

Automatisierte Verwertungsverfahren für LCD-Displays

Carl Johan Wahlund, GRIAG Glasrecycling AG





The Stena Sphere

- Three wholly-owned parent companies
- Sales 4 615 MEUR, 18.700 employees (2009)
- Stena Metall Group 2 012 MEUR (2008/09)

Stena Metall AB

Stena AB

Stena Sessan AB

Concordia
Maritime AB (52%)

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Recycling that carries all the way

Stena's recycling has so far this year contributed to the prevention of

8 340 097.15
tons of carbon dioxide emissions

This equals the emissions from

1 295 046
round the world flights



Stena Metall AB

The leader in recycling

- Recycling, processing and refinement of metals, paper, plastics, electronics, hazardous waste and other production waste
- Customized service with total waste management solutions and expertise
- Advice and environmental training programs
- International trading in ferrous and non-ferrous metals and oil



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Value-added services

within ten business areas



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Stena WEEE

The leading electronics recycler in Europe

- First class processes and solutions for customers, environment and society
- The most comprehensive and high-quality offers in WEEE management, logistics and recycling for manufacturers, manufacturers' associations, retailers and businesses

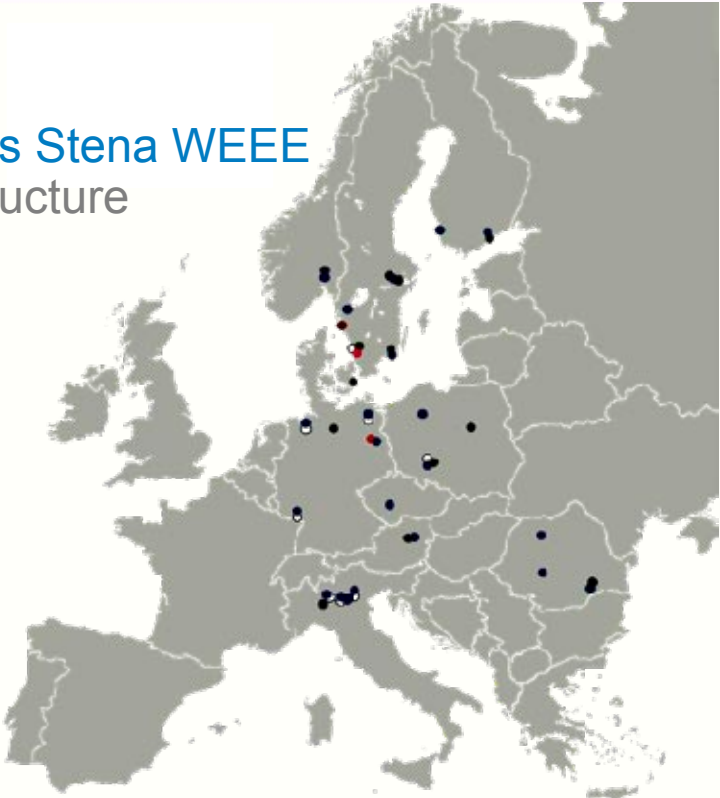
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European locations Stena WEEE

Plants and infrastructure

- Head Office
- EE Dismantling
- Cooling Appliances Treatment
- PMR
- PRC
- CRT
- Sales Office

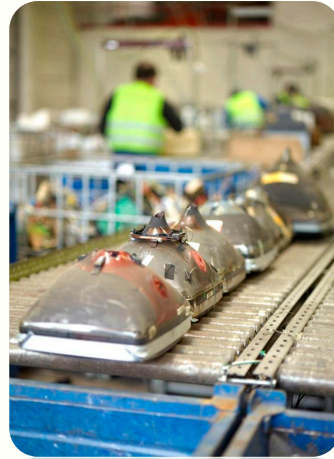


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GRIAG Glasrecycling AG Europe's leading CRT recycler

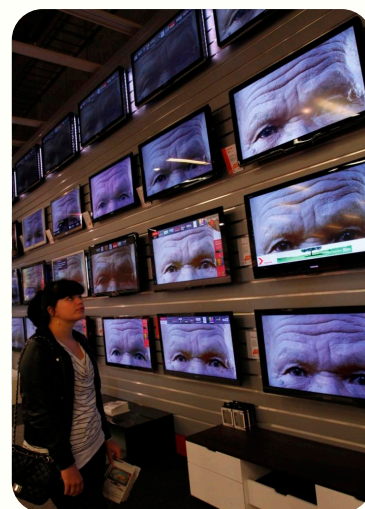
- Outstanding technique for CRT glass
- Over 15,000,000 picture tubes recycled
- A great potential – 65% of Europe's CRT glass is not yet being recycled
- The process consists of three top level steps
 - Cleaning
 - Separation
 - Upgrading



