

FPD Recycling: Case Study of the Swiss Market and the BLUBOX

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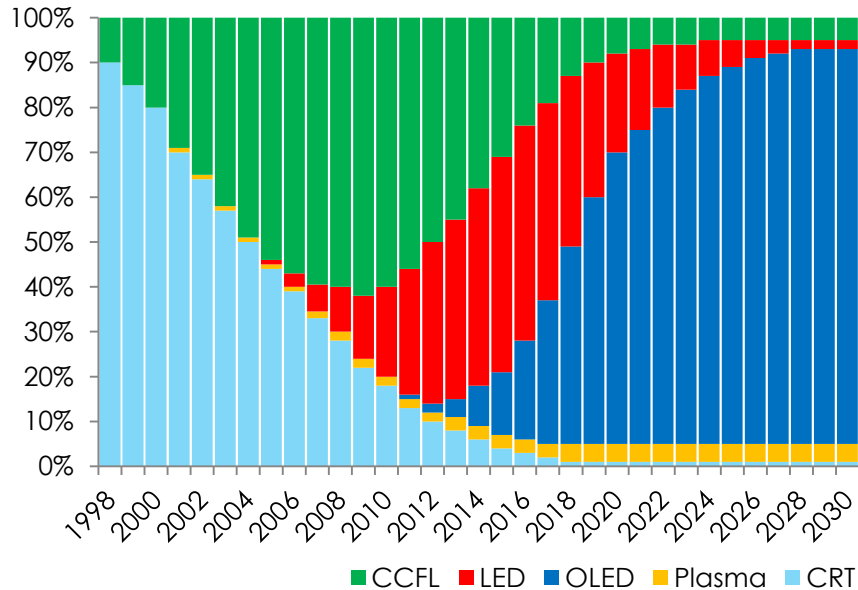
Introduction

- WEEE-Recycling is a big business with a wide variety of waste streams. Some special products contain hazardous materials such as Mercury.
- We find it in:
 - Fluorescent lamps
 - Flat Panel Displays
- By studying a country case we can learn about the mechanics of the market and use it for our business.

Case Study FPD



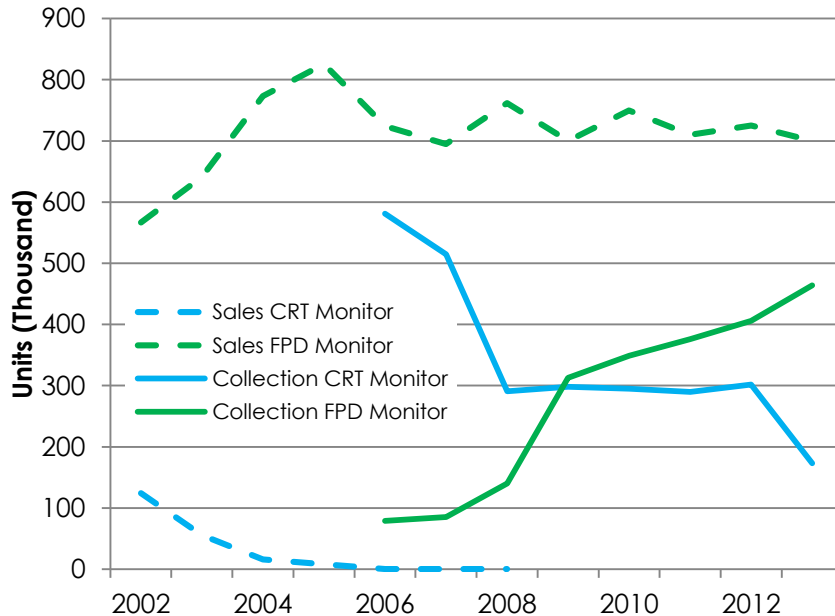
Market Overview: Display Technologies



- CRT's are replaced by FPD's
- CRT's are still used and a feedstock for recycling
- FPD's are the upcoming and increasing feedstock for recycling

Overview of the used TV and Monitor Technologies, Estimation EMPA 2013, Switzerland

