E-waste Africa Project

Impacts of current recycling practices and recommendations for collection and recycling

Pan-African Summit on E-waste, 14.-16.03.2012, Nairobi

By Andreas Manhart
Regional coverage of analysis

1.) Ghana
Initiator: VROM-Inspectorate & NVMP
Duration: 09/2009 – 08/2010
Partner: Green Advocates, EMPA

2.) Nigeria
Initiator: UNEP - SBC
Partner: BCCC-N, EMPA
Activities in Ghana and Nigeria:

- In-depth socio-economic study on the sustainability impacts of the informal e-waste recycling sector

- Feasibility study for developing local niche markets for environmentally sound management

- Training of informal recyclers (Nigeria only)
Key findings that need to be considered in future strategies

Key finding 1:

There is no “e-waste sector”
Structure of e-waste management in Ghana & Nigeria:

1. Repair & refurbish

2. Collect

3. Dismantling / pre-processing

Refurbishers

Scrap metal workers (sometimes “scavengers”)

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Difference between refurbishers and scrap metal workers:

- Refurbishers typically work in registered businesses and pay taxes
- Average size of refurbishing enterprise: 1-8 persons
- Repair & refurbishing is technically demanding, thus the jobs are perceived as prestigious and high-tech
- Repair & refurbishing sectors run self-organised apprenticeship systems

- Scrap metal workers are typically not registered and do not pay any taxes (informal sector)
- Scrap metal workers are typically poor migrants from rural areas of the Sahel region
Key finding 2:

Refurbishing & scrap metal sector provide many jobs
5,500 enterprises providing 15,000 jobs
Socio-economic opportunities of these two sectors:

Collection and recycling:

Employment and income opportunities for thousands of low skilled workers (in particular from rural areas in the north of the countries)

Refurbishing:

- Employment and income opportunities for a medium and high skilled workforce
- In Accra & Lagos: 30,000 jobs
- Potential to form a nucleus for further technical and economic developments
Every attempt to reform e-waste management needs to take into account the social dimensions of these two sectors!

Preservation of jobs
Key finding 3:

Jobs in refurbishing are better than in the scrap metal sector
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Collection &amp; recycling</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Door-to-door collectors</td>
<td>250–500</td>
<td>1.68–3.36</td>
</tr>
<tr>
<td>Collectors addressing freely available wastes</td>
<td>33–67</td>
<td>0.22–0.45</td>
</tr>
<tr>
<td><strong>Refurbishing</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Workshop owners</td>
<td>1,000–3,300</td>
<td>6.72–22.2</td>
</tr>
<tr>
<td>Employees</td>
<td>330–500</td>
<td>2.22–3.36</td>
</tr>
<tr>
<td>Apprentices</td>
<td>0–300</td>
<td>0–2.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Collectors &amp; Recyclers</th>
<th>Refurbishers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working hours per day</td>
<td>8.5 – 9.5</td>
<td>8.5 – 9.5</td>
</tr>
<tr>
<td>Working hours per month</td>
<td>255 – 285</td>
<td>210 – 240</td>
</tr>
</tbody>
</table>
Child labour:
Key finding 4:

Environmental hot spots are also in the scrap metal sector
Principle pollution pathways are known:

Source: Sepulvéda et al. 2010
Dioxin emissions from cable burning:

Observations in Agbogloshie (Accra, Ghana):

~ 200kg of cables are burnt per hour

10-20% from WEEE
(rest mainly from waste cars)

Extrapolation to 5 West-African countries

3-7% of total dioxin emissions to air in Europe

Source: EMPA
Key finding 5:

Collection works different in W-Africa
House-to-house collection:

Prices for non-reparable equipment in Lagos 2010:

- CRT-monitor: 50 Naira (US$ 0.34)
- Fridge: 100 Naira (US$ 0.67)
- Desktop PC: 100 Naira (US$ 0.67)

Informal collectors offer a convenient pick-up service and pay money for e-waste.

Ghana is world champion in e-waste collection, achieving collection rates of 95%.

Collection systems based on the consumers’ willingness to actively bring back old equipment for free will fail!
Key finding 6:

Environmentally sound recycling cannot compete with crude recycling
Example CRT-devices:

Copper: + 7231 US$/t  
+ 5 $/device

CRT-glass: - 160 US$/t  
- 2.73 $/device
Key finding 7:

European solutions will not work
Currently Applied Recycling Technologies
Analysing environmental, social and economic strengths & weaknesses

Best Available Recycling Technologies
Analysing environmental, social and economic strengths & weaknesses

Best Applicable Recycling Technologies
Solutions:

- Here, no full e-waste management strategy can be provided.

- But elements that should be part of coherent and sustainable e-waste management strategies.
Solution 1:
The Best of 2 Worlds Approach (Bo2W)
Solution for Information and Communication Technologies (ICTs):

- A: Steel scrap
- B: Aluminium scrap
- C: Printed circuit boards
- D: Cables
- E: Copper-steel scrap
- F: Plastics
Belgium, Germany, Sweden...  Nigeria, Ghana, Côte d'Ivoire...

