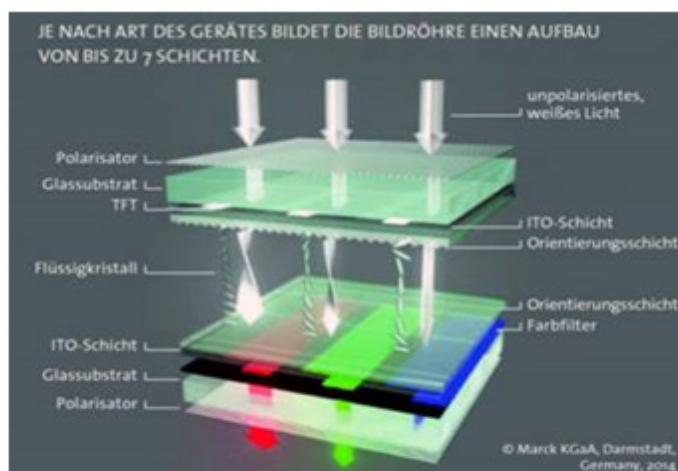


## Recycling Facilities

### **The safe extraction of valuable raw materials: robots automatically dismantle monitors containing mercury, while protecting workers' health at the same time**

Machine handles up to 45 monitors per hour

According to initial projections, around three million LCD screens will be recycled in Germany in 2016. However, their backlighting system often contains mercury, which means they are classified as 'hazardous waste' in accordance with the EWC, and as 'Collection Group 3' in accordance with the Electrical and Electronic Appliance Law. They also contain valuable raw materials, such as metals and plastics, which have to be recovered in such a way, that the environment is not harmed. As no suitable automated procedures had been available, the devices could only be dismantled by means of a complex manual process which had also put workers at risk. However, recycling specialists, Erdwich Zerkleinerungssysteme GmbH, have now developed an alternative: The company from Kaufering has developed an automatic processing system that enables mercury and other valuable raw materials to be easily extracted and recycled in an environmentally-friendly way.



Je nach Art des Bildschirmes bestehen LCD-Geräte aus bis zu sieben Schichten.

Besonders vorsichtig muss dabei mit den ITO-Schichten und der quecksilberhaltigen Hintergrundbeleuchtung verfahren werden.

Flat-screen monitors comprise up to seven layers. In addition to the valuable metal compound, indium tin oxide (ITO), they also contain mercury in their backlight components. The law requires that such devices are handled in such a way, that the exposure of nature and humans to this toxic substance are prevented. The Federal Environment Agency has laid down recovery quotas for electronic waste, which means that monitors may not be disposed of on refuse sites. Until now, the dismantling process has been too complex to be performed by machines, and has therefore been conducted manually. In particular, the dismantling of LCD screens with flat backlighting has hitherto been a complex and time-consuming process. "It is necessary to remove up to 30 screws just to separate the two halves of the housing. This dismantling procedure takes trained personnel between eight to twenty minutes, depending on the construction of the monitor and the type of background lighting," explains Harald Erdwisch, head of sales and marketing for the recycling experts.

## **Four-stage treatment process**

Erdwisch has now developed a time-saving facility system that uses camera equipment and robots to automatically cut open and dismantle monitors of up to 55" in size, under safe working conditions. The process consists of four stages: first of all, the individual screens are placed on a conveyor belt and transported into a sealed processing chamber, where they are put into the required position. A robot fitted with four different locking-arm mechanisms centres each one and subsequently raises it into the final position for the treatment process. An articulated robot then measures the contours of the screen glass with a camera system. As soon as the co-ordinates have been calculated, the robot cuts open the housing; the chippings from the cutting process are automatically extracted through a filter system.

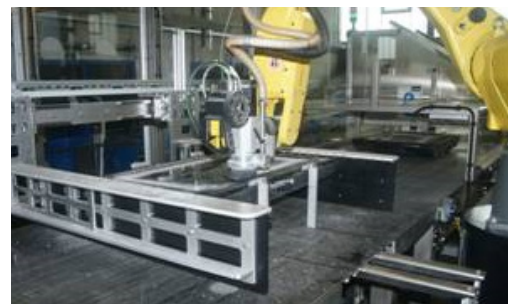
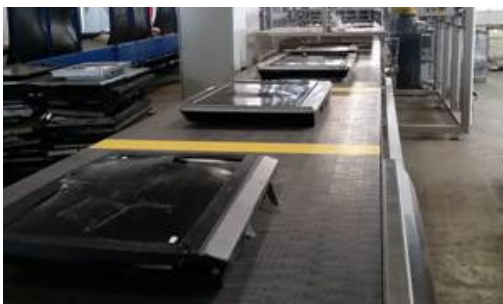
After each cutting cycle, the tools are automatically examined by a camera to enable any breakage or damage to be promptly detected. The cameras also examine the degree of wear on the cutters. The system also notifies the operator when it is necessary to replace the units to maintain process reliability. In a third step, the various layers, such as the multi-ply polarisation filter and the diffuser, are removed in a low-pressure chamber.



## Throughput of up to 45 panels per hour

The final step comprises the removal of the background lighting. "A closed waste container is installed directly in the chamber for the gas discharge lamps that contain the mercury," says Erdwisch, explaining the process. "At the same time, the exhaust air is extracted in a controlled process and collected by means of a mercury filter system, in which the harmful metal is converted into a non-toxic sulphide." Finally, the screen is transported out again, and its processing continues in a downstream system. For instance, the valuable indium tin oxide, which is used in the production of printed circuit boards, is located in conductor tracks on two thin glass panels. As the global demand for this metal compound is increasing, and prices have shot up in recent years, it makes particular sense to recycle this material.

In addition to LCD panels of up to 55", which can be dismantled with the aid of robots in an automatic processing facility, Erdwisch also offers a cutting system for LCD monitors of up to 25". "Previously, it was only possible to dismantle between four to seven monitors per hour by hand, but this system can handle up to 60 monitors per hour – with absolutely no health risks," explains the head of sales and marketing.



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