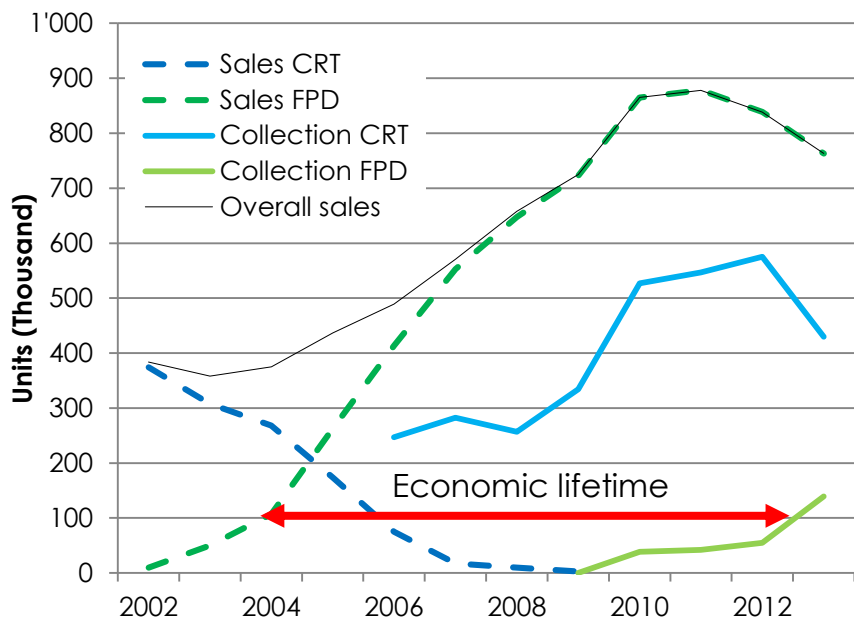
Case Study Switzerland: Monitor Market



- Constant number of FPD's sold
- No sales of CRT's any more
- Decreasing number of CRT's collected
- Constant increase of FPD collected

Overview of the Monitor Market, Data's from Technical Reports Swico, SENS, SLRS, Switzerland

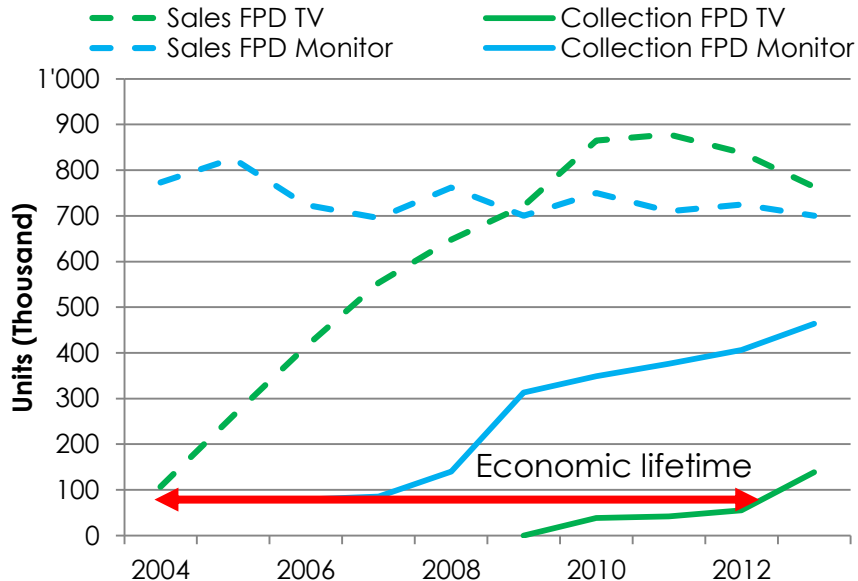
Case Study Switzerland: TV Market



- Increase collection of CRT's after sold out
- Increase in sales of FPD because of lifetime and price
- Small collection compared to the sales of FPD → hoarding or second use of FPD
- Delay in collection of 8 to 10 years for FPD (economic lifetime)

Overview of the TV Market, Data's from Technical Reports Swico, SENS, SLRS, Switzerland

Case Study Switzerland: FPD Market



- Important stockpile of FPD Monitors and TV's in use or hoarded.
- Collection 8 - 10 years after commercial launch
- Units are more important than the tonnages.
- The ratio weight/unit and value/unit is determining the recycling technology used.

Overview of the FPD TV and Monitor Market, Data's from Technical Reports Swico, SENS, SLRS, Switzerland

Comparison to other Markets or Countries

We cannot simply take a case study and apply it for every country. There are many aspects we have to take in consideration.

- Different habits
 - Leasing of IT equipment
 - Reusing or secondary use
 - Export
 - Labor costs
 - Industry strengths
 - etc.
- Industrial or office sector
 - Different understanding of use and waste handling
 - Different collection routes and rules.
- Private sector
 - Development of the IT-infrastructure, Hardware and Software
 - More electronic and IT appliances used
 - Economy of the country

The BLUBOX Technology



The BLUBOX

Simultaneous Treatment of....

