

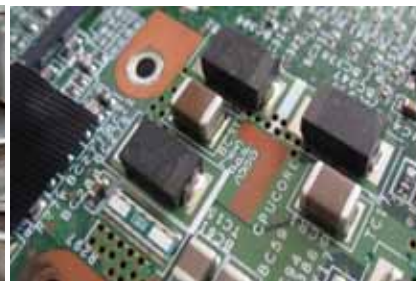


Status of the project and outlook

Bo2W Project

Matthias Buchert, Georg Mehlhart

Egyptian Solid Waste Management Forum, Cairo 25 November 2014



Agenda

1 Concept of the Best of Two Worlds (Bo2W) Project

2 Example for Bo2W: HDD dismantling

3 Extracts from the report on WEEE management in Egypt

4 Recycling Options for WEEE plastic components and CRT glass

5 Outlook

Background: disastrous recycling



Source: Oeko-Institut



Background: Critical metals are lost...



Source: Oeko-Institut

The challenge is

Challenges

- To reduce threats to human health and the environment
- To create better working conditions
- To close the loop of valuable metal cycles

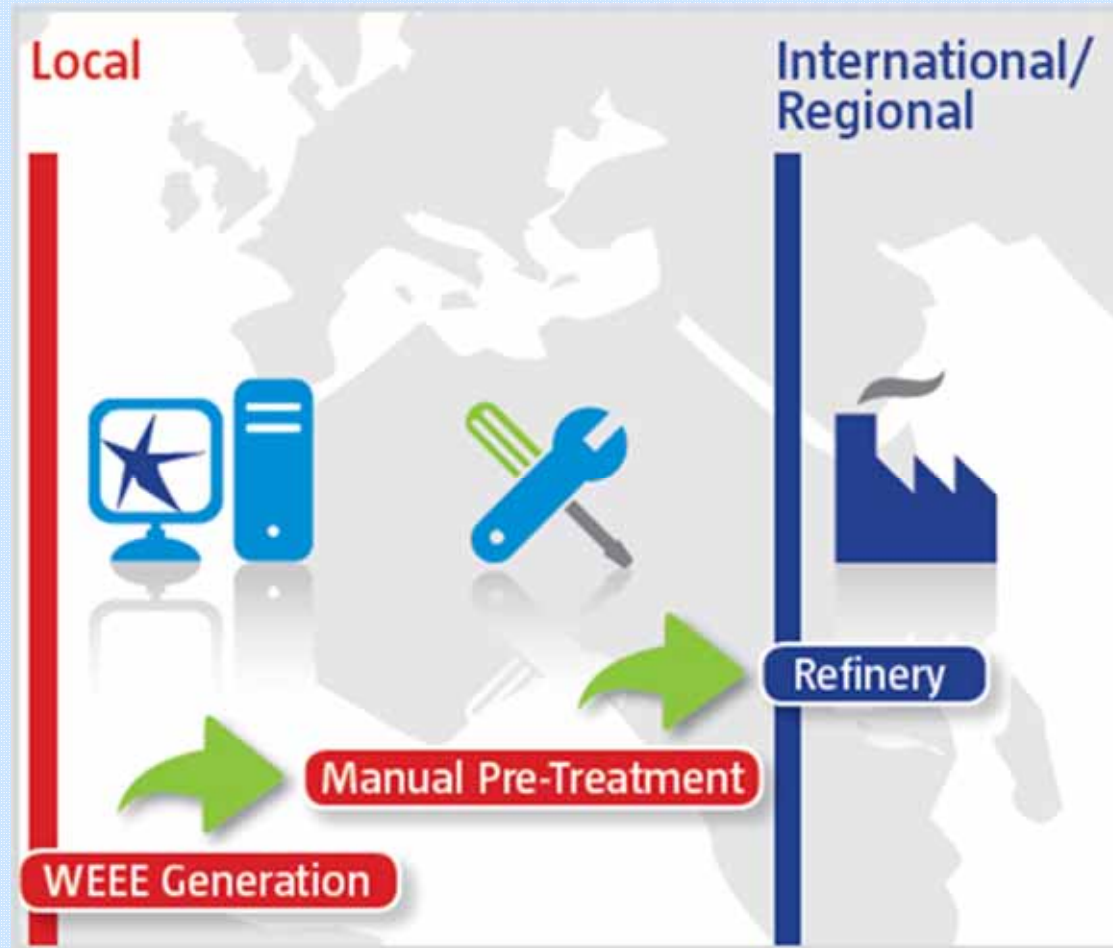
Focus of the project: electronic waste and end-of-life vehicles



Source: Oeko-Institut

The Bo2W approach:

**Bo2W
approach**



The Bo2W approach

Advantages

- Improved management of hazardous substances
- Increase of resource efficiency / closing global material cycles
- Reduced greenhouse gas emissions
- Generation of income and employment opportunities in Egypt and Ghana
- Increased investment in social and environmental standards

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HDD Dismantling: The Concept