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Into the future State of the art LCD recycling

- A closed and automated recycling process
- Environmentally friendly
- High recycling rate
- World wide interest
- Patents pending



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Three challenges within LCD recycling

- Process challenges
- Logistic challenges
- Market challenges

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Process challenges Recovering the value

Recovery and sorting of

- FE
- Aluminium
- Copper
- Circuit boards
- Plastics ABS, PS and PMMA
- Foils and glass with LC and ITO



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Process challenges

The development of a novel technique

- Patent pending
- Development led by Stena's R&D department
- Co-operation with Chalmers University of Technology
 - Recovery of ITO from solar panels
 - Recovery of ITO from broken LC glass
 - Zero Waste project



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Process challenges

Achieving fractions free from mercury

- Legal requirement:
 - 5ppm Hg
- Customer requirements:
 - 2 ppm Hg
- Maximum recommended level in fish:
 - 1 ppm Hg
- The Stena LCD process:
 - <<0.5 ppm Hg



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Process challenges

Recovering the mercury safely

- Mass balances made based on a homogenous stream straight from production
- Input amount of mercury known
- A recovery rate of 85% achieved
- Remaining 15%?
- The declared amount of Hg in lamps is a maximum value, but from cost reasons the real amount is lower

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Process challenges

Making sure no worker is exposed to mercury

- Manual processes have cost advantages in low scale
- During dismantling of broken screens, workers are exposed to mercury.
- During dismantling, lamps easily break
- Stena's sealed mechanical process controls the mercury
- Continuous measurements in all worker environments guarantee no hazardous exposure



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Logistics challenges

Keeping the LCDs intact

- LCDs are easily broken
- Collection and transport may be ungentle
- Transport is preferably done in boxes or cages

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Market challenges

Illegal export

- Market prices exist of 3.95 EUR/screen. This is above material value.
- Screens are exported to Pakistan for "re-use"



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Market challenges

Insufficient treatment

- LCD is a small waste volume
- Apart from the mercury contents LCDs are similar to small domestic appliances
- The easiest route is to mix LCDs into the normal waste stream
- Treatment takes place illegally in normal shredders
- Mercury is diluted into larger volumes



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Market challenges

Incineration

- Special ovens suited for mercury
- A legal alternative
- Energy recovery instead of recycling, against the Waste hierarchy defined in Directive 2008/98 EC



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Summary

- We meet the challenges in our process and logistics
- We need help from authorities and municipalities to address the market challenges

Thank you for listening!
Contact me if you have further questions

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Demontage von Flachbildschirmen mit Quecksilberfiltration

Peter Heßler, UNTHA Recyclingtechnik GmbH



Zerlegetisch für Flachbildschirme mit Quecksilberfiltration
dismantling table for flat screens with mercury filtration