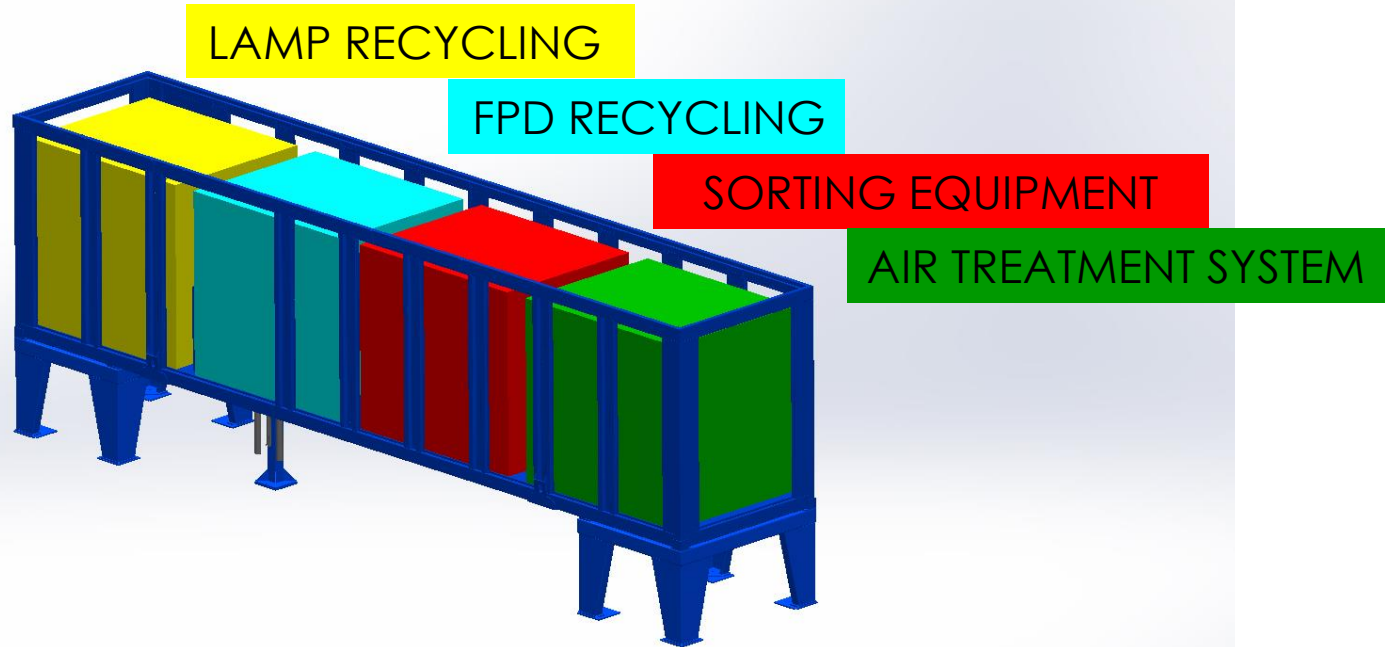


Fluorescent Lamps



Flat Panel Displays

The Inside



All-In-One: Everything is built into a 40 feet container

The Capacity

- The capacity based on an 8 hour workday

$$\begin{array}{rcccl} 1000\text{kg} & & 500\text{kg} & & 3000\text{t} \\ \text{FPDs} & & \text{Lamp waste} & & \text{Lamps and FPDs} \\ \text{per hour} & + & \text{per hour} & = & \text{per year} \end{array}$$

- One BLUBOX recycles the FPD and lamps of a city or area of 8 million inhabitants.
- You can treat other electronics such as Laptops, Mobile phones, Tablets, etc.
- By working on two shifts you double the capacity and multiply the benefit.

Treatment of Fluorescent Lamps



- Mechanical process
- All lamps can be treated in one machine
- Recovery of Rare Earth elements
- Clean products



