PROGRESS MADE TO DATE WITH THE RUNNING THE CAPE TOWN BASED REGIONAL INTEGRATED E-WASTE MANAGEMENT FACILITY

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ABSTRACT

E-waste is currently one of the fastest growing waste stream in South Africa as well as in many other African countries. Informal collectors, dismantlers and recyclers based in Africa play an increasingly larger role in the processing of e-waste under generally unacceptable social and environmental conditions.

In direct response to this trend, and as part of Hewlett Packard's international Extended Producer Responsibility, the project "e-Waste Management in Africa" was started in 2007 in cooperation with the Global Digital Solidarity Fund (DSF) and the Swiss Federal Laboratories for Materials Testing and Research (Empa). This project is investigating the e-Waste situation in various African Countries, including South Africa, while actively supporting the development of practical, socially just and environmentally acceptable local e-waste management solutions.

To this end, the project has been funding the development of a pilot project in Cape Town, South Africa since February 2008, supporting the start-up of a low tech/highly labour intensive material dismantling and recovery facility (MRF) for the pre-processing of e-waste.

The aim is to test the feasibility of an integrated value-adding local e-Waste management system, designed to maximize the potential of refurbishment, repair, reuse, dismantling and recycling of equipment, with environmentally responsible disposal as a last resort only. The project also seeks to incorporate the current informal e-waste processing activities, by transforming them into sustainable and environmentally sound operations.

The MRF acts as a nucleus, raising awareness, and providing training and education to previously disadvantaged individuals as a means of creating opportunities for entrepreneurship in the technical maintenance, dismantling and waste-to-art project sectors.

This study presents an analysis of the implementation of the MRF including quantitative mass flow data, financial numbers and social indicators as well as challenges and opportunities encountered in each phase. It provides a blueprint concept for the sustainable instalment of MRFs into the specific environment of developing countries.

KEYWORDS

MRF, Dismantling, Refurbishing, Integrated e-Waste Management

INTRODUCTION

> *"Make a significant contribution to the preservation of our environment, whilst also ensuring that local industry plays an active part in the expansion process, and contributes towards Social Upliftment and Community Development within the region"*
>
> (Vision from Hewlett Packard's "*Planet Partners*" initiative)

In early 2008 Hewlett-Packard (HP), the Global Digital Solidarity Fund (DSF) and the Swiss Institute for Materials Science (EMPA) joined forces to provide the local non-profit NGP Recover-e-Alliance with a combined funding to the value of $ 105 000 for the start-up, evaluation and monitoring of a pilot regional e-waste recovery plant in Maitland; Cape Town.

Recover-e-Alliance's Working Philosophy and Core Business

True to the hierarchy of any integrated waste management plan (that is based on preventing and reducing the waste at source before recovering remaining waste for reuse and recycling purposes l), the primary goal of Recover-e-Alliance is to reduce the amount of e-waste that is generated and needs subsequent disposal at a landfill site with a focus as follows:

- ***Primary Focus: Recovery of function*** by ensuring that all suitable equipment is refurbished and repaired, and made available for "***Reuse"***.
- ***Secondary Focus:*** Through the use of a manual dismantling process, we encourage ***Recovery*** of all materials and components that can be either
  - ***Reused*** as part of other entrepreneurial initiatives,
  - or have increased value as a result of separation prior to subsequent external industrial ***Recycling***.

The manual separation also ensures that as much material as possible is removed and recycled, lessening significantly the amount of e-waste that automatically ends up in landfill as a result of an automated process. **E-Waste** is mainly generated as a by-product of the repair and refurbishment processes at the plant and through careful and selective downstream processing any resulting e-waste can be easily managed with little or no hazardous consequences.

The pilot project also aims to explore how additional local jobs can be created in a formal environment, while making the processing of electronic equipment safer in this sector. Thus the program aims to help develop a blueprint for a sustainable e-waste management system in African countries, in collaboration with existing local recycling projects. By sharing knowledge between countries and learning from other continents, new usage and potential markets for the recovery and recycling of electronic equipments and its components & materials can be explored.

DESCRIPTION OF THE E-WASTE MRF FACILITY

Location and Layout

The Materials Recovery Facility, (MRF), is located in Maitland, Cape Town for the purpose of e-waste testing and the manual dismantling of exclusively non-toxic e-waste components. The MRF is divided up into 3 distinctive working areas namely testing/refurbishing, dismantling and waste to art production sections.