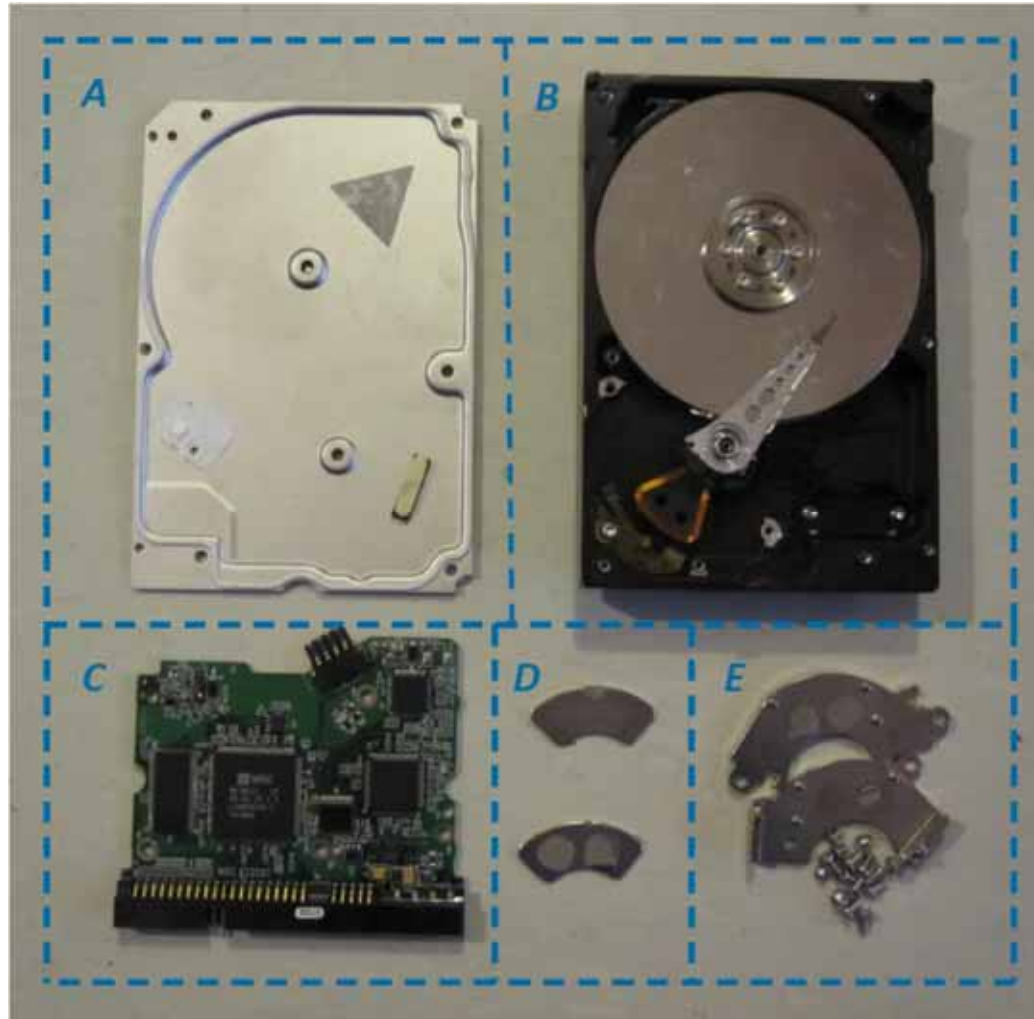
- Currently sold as complete item
- Investigate the effort for manual dismantling:
 - time for dismantling
 - labour costs
- Investigate the market / shipment conditions for separated components
 - HDDs (not dismantled)
 - Aluminium parts; Steel parts
 - Printed Wiring Boards (PWBs)
 - Rare earth magnets

HDD Dismantling: Duration of Manual Dismantling



Impression of the Hard Disk Drive Dismantling Trial carried out at City Waste Recycling in Accra in summer 2013 (photo by Oeko-Institut)

HDD Dismantling: The Components

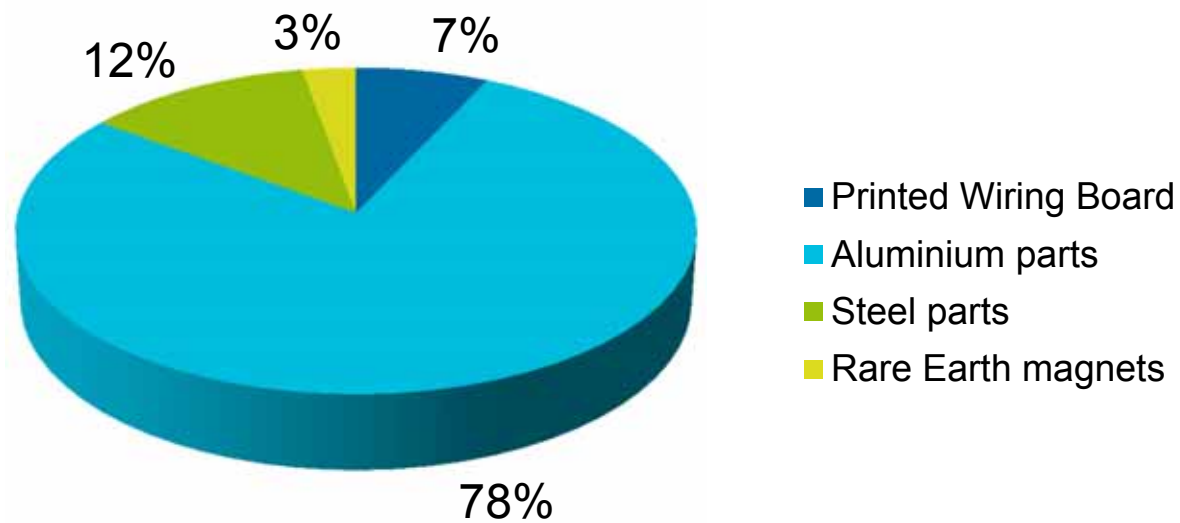


Dismantling depth of the Hard Disk Drive Dismantling Trial
(photo by Oeko-Institut)

- A: Case – mostly Aluminium
- B: Aluminium case
- C: Printed Wiring Board
- D: Rare Earth magnets
- E: Magnet shoes & screws (steel)

HDD Dismantling: The Composition

Average weight of an HDD: 509.8 grams



Source: Oeko-Institut

HDD Dismantling: First Calculations

Preliminary result of economic calculation:

- labour costs not decisive
- Transport costs the same
- Important are purity of the different fractions and the revenues for the different fractions!
- However revenues are volatile and access to reliable market information is necessary

With a manual dismantling almost twice of the profit is possible compared to selling the complete HDDs (for Aluminiumrecycling)!