End Caps, Aluminum

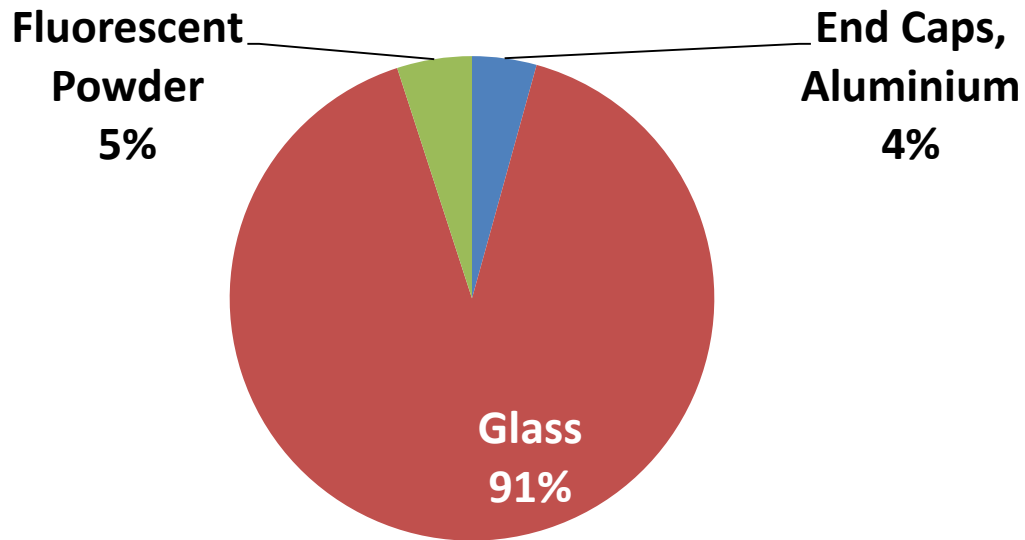


Glass



Fluorescent Powder

Output from FL



All outputs are products. No waste!

Treatment of FPD



Magnetic Metals



Non Magnetic

- Mechanical process
- All FPD technologies can be processed
- Automated sorting of the “Non Magnetic Fraction” outside the BLUBOX
- Clean products