Gefördert von der DBU, Deutsche Bundesstiftung Umwelt

Partner of:
UNTHA
shredding technology



2010 wurden 9,6 Mio. LCD Fernsehgeräte in Deutschland verkauft

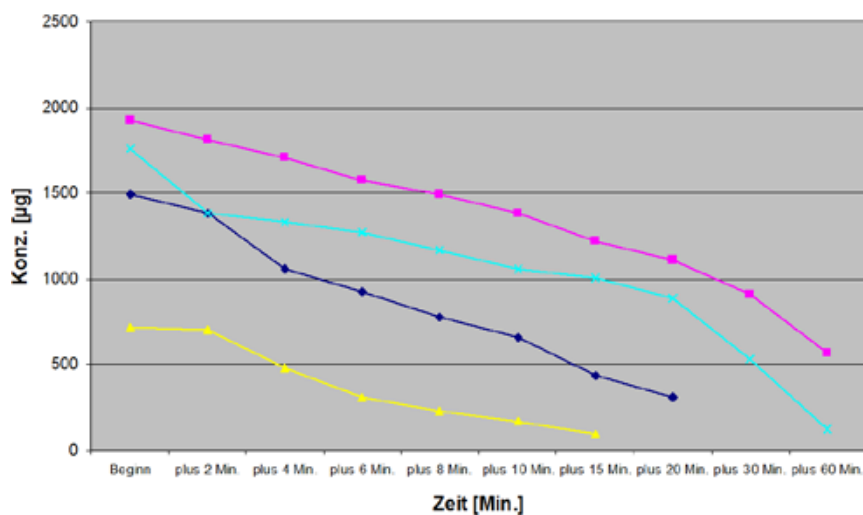


Rückwand mit Kapillarröhren



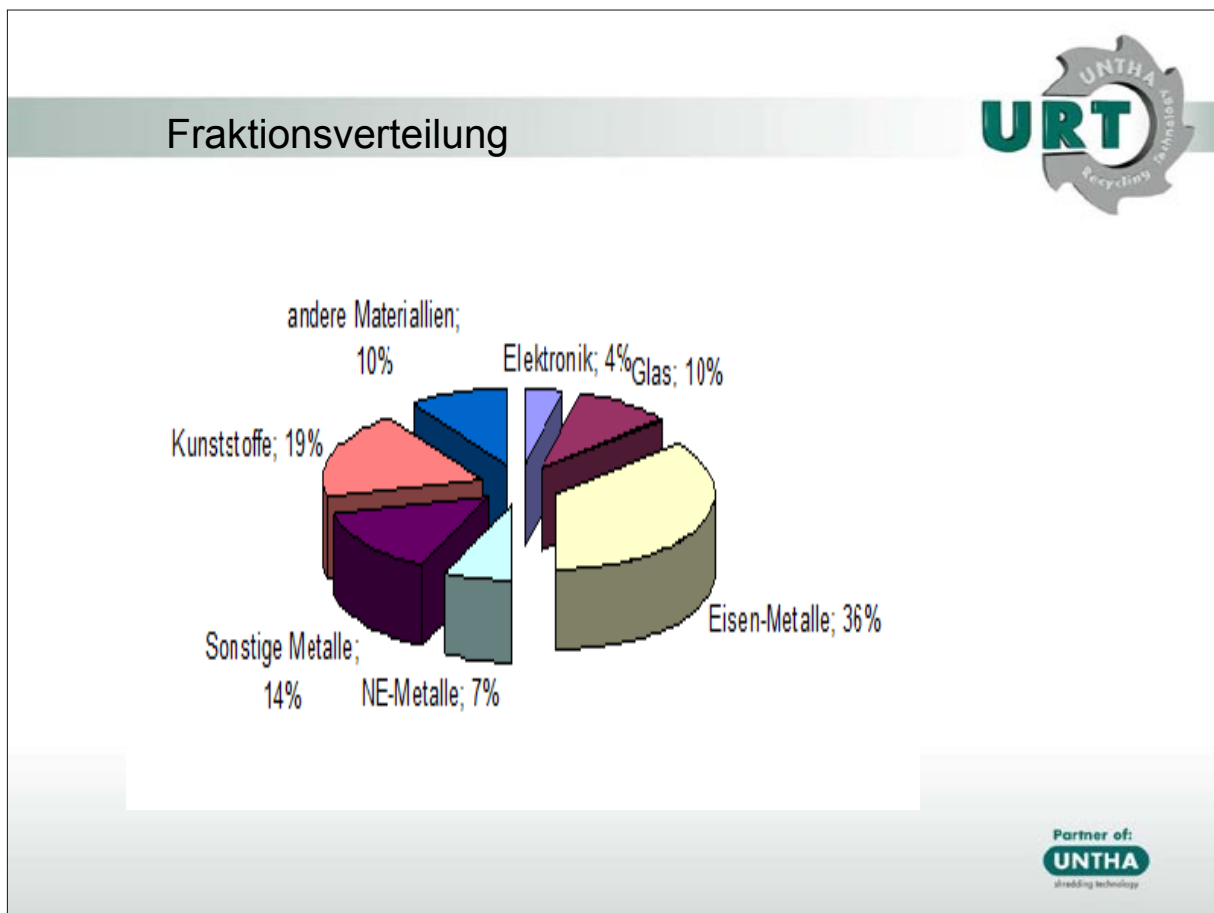
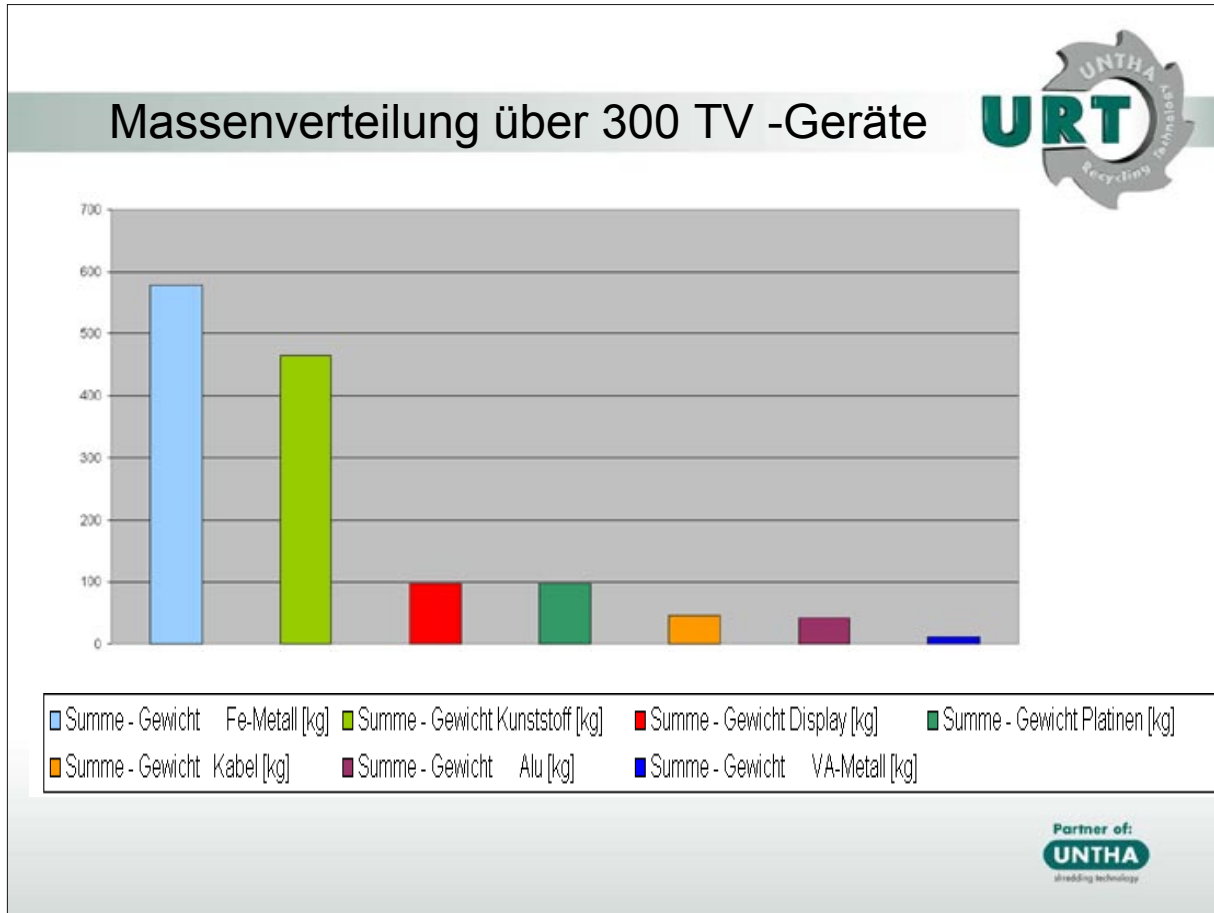
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UNTHA
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Emissionen beim Bruch von Kapillaren am Beispiel von TV-Geräten