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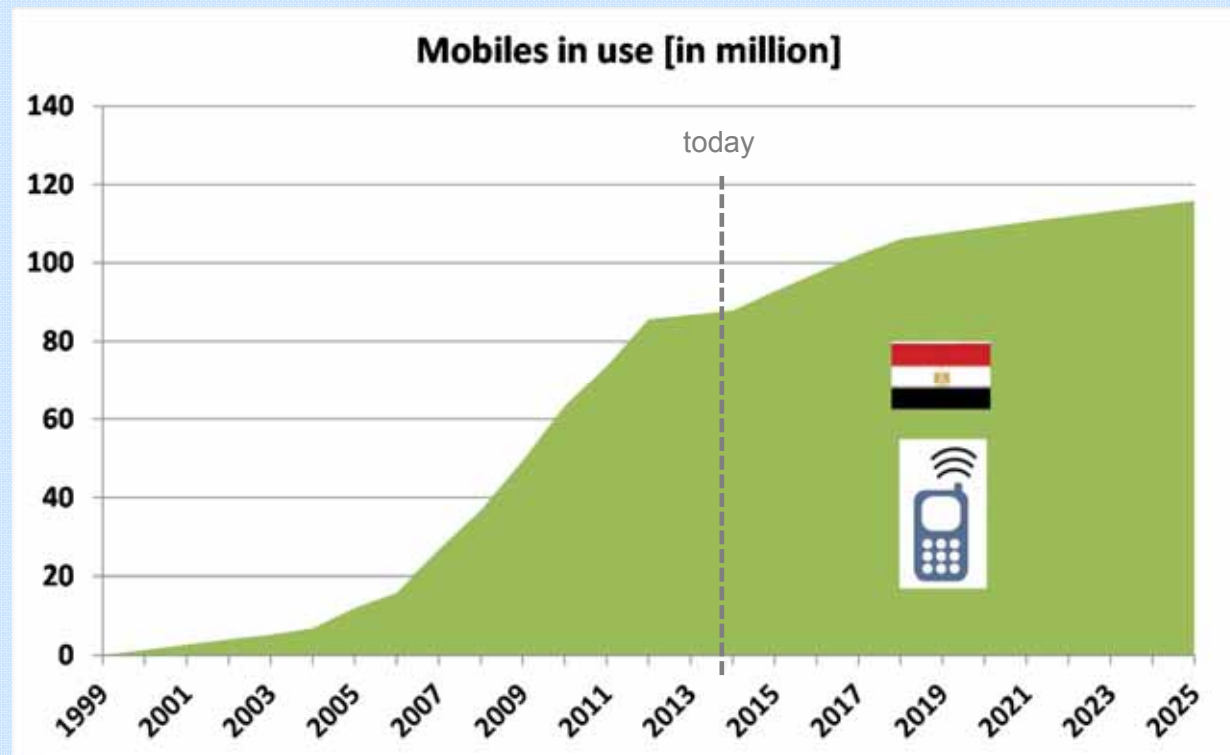
Report on WEEE management in Egypt

- Overview of the waste management sector in Egypt
- Current WEEE management in Egypt
- Analysis and projections for mass flows in WEEE

The full report is published in July 2014 and online available:
<http://www.resourcefever.org/detail/items/global-circular-economy-of-strategic-metals-bo2w-chapter-egypt.html>

Projection of EoL mobiles: Mobiles in use

Mobile phones

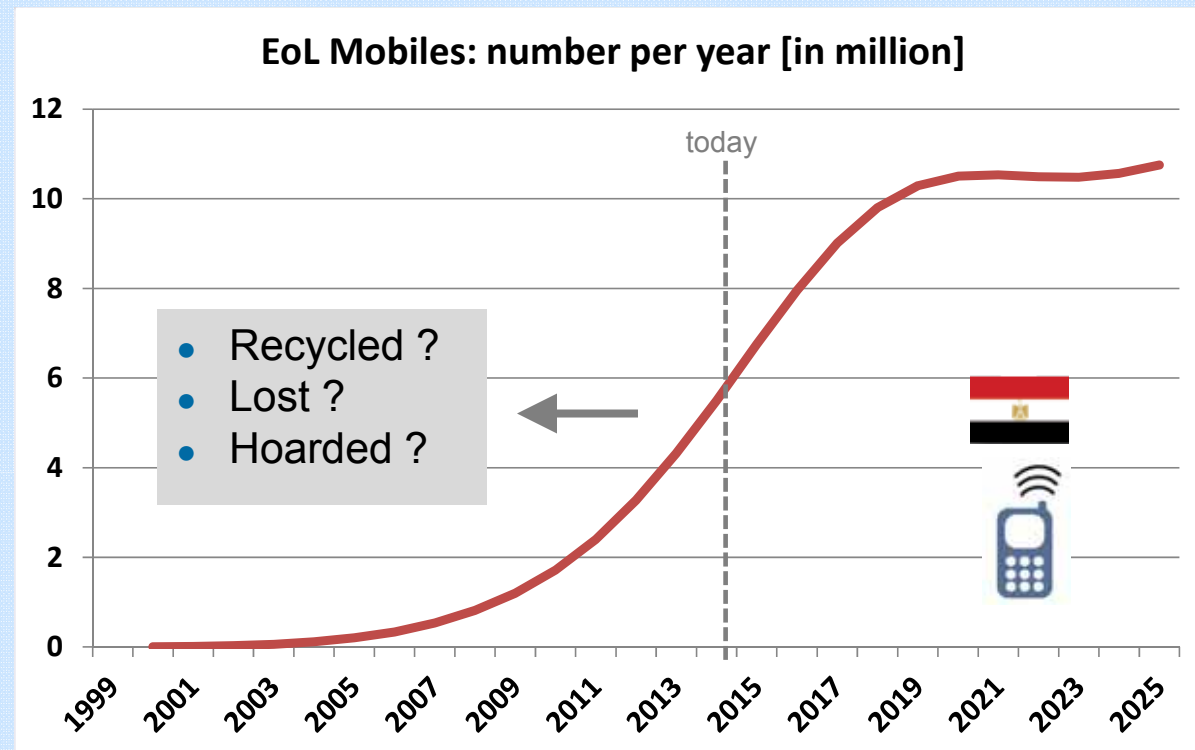


Caution: Projections are based on various assumptions.