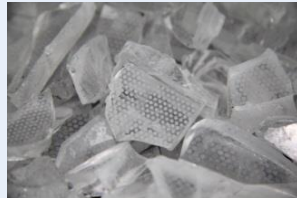
Automated Sorting



Aluminum



PCB's



PMMA



Mixed Plastics

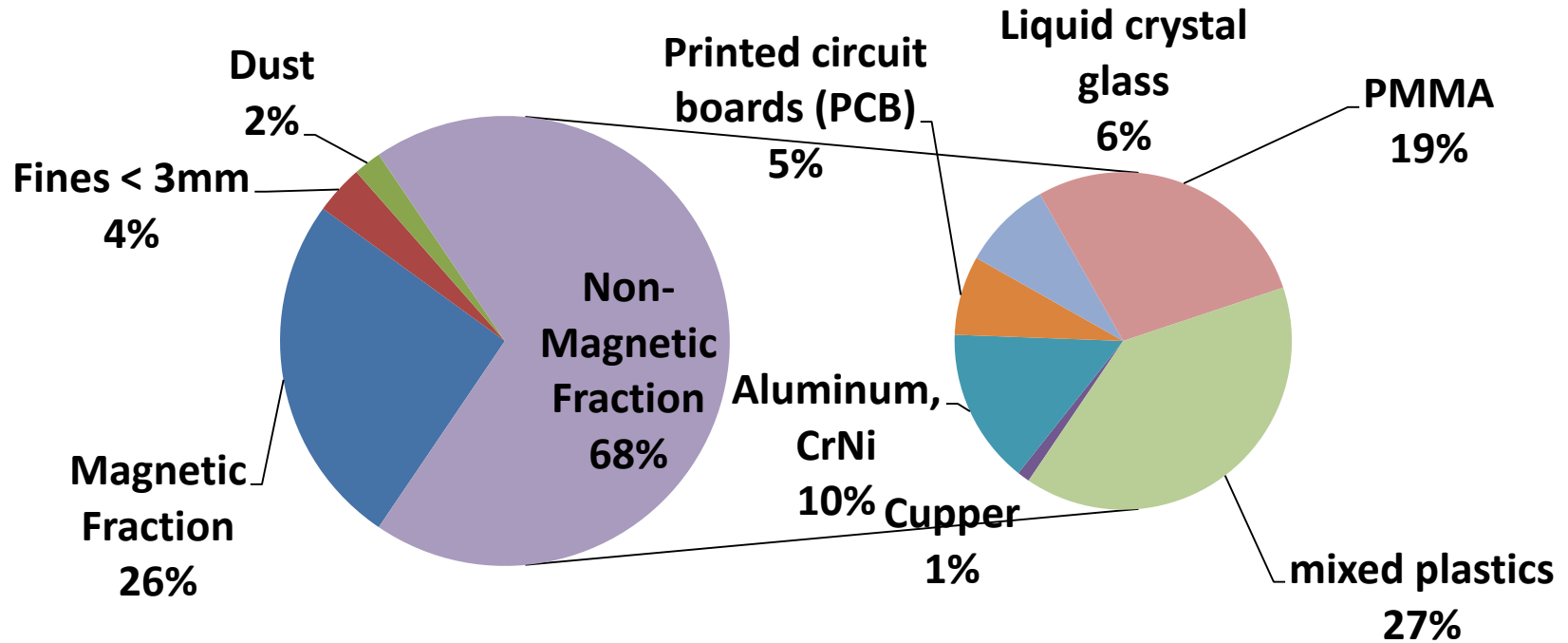


LC-Glass

Sensor Based Sorting of the Non Magnetic Fraction



Output from FPD

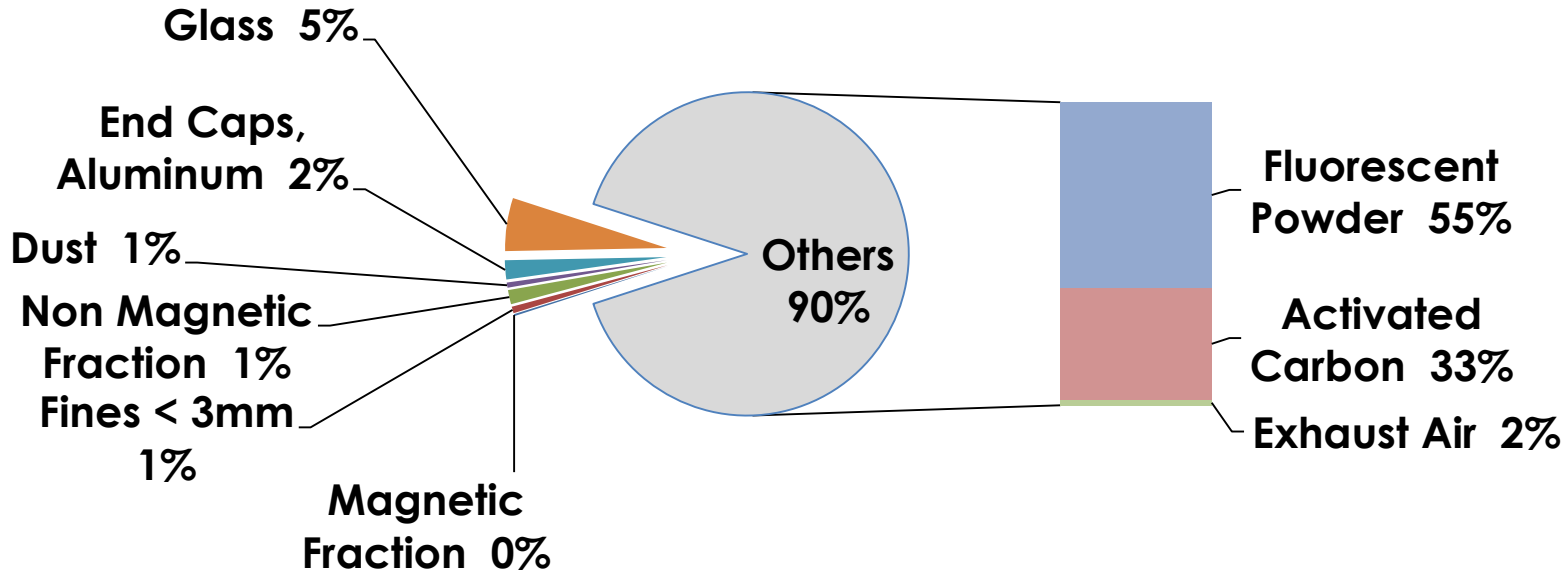


The BLUBOX liberates the values and the sorting make them valuable!

The BLUBOX ...

- Solves a problem economic and environmental safe
- The products are cleaned and can be further processed and treated without any danger to humans or the environment
- There are no emissions, the BLUBOX works under permanent negative pressure
- The BLUBOX meets the standards: R2, e-Steward and CENELEC
- **But. Where does the Mercury end up?**

The Mercury Balance



Balance made on a production of 1'000 tons of FLs and 700 tons of FPDs.
Represent a Mercury input of 34 kg.

Conclusions

1. A country study can't be applied 1 to 1 to another country, but can help to understand the market and take the right decision.
2. Market volumes of FPD are increasing rapidly.
3. The lifetime of FPD is 8 to 10 years. FPD put on the market have to be recycled sooner or later.
4. The ratio weight or value per unit is determining the recycling technology used.
5. Industrial recycling of hazardous materials is the standard.



Thank you for your attention