Refinery  manual pre-treatment  WEEE-generation
## Material content, intrinsic and net values of an average desktop computer

<table>
<thead>
<tr>
<th>Material</th>
<th>Amount contained in a desktop computer [g/unit]</th>
<th>Average material price 2007 [US$/t]</th>
<th>Intrinsic material value 2007 [US$/unit]</th>
<th>Estimated recovery rates with presently applied technology</th>
<th>Estimated recovery rates with best applicable technology</th>
<th>Net material value with presently applied technology [US$/unit]</th>
<th>Net material value with best applicable technology [US$/unit]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel</td>
<td>6,737.50</td>
<td>253*</td>
<td>1.70</td>
<td>95%</td>
<td>95%</td>
<td>1.62</td>
<td>1.62</td>
</tr>
<tr>
<td>Plastics</td>
<td>1,579.55</td>
<td>310**</td>
<td>0.49</td>
<td>0%</td>
<td>0%</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Aluminium</td>
<td>550.21</td>
<td>2,700</td>
<td>1.49</td>
<td>88%</td>
<td>78%</td>
<td>1.31</td>
<td>1.16</td>
</tr>
<tr>
<td>Copper</td>
<td>413.225</td>
<td>7,231</td>
<td>2.99</td>
<td>85%</td>
<td>98%</td>
<td>2.54</td>
<td>2.93</td>
</tr>
<tr>
<td>Zinc</td>
<td>25.94</td>
<td>3,400</td>
<td>0.09</td>
<td>0%***</td>
<td>0%***</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Tin</td>
<td>19.57</td>
<td>19,800</td>
<td>0.39</td>
<td>0%</td>
<td>0%**</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Antimony</td>
<td>18.58</td>
<td>5,660</td>
<td>0.11</td>
<td>0%</td>
<td>0%**</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Nickel</td>
<td>12.70</td>
<td>37,200</td>
<td>0.47</td>
<td>0%***</td>
<td>0%***</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lead</td>
<td>6.59</td>
<td>2,730</td>
<td>0.02</td>
<td>0%</td>
<td>0%**</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Neodymium</td>
<td>5.87</td>
<td>100,000****</td>
<td>0.59****</td>
<td>0%***</td>
<td>75%****</td>
<td>0</td>
<td>0.44****</td>
</tr>
<tr>
<td>Silver</td>
<td>1.70</td>
<td>550,000</td>
<td>0.94</td>
<td>0%</td>
<td>87%</td>
<td>0</td>
<td>0.81</td>
</tr>
<tr>
<td>Gold</td>
<td>0.26</td>
<td>22,400,000</td>
<td>5.82</td>
<td>30%</td>
<td>93%</td>
<td>1.75</td>
<td>5.42</td>
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<tr>
<td>Palladium</td>
<td>0.12</td>
<td>11,488,748</td>
<td>1.38</td>
<td>0%</td>
<td>91%</td>
<td>0</td>
<td>1.25</td>
</tr>
<tr>
<td>Chromium</td>
<td>0.02</td>
<td>2,010</td>
<td>0.00</td>
<td>0%***</td>
<td>0%**</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Ceramics &amp; others</td>
<td>366.04</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Sum</strong></td>
<td><strong>9,737.87</strong></td>
<td><strong>15.88</strong></td>
<td><strong>-</strong></td>
<td><strong>-</strong></td>
<td><strong>-</strong></td>
<td><strong>7.22</strong></td>
<td><strong>13.63</strong></td>
</tr>
</tbody>
</table>

* Prices for iron & steel scrap  ** Prices for mixed plastic  *** Partly indirectly recovered together with other metals  **** Material price as of November 2010  ***** Recovery rates not yet achieved on an industrial scale
Notification required according to the Basel Convention?

Yes

Environmentally sound recyclers depend on a sound administrative procedure for export notification.
Solution 2:

CFC-recovery from fridges & air-conditioners
Solution for fridges, freezers & air conditioners:
Possibility to finance environmentally sound recycling via emission reduction trading schemes

**Clean Development Mechanism (CDM):**  
• CFCs are not eligible

**Climate Action Reserve (CAR):**  
• Does account for CFC from cooling circuits but not from foams  
• R22 (CFC used in many air conditioners) is not eligible  
• CFCs must be shipped to the USA for destruction

**Voluntary Carbon Standard (VCS):**  
• Does account for CFC from cooling circuits and from foams  
• Recovery & destruction efficiency ≥ 85% → high standards for foam treatment

\[ \text{2.8 t CO}_2\text{-equ} \times 0.9 \times 5 \text{ US$/t} = 12.60 \text{ US$} \]

~ 50% achievable with medium investments (280,000 US$)  
~ 50% achievable with high investments (6,300,000 US$)

Not very labour intensive (~ 6-8 people to operate and maintain the machinery)
Solution 3:

Training & start-up support
Training programme in Nigeria:

- 3 days training
- 70 participants from refurbishing
- Majority of participants from refurbishing & scrap metal sectors
- Some participants from administration
- Steep learning curve of all participants
- Participants registered one recycling company after completion of training

Continuous support needed
Solution 4:

Framework conditions
Thank you for your attention!

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