- Testing, Repairing and Refurbishing
- Dismantling (for external industrial recycling)

-Stripping of equipment (mostly PCs, printers & monitors)
-Cleaning of the monitors
-Cleaning of the plastic casing recovered
-Cleaning and mechanical stripping of all wires

- Waste2Art (W2A) Manufacturing, Product Development and Marketing

Space Requirements
Initially the plant was designed to have 100 m^2 for the testing and dismantling process, 150 m^2 for the W2A section, a 6 x 2.5 m^2 shipping container for temporary storage of incoming equipment and an external area of 20 m^2 for storage of separated plastic. Available space has been rearranged numerous times and according to frequently changing space requirements.

Reflecting the current need the plant space is now extended to a total of 335 m^2 and allocated as follows:

IT testing and repair (incl. lockable safe)	90 m^2
TV and Domestic Appliance Testing & Repair	20 m^2
Equipment Dismantling	80 m^2
Sub Assembly Dismantling	20 m^2
Storage: 15 m2 (container) + 20 m2 (external storage)	35 m^2
W2A Development & Manufacturing (incl. lockable office)	40 m^2
Communal & Meeting Areas	50 m^2

Staffing:
The number of personnel has continued to grow over the 6 month period since inauguration in March 2008 and now comprises of:

IT Testing & Repair	2 people
TV & Domestic Appliance Testing & Repair	2 people
Equipment Dismantling	5 people
Sub Assembly Dismantling	1 person
W2A Development & Manufacturing	3 people
Project and Marketing Management	2 people
Daily operations co-ordination	1 person
TOTAL:	***16 people***

The number of people employed at present is adequate for the efficient operation of the facility. However within the available space of the facility staff compliment could possibly increase by a further 50% to a total of 24 people

EVALUATION PARAMETERS

Key Performance Indicators (KPIs)

Since this initiative is a pilot project which serves as a study model and blueprint for similar e-waste MRFs in other developing countries, it has been imperative to develop and monitor KPIs regularly as they can show at a glance any progress made or challenges encountered on a month by month basis. In consultation with the entire MRF management team, KPIs were set shortly after the start-up phase of the operation to be able to evaluate activity levels in each of the distinctive key activity areas of the MRF which are namely:

- Collection and sorting of e-waste (C&S)
- Testing and Refurbishment of suitable equipment (T&R)
- Dismantling and stripping of the non-refurbishable e-waste portion (D)
- Manufacturing of “waste to art” products from suitable and non-toxic e-waste components (W2A)
- Educational and awareness creation activities (E&A)

KPIs were mainly structured into three areas to cover volumetric, economical, social and environment, health & safety indications. The table below outlines the KPIs linked to the various MRF activity areas as described in the table below

Table 1: KPIs to Assess the e-Waste MRF Performance

Activity Area	KPI 1 (Volumes)	KPI 2 (Economical)	KPI 3 (Social)	KPI 4 (EH&S)
General	Physical size of working area	Facility set-up costs	Number and names of working partners	Location of Plant and risk factor in terms of EH&S
C&S (Collection & Sorting)	Weight of material collected and sorted	Total income and expenses	Sources of manpower to collect and sort	Risk from Hazardous processes
T&R Testing, Repair & Refurbishment	Number and types of units tested and refurbished	Number and types of units sold or donated	Workforce size and experience	
D Dismantling	Number and types of units dismantled	Income from components & materials	Workforce size and ability	Type, Qty, Weight and handling of separated hazardous fractions
W2A Waste to Art & Manufacture	Qty and types of e-waste used for art	Income generated from sale of manufactured products	Total amount of people empowered by W2A	Awareness of handling potentially hazardous materials
E&A Educational & Awareness Activities		Income from training given to staff of satellite MRF projects	Qty of people receiving training & skills transfer	No of people receiving EH&S induction training

PRELEMINARY RESULTS OF THE PILOT PROJECT

INCOMING EQUIPMENT PROCESSED FOR EQUIPMENT REUSE FROM MARCH-SEPTEMBER 2008

At the end of September 2008, key electronic equipment types received and suitable to get refurbished (to be available for equipment reuse, by sale or donation) was as follows

Table 2: Recovery for Reuse Rate of Selected Received Equipment

Type of Equipment	Refurbishable/repairable	from Total Units received	
PCs	37	from 676	5%
Keyboards	50	from 603	8%
Monitors	64	from 1096	6%
Printers	18	from 380	5%
Copiers & Faxes	2	from 71	3%
Notebooks	4	from 31	13%

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From the low refurbishment rates above for most equipment types it can be seen that the quality of the equipment received has generally been very poor as most of the equipment received is old, badly cannibalised and requires extensive testing and repairing during the rebuild process.