- Increasing mobile phone market projected
- > 115 million mobiles projected for 2025

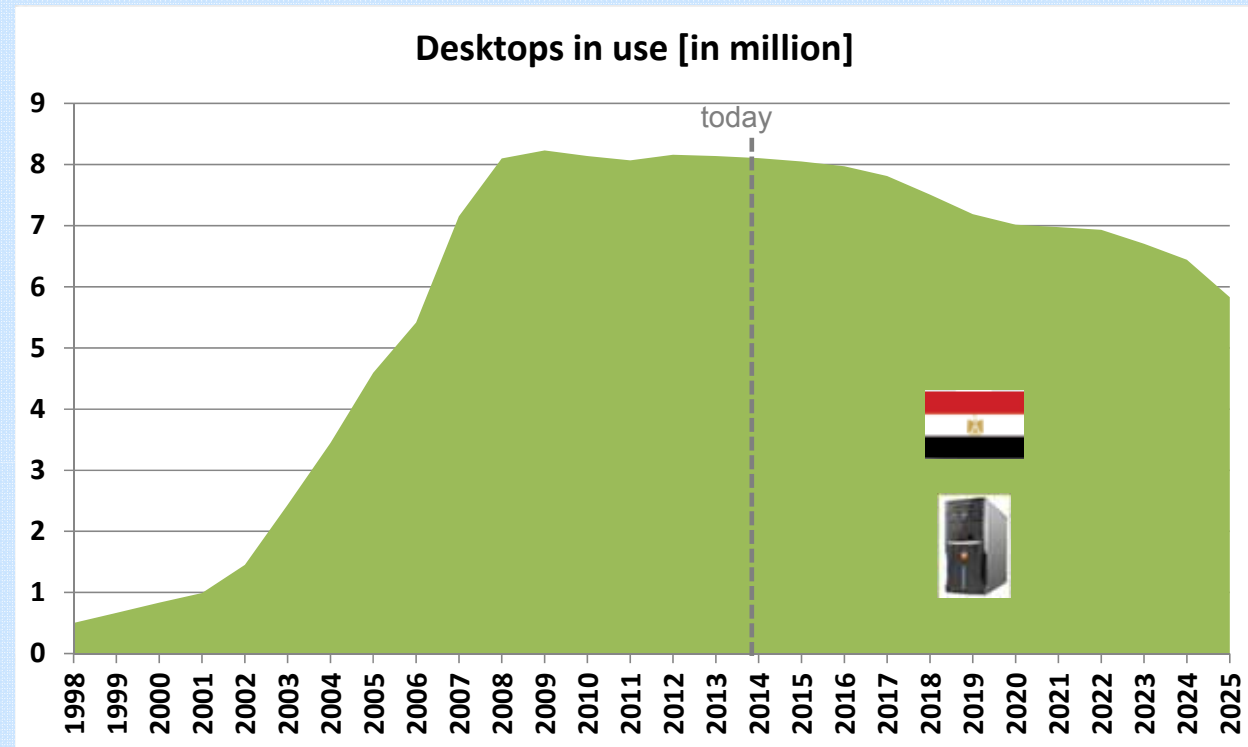
Projection of EoL mobiles: Number per year

Mobile phones



- A strong increase in yearly numbers is projected
- After 2018 the number of EoL mobiles is projected to be around 10 million EoL mobiles per year