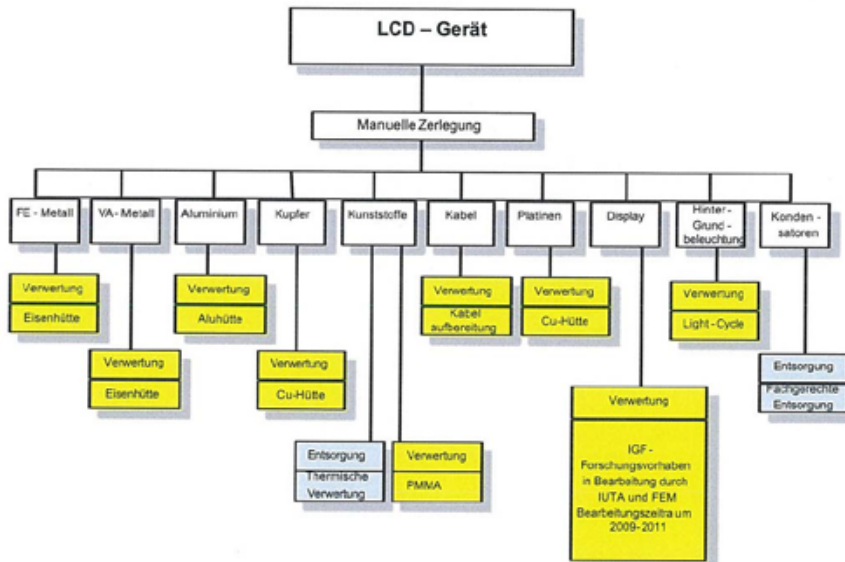


	Reihe 1	Reihe 2	Reihe 3	Reihe 4
Länge [cm]	71	86	97	127
Aussendurchmesser [mm]	3,9	4,0	4,0	4,0