Financial Value generated by the Refurbishment/Repair Unit from March to September 2008

By the end of September 2008, equipment refurbished and sold reached a cumulative income of R 16 157.- including the sales of TVs and other domestic electronics for about R 4000 alone. In addition the (yet unsold) stock value of refurbished equipment is estimated to have a current value in excess of R 68 000-. This stock is made up from products comprising mostly Pentium 2 and 3 systems, but with a large volume of peripheral and component items that will be integrated into any machines that require refurbishment.

SUB ASSEMBLY DISMANTLING AND STRIPPING OF THE NON-REFURBISHABLE COMPONENTS AND MATERIALS

The dismantling unit assumed activities in late March 2008, albeit with limited staff, and operated on a temporary and ad-hoc basis as the entire MRF was still in the process of finalising the set-up phase.

Until the end of September 2008 re- sellable materials and components have been dismantled with the financial values as follows:

• **Light steel**	**Kg 22075 @ R 27320**
• **Aluminium**	**Kg 463 @ R 5254**
• **Copper**	**Kg 261 @ R 13553**
• **Light cables and wiring**	**Kg 826 @ R 5682**
• **Medium &low grade electronics**	**Kg 2121 @ R 17304**
• **Styrene based plastics**	**Kg 5895 @ R 6441**
• **Lead Acid batteries**	**Kg 712 @ R 1496**
TOTAL:	**Kg 32353 @ R 77050**

In addition the following components and materials have been isolated as part of the operation

- **Special batteries & components (Under evaluation for disposal solution) Kg 1000**
- **Sub Assemblies materials (In stock for "Waste to Art" applications) Kg 2000**
- **CRTs and LCD displays disposed off as Haz. waste Kg 7000**
- **Non-haz. materials & residues constituting general waste Kg <1000**

Evaluating the "Recovery for Recycling" potential and cost/benefit scenario the following picture emerges:

Recovered for Recycling/W2A: 34 353 kg
Recovered for Safe Disposal: < 9 000 kg

This results in a Recovering for Recycling Efficiency for manual dismantling activities of more than **79%.** From a cost/benefit perspective the

Total "Recovery Value from Recycling" (March-Sept 08) is > R 77 000,00

Total "Recovery for Safe Disposal" Costs amounts to:
- Hazardous Waste: < R 5 500,00
- General Waste: < R 500,00

The cost portion of R 6000 for landfilling would obviously constitute the "non-viable" fraction of e-waste for which ideally eWASA's future "Advanced Recycling Fee" (ARF) would compensate for to some degree.

MANUFACTURING OF "WASTE TO ART" PRODUCTS FROM SUITABLE AND NON-TOXIC E-WASTE COMPONENTS (W2A)

Development of expertise in the manufacture of new W2A products (such as clocks and jewellery) and the accumulation of sufficient parts to establish a cost efficient manufacturing process started in early August 2008.

Orders are still slow to come in but a stock holding has been created and products are already marketed as corporate gifts. The creation of stock has also allowed to accurately calculate costs and the realistic pricing of any end product. Recover-e-Alliance is currently engaged in the preparation of a priced catalogue of component parts which are available for future runs.

Financial Value generated in the W2A Section

Sales of clocks so far during August amounted to R15000 including an exclusive project that alone is contributing R10000,00. As a result of the production test runs, some 50 clocks are in stock with an estimated sale value of R20000.- and a further 40 units are currently in production, which will add a further R15000.- making the total value generated in this unit some R 50 000.-

SWOT Analysis and Key Recommendations

A SWOT analysis and final evaluation is currently conducted as part of the final evaluation of the HP project. Detailed results will be shared and discussed with the delegates at the eWASA conference and in due course. As a result of the SWOT analysis the author will derive at a set of key recommendations that will also be shared with the audience in November 2008

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