Projection of EoL Desktops: Desktops in use

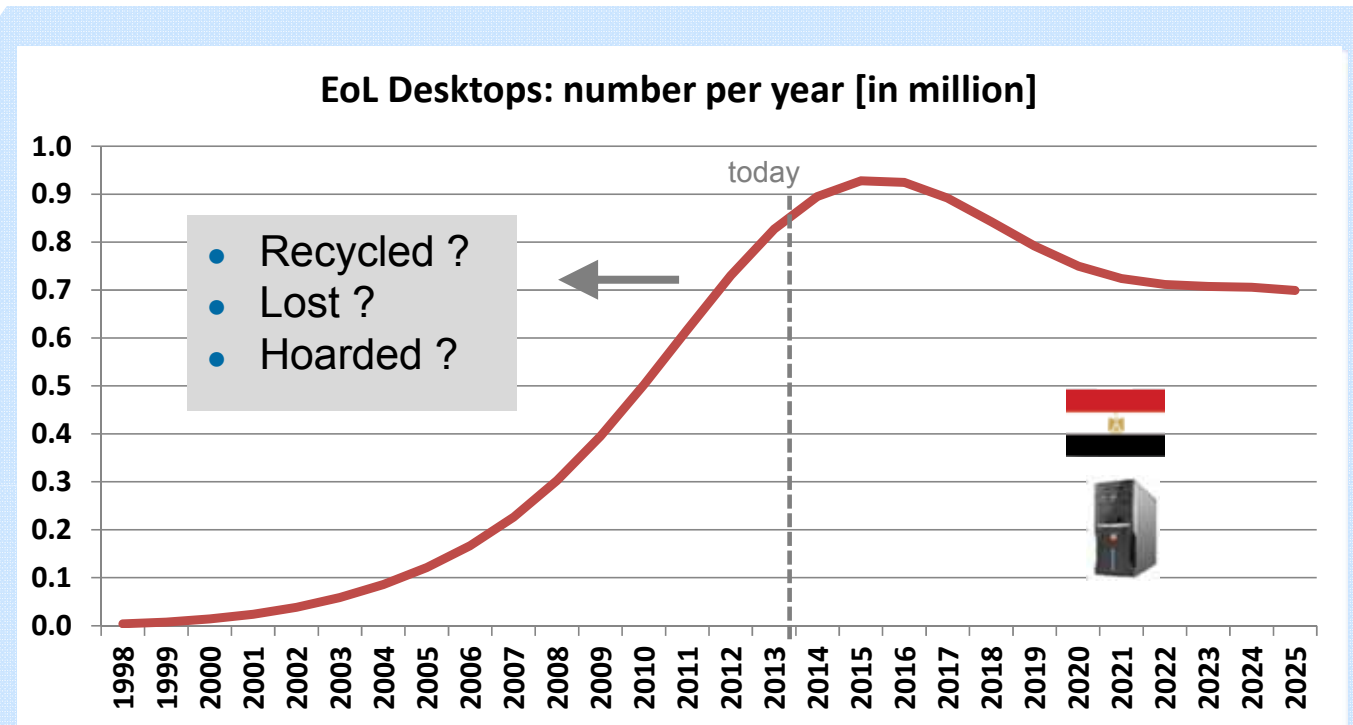


Caution: Projections are based on various assumptions.

- It is projected that the market saturation is already reached

Projection of EoL Desktops: Number per year

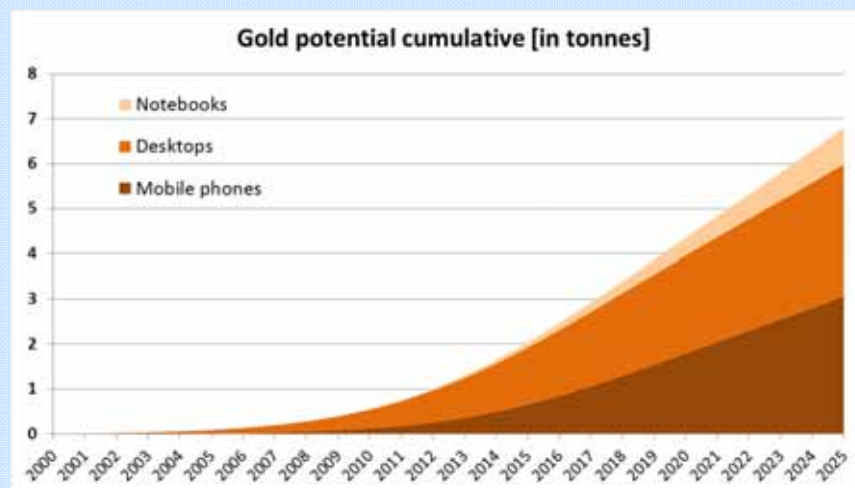
Desktops



- **Maximum of EoL Desktops per year is projected to be in 2015**

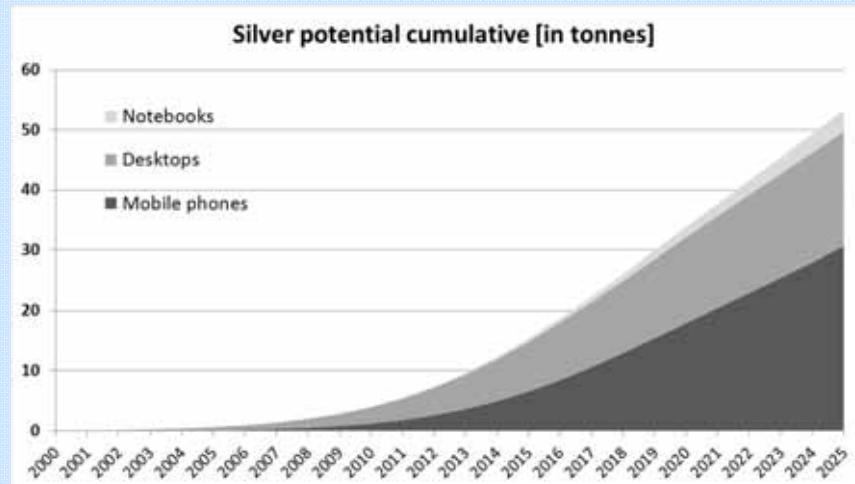
Projection of Gold and Silver in EoL Mobiles, Desktops and Notebooks (cumulative)

**Desktops,
Notebooks,
Mobiles**



Caution: Projections are based on various assumptions.