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UNTHA
shredding technology



Verwertung der Fraktionen





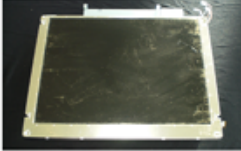


Bildschirmzerlegung



Bildschirmzerlegung



4. Arbeitsschritt Kunststoffrahmen lösen und entfernen 	5. Arbeitsschritt Platinen lösen und entfernen 	6. Arbeitsschritt Kondensatoren lösen und entfernen 
7. Arbeitsschritt Metallrückwand lösen und entfernen 	8. Arbeitsschritt TFT-Einheit weiterer Demontage zuführen 	



Bildschirmzerlegung



9a. Arbeitsschritt Hintergrundbeleuchtung lösen und entfernen VORSICHT Quecksilberdampf 	9b. Arbeitsschritt Hintergrundbeleuchtung lösen und entfernen VORSICHT Quecksilberdampf 	9c. Arbeitsschritt Hintergrundbeleuchtung lösen und entfernen VORSICHT Quecksilberdampf 
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Bildschirmzerlegung



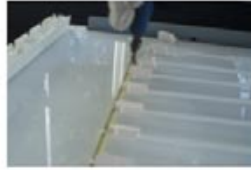
9d. Arbeitsschritt

Hintergrundbeleuchtung lösen und entfernen
VORSICHT Quecksilberdampf



10. Arbeitsschritt

Beleuchtung abknipsen (falls notwendig)



11. Arbeitsschritt

Folie entfernen

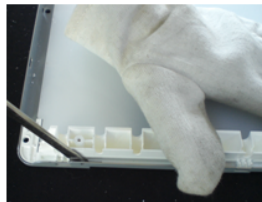


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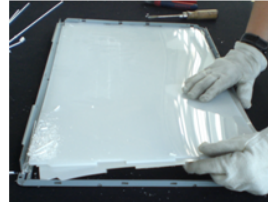
12. Arbeitsschritt

Kunststoffhalter lösen und entfernen



13. Arbeitsschritt

Kunststoffplatten entfernen



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Demontagewerkbank



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Einflussnehmende Parameter auf die Filterauslegung der LCD-Demontagewerkbank



Abmasse der Arbeitsfläche

Anzahl demontierter Geräte pro Stunde

Anzahl gebrochener Kapillare pro Gerät

Hg-Belastung pro Gerät

Hg-Belastung pro Stunde

Volumenstromermittlung mittels MAK-Wert

Volumenstromermittlung über die LW-Zahl



Benötigte Adsorbensmenge

Erforderliches abzusaugendes Luftvolumen aus der Werkbank

Druckverluste innerhalb des Leitungssystems

Auswahl des Ventilators

Erforderliche Adsorbergeometrie

Erforderliche Kontaktzeit

Beladekapazität

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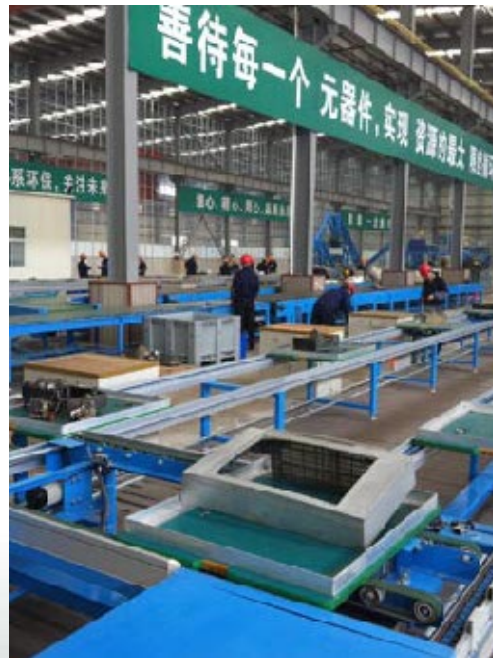
Demontagewerkbank



Kaliumpermanganat als
Adsorbens mit
Farbumschlag

Partner of:
UNTHA
shredding technology

Bildschirmzerlegung in China



Partner of:
UNTHA
shredding technology

Kunststoffaufbereitung in China



Partner of:
UNTHA
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