability- implementation
	• Understand which materials we are dealing with • Competency classification • Matching waste with industry needs for reuse • Describe final product/ market analysis

	• Training course for staff
	• Technology for WEEE such as ABS plastics, CRT tubes, CFC extraction, chargeable and non-rechargeable batteries, fridges and cartridges
	• Need to develop WEEE processing capacity (technology, facilities) in South Africa – this can be supported by
	  ○ Developing local markets *(create demand)*
	  ○ Providing financial support for the implementation of appropriate WEEE reprocessing technologies *(economic incentives)*
	  ○ Research and development into appropriate technologies;
	  ○ Increase collection and directing e-waste to registered recyclers and reprocessors

	• Identification of WEEE traded in SA
	  ○ SARS inventory of E&E equipment on market
	  ○ How much of EE do we have?
	• Techno-economics feasibility studies on valuable fractions e.g. rare earth metal recycle

What R&D on WEEE is needed for South Africa?	• Other uses for problematic fractions • Find uses for all components • Make up of different fractions to be determined and uses • Modelling how WEEE can be a key driver for the circular economy in South Africa
	• CRT, batteries, etc. • Rare earths from P power • Reviewing legislation and implications • Number of new real jobs that can be created from the WEEE recycling sector in South Africa • Number of collection points/dismantling/recycling facilities needed to accommodate the potential influx of e-waste collected (stockpile plus new end-of-life) • Look into mining of landfill sites

	• Feasibility studies on volumes within SA
	• Techno-economic studies to determine technical, economic and environmental feasibility in SA
	• Developing of technologies for the following:
	  ○ Metal recovery from PCB
	  ○ Lighting and LCD flat panels
	  ○ Batteries
	  ○ Plastics
	  ○ Low grade materials
	• Developing of small volume processes that use manual sorting
	• R&D on fluorescent powder to extract 5-6 rare earths

	• An understanding of the material streams (need data)

3. How can the R&D community support industry in realising these opportunities	
	• Proof of concept for potential products to aid with the investment • Potential for landfill mining • Phosphorus powder study & recovery of valuable metals

	• R&D should be focussed on innovation that has not already been proven.
	  ○ The opportunity to get refurb units into needy communities and the benefits this brings
	  ○ Polymer processing additives and solutions to dealing with mixed e-waste plastics
	  ○ Supply and demand on refurb units
	  ○ Research and strategic planning for developing collection infrastructure and logistics
	  ○ Critical mass elements, i.e., what volumes are required to substantiate investment into what beneficiation technologies; can these be distributed, central or mobile; address demand side management to rule out obsolescence of equipment procurement, etc.?
	  ○ Role of technical colleges and universities in directing IT students into peri-urban and rural applications to help bridge the digital divide

What should the role of universities and the science councils be in supporting the South African WEEE industry?	• Universities should make waste management part of curriculum
	• Support local suppliers • Develop legislations / regulations • Manufacturing and recovering of by-products locally • Grow value chain for consumption of local products
	• R&D work • Understanding waste streams, characterising them • Technology transfer • Assess recycling approach of the universities and ensure compliance • Partner universities with international partners • Understanding social impact of bringing processing into communities • Use business imperative to solve social problems • Only one university offering waste degree – Hons (NWU): Masters (UKZN)(planned) - Civil Engineering

	• Graduates specialising in WEEE industry
	  ○ Internships
	  ○ Industry grants students with practical experience
	• Collection of reliable data (currently lacking) on WEEE in South Africa

science & technology
Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

ANNEXURE 3: ATTENDANCE REGISTER

INDUSTRY meets SCIENCE Waste Sector

No.	Contact Person	Organisation	Telephone	E-mail
1	Gulio Airaga	Desco Electronic Recyclers Ltd	Industry	gulio@desco.co.za
2	Jan Barnard	Desco Electronic Recyclers Ltd	Industry	jan@desco.co.za
3	Devin Beattie	SIMS Recycling	Industry	Devin.beattie@simsmm.com
4	Len Cloete	Enviroclaim	Industry	lencloete@gmail.com
5	Shauna Costley	DEA	Government	scostley@environment.gov.za
6	Dr Christie Dorfling	Stellenbosch University	Academia	dorgling@sun.ac.za
7	Ashely du Plooy	IndWMP Steering Committee	Industry	ashelyduplooy@gmail.com
8	Lene Ecrnoignard	eWASA	Industry	lene@ewasa.org
9	Mariekie Gericke	Mintek	Academia	mariekiegericke@mintek.co.za
10	Dr Linda Godfrey	CSIR	Academia	LGodfrey@csir.ac.za
11	Dr Elaine Govender	University of Cape Town	Academia	elaine.govender@uct.ac.za
12	Darren Grusin	SA Precious Metals	Industry	darren@sapreciousmetals.com
13	Prof Sue Harrison	University of Cape Town	Academia	sue.harrison@uct.ac.za
14	Jenna Holmes	Electronic Cemetery	Industry	jennaholmes@gmail.com
15	Kouw Khaleva	DEA	Government	kkhaleva@environment.gov.za
16	Dr Athanasios Kotsiopoulos	University of Cape Town	Academia	athanasios.kotsiopoulos@uct.ac.za
17	Mr Zakhele Mdlalose	DTI	Government	Zmdlalose@thedti.gov.za
18	Pravashen Naidoo	E-Waste Africa	Industry	info@ewasteafrica.net
19	Jami Nash	Electronic Cemetery	Industry	info@electronic-cementry.com
20	Wonder Nyanjowa	Mintek	Academia	wondern@mintek.co.za
21	Tonie Pieterse	Enviro Claim	Industry	tonie@dasl.coza
22	Anben Pillay	DEA	Government	apillay@environment.gov.za
23	Dr Henry Roman	DST	Government	henry.roman@dst.gov.za
24	Patricia Schroeder	Reclite	Industry	patricia@reclite.co.za
25	Steffen Schroder	Reclite	Industry	steffen@reclite.co.za
26	Siphokazi Simandla	Bolunga Trading	Industry	siphokazis@bolunga.co.za
27	Dion Smit	SA Precious Metals	Industry	Dion@sapreciousmetals.com
28	Mr Douw Steyn	PlasticsSA	Industry	douw.steyn@plasticssa.co.za
29	Ulze Van Wyk	Africa e-Waste	Industry	Ulze.vanwyk@africaewaste
30	Allan Werth	SIMS Recycling Solution	Industry	Allan.werth@simsmm.com