Dimension cumulative in 2025 around **6.8 tonnes Gold**

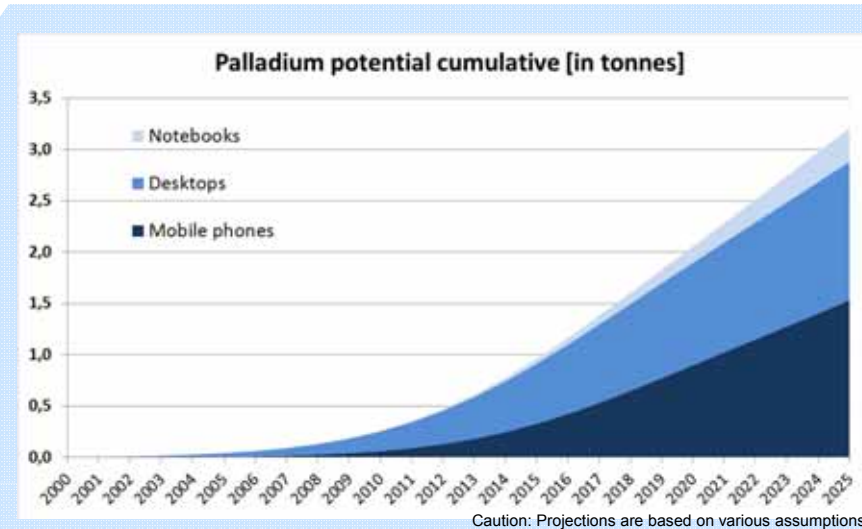


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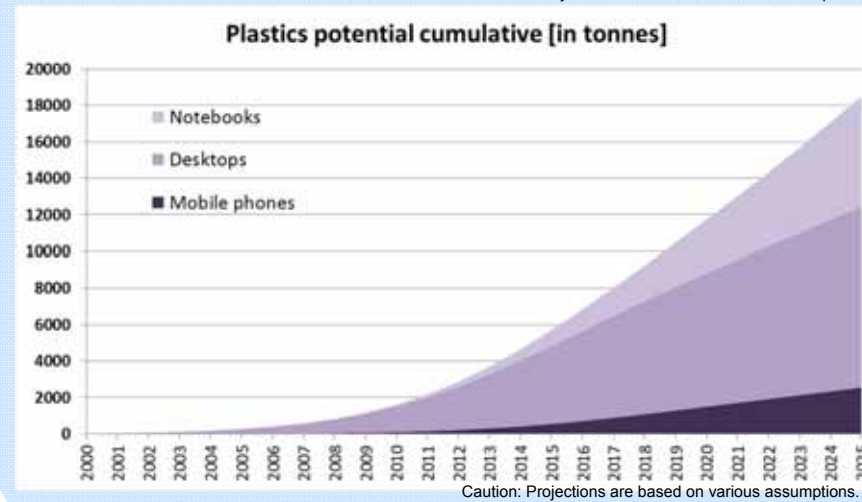
Dimension cumulative in 2025 around **53 tonnes Silver**

Projection of Palladium and Plastics in EoL Desktops, EoL Notebooks and EoL Mobile phones cumulative

**Desktops,
Notebooks,
Mobiles**



Dimension cumulative in 2025 around **3.2 tonnes Palladium**



Dimension cumulative in 2025 around **18 500 tonnes Plastics**

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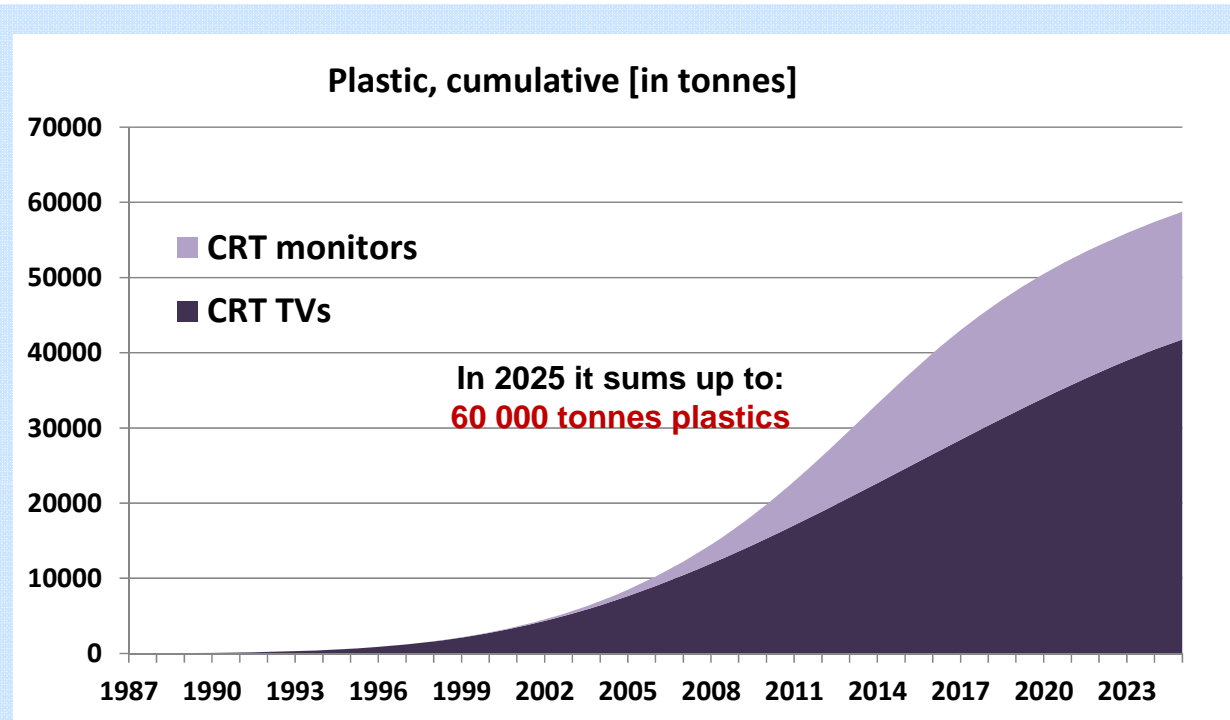
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Recycling options for WEEE: issues of concern

	Issue of concern						(national) disposal options
	(Cable) burning	Acid from lead acid batteries	Emissions of smelters	H&S effort for staff employed	Knowledge on qualities	Legal access to international markets	
Copper	X		X	X			
Steel			X	X			
Aluminium			X	X			
Lead		X	X	X			
Printed circuit boards (send for treatment abroad)	(X)				X	X	
Plastics components	(X)				X	X	X
Cathode ray tubes (CRT)	(X)						X
Other components like gas discharge lamps							X

Projection of plastics in EoL CRTs (cumulative)

**CRT TVs
CRT monitors**



Caution: Projections are based on various assumptions.

Representing
3500 TEU container



Recycling options for WEEE plastic components (1)

The challenges

- Housings of monitors and TVs are currently the most significant source for plastic from WEEE.
 - Common practice: uncontrolled disposal, open burning, dioxin emissions.
- Wide range of different types of:
 - Polymers (ABS, HIPS etc.)
 - Flame retardants used, especially brominated flame retardants (BFRs)



A full report addressing this issue is published in October 2014 and online available:
<http://www.resourcefever.org/detail/items/recycling-options-for-weee-plastic-components.html>

Recycling options for WEEE plastic components (2)

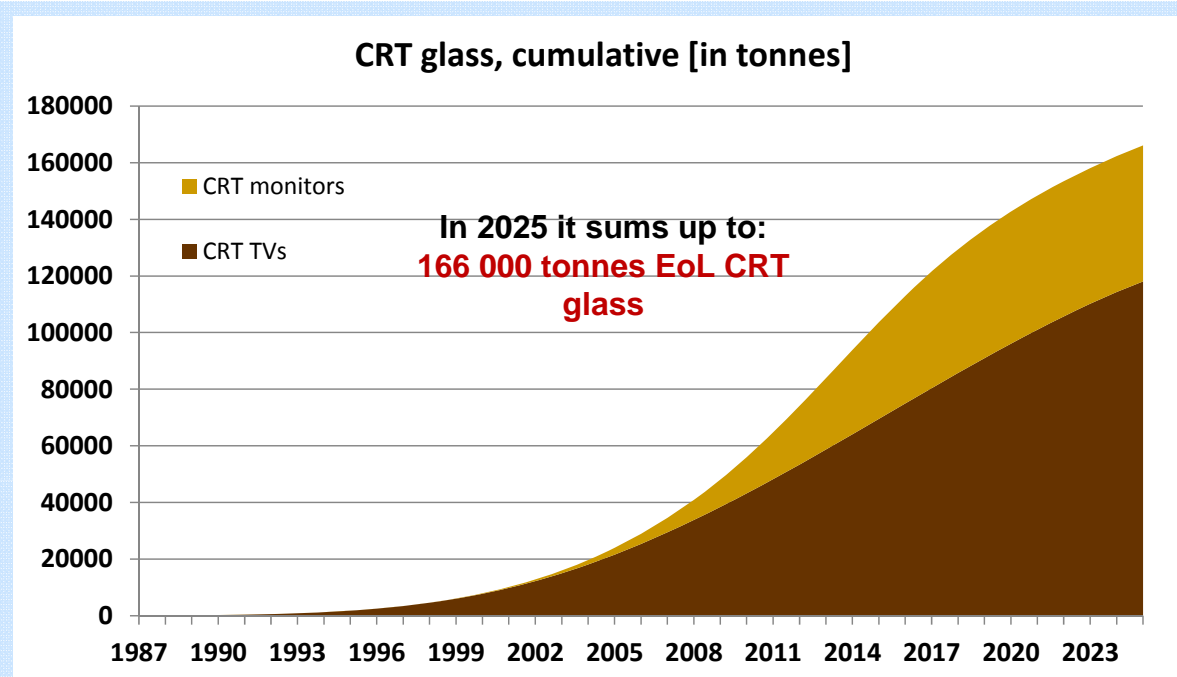
Proposed process optimization

- High investment (and very high mass flows to recover investment) are necessary for economic viable separation at industrial level in different plastic types and BFR content. BFR contaminated material should be separated from the recycling loop and directed to energy recovery with appropriate flue gas cleaning.
- Labour intensive pre-separation of BFR is in principle possible with e.g. sliding spark technology (hand held, cost approx. 6,000 US\$). More advanced equipment (combination with infrared sensor, + 33,000 US\$) will allow to determine / separate the polymer type: Access to higher revenues.
- However the market for BFR contaminated material (in Asia) is shrinking and if the more valuable material like Polycarbonate/ Acrylnitril Butadien Styrol (PC-ABS) is separated and sold, national solutions for the BFR contaminated material are required and need appropriate funding accordingly.

A full report addressing this issue is published in October 2014 and online available:
<http://www.resourcefever.org/detail/items/recycling-options-for-weee-plastic-components.html>

Projection of Glass in EoL CRTs (cumulative)

**CRT TVs
CRT monitors**



Caution: Projections are based on various assumptions.

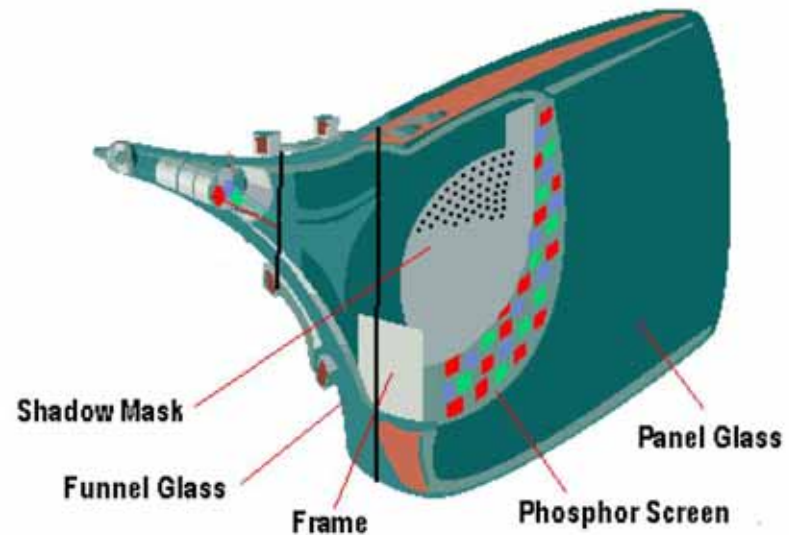
Representing
8 000 TEU container



Recycling options for CRT glass: Set-up

CRT unit after dismantling:

- funnel glass
- panel (screen) glass
- metal frame
- shadow mask (inside unit)



Source: Townsend et al. 1999: Characterization of Lead leachability from Cathode Ray Tubes using the toxicity characteristic leaching procedure

Recycling options for CRT glass

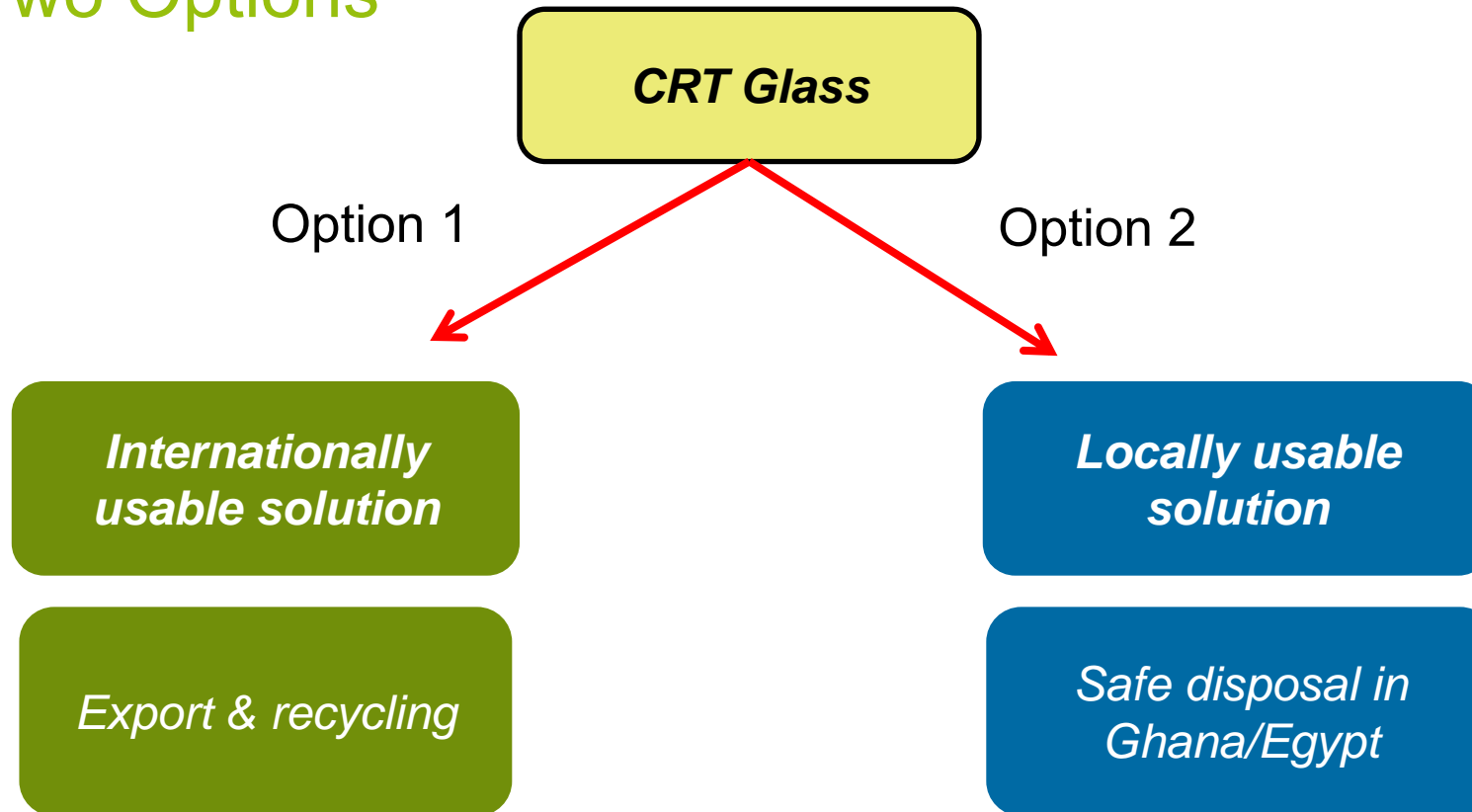
Costs for Recycling or Landfilling

Recycling path	Description	CPT* Cost (EURO/ton)
rp 2	funnel and screen glass to landfill	~ 26
rp 2 & rp 4	funnel glass to landfill & screen glass for other applications	~ 42-70
rp 3.1	funnel glass to lead smelter	~ 50
rp 3.1 & rp 4	funnel glass to lead smelter & screen glass for other applications	~ 50-75
rp 3.2	recovery of lead and glass	~ 150

Costs for transport and notification (Ghana to Germany) approx. 120 €/t

Recycling options for CRT glass

Two Options



A full report addressing this issue is published in April 2014 and online available:
<http://www.resourcefever.org/detail/items/recycling-options-for-waste-crt-glass.html>

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Next steps in 2014 / 2015 in Egypt I/II



- Working trip to Cairo in November (22nd - 27th November 2014)
- Keep in contact with possible business partners in Egypt
- Know-how transfer: How to optimize WEEE separation and treatment according the Bo2W concept (important for further business opportunities)
- Fixing dates for final working trip in 2015

Next steps in 2014 / 2015 in Egypt II/II



Desired targets for field work within the funding period (September 2015):

- Further shipments of material to Umicore (enhanced quality of materials after negotiations with partners)
- Egyptian partners follow at least partly Bo2W approach
- Dismantling of hard disc drives (HDDs) in Egypt (material for Umicore and VAC)

Desired targets beyond the funding period:

- Establishing of valid business relationships between Bo2W partners in Europe and Egyptian companies according to the Bo2W approach



Thank you for your attention!

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