Environmental Research Plan
of the Federal Ministry for the Environment,
Nature Conservation and Nuclear Safety

Waste Management

Grant No. (UFOPLAN) 3708 93 300

Transboundary shipment of waste electrical and electronic equipment / electronic scrap – Optimization of material flows and control

by
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Ökopol GmbH

ON BEHALF OF
THE FEDERAL ENVIRONMENT AGENCY

FEBRUARY 2010

(Original document language: German)

Berichts-Kennblatt

<table>
<tr><td>1. Berichtsnummer:</td><td>2.</td><td>3.</td></tr>
<tr><td colspan="3">4. Titel des Berichts: Optimierung der Steuerung und Kontrolle grenzüberschreitender Stoffströme bei Elektroaltgeräten/Elektroschrott</td></tr>
<tr><td colspan="2" rowspan="2">5. Autor(en), Name(n), Vorname(n): Sander, Knut; Schilling, Stephanie</td><td>8. Abschlussdatum: 17.02.2010</td></tr>
<tr><td>9. Veröffentlichungsdatum: 04.03.2010</td></tr>
<tr><td colspan="2" rowspan="2">6. Durchführende Institution (Name, Anschrift):
ÖKOPOL – Institut für Ökologie und Politik GmbH, Nernstweg 32 - 34, 22765 Hamburg</td><td>10. UFOPLAN-Nr. 3708 93 300</td></tr>
<tr><td>11. Seitenzahl: 133 (Deutsche Fassung)</td></tr>
<tr><td colspan="2" rowspan="3">7. Fördernde Institution (Name, Anschrift):
Umweltbundesamt, Wörlitzer Platz 1, 06844 Dessau</td><td>12. Anz. Literaturangaben: 63</td></tr>
<tr><td>13. Anz. Tabellen: 32</td></tr>
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Der Bericht beschreibt Ansätze, Maßnahmen und Regelungsstrukturen zum Export von gebrauchten Elektro(nik)geräten und Elektro(nik)altgeräten in Nicht-EU-Staaten mit dem Ziel, den Schutz der Umwelt und der Ressourcen zu optimieren. Der Schwerpunkt wird dabei auf Exporte über den Hamburger Hafen gelegt. Der Export der untersuchten Gerätearten in Nicht-EU-Staaten erfolgt ausschließlich als Gebrauchtgeräte. Notifizierte Abfallexporte solcher Geräte sind nicht bekannt. Die deutsche Außenhandelsstatistik erfasst einen Teil der tatsächlichen Exporte und differenziert nicht zwischen Gebraucht- und Neuwaren. Die im Rahmen der Untersuchung hochgerechnete Gesamtmenge der Exporte lag 2008 zwischen 93.000 t und 216.000 t. Der spezifische Wert der Exporte (€/kg) liegt signifikant unter dem Wert der Exporte in EU-Staaten. Die Geräte stammen aus einer Vielzahl unterschiedlicher Quellen (insgesamt >4.000), teilweise von privaten Endnutzern, teilweise aus gewerblichen Quellen und teilweise aus dem Abfallregime. Private Sammel- und Umschlagplätze stellen einen der wichtigsten Drehpunkte für den Export von geringwertigen Geräten dar. In den Empfängerstaaten treffen die Geräte auf Entsorgungsstrukturen, die nicht geeignet sind, den Schutz der menschlichen Gesundheit und der Umwelt sowie die weitgehende Wiedergewinnung von Ressourcen sicherzustellen. Hierdurch gehen mehrere hundert Kilo Edelmetalle bzw. Seltene Erden dem Wirtschaftskreislauf verloren. Die erarbeiteten Maßnahmen zur Optimierung der Stoffströme decken kurzfristige Bereiche (Novellierung der WEEE-Richtlinie, Exportkontrollen, Information der Öffentlichkeit, Verpflichtung von Herstellern und Re-Marketing-Firmen, Rücklogistik) ebenso ab, wie mittelfristige Maßnahmen (Änderung der Außenhandelsstatistiken, Verbesserung der Situation in den Empfängerstaaten).</td></tr>
<tr><td colspan="3">17. Schlagwörter: Abfallverbringung, Ausfuhr, Export, Elektro(nik)altgeräte, Elektro(nik)geräte, Elektroschrott, gebrauchte Elektro(nik)geräte, Hamburger Hafen, Kontrollen, Abfalltransport, Drittländer, Nicht-EU-Länder, Basler Übereinkommen, Außenhandel, Statistik, Rohstoffrückgewinnung, Informelle Verwertung, Sammlung, Zoll, Polizei, Behörden, Entwicklungsländer</td></tr>
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Report Cover Sheet

1. Report No.	**2**	**3**
4. Report Title: Transboundary shipment of waste electrical and electronic equipment/ electronic -scrap – Optimization of material flows and control		
5. Author(s), Name(s), First Name(s): Sander, Knut; Schilling, Stephanie		**8. Report Date:** 17.02.2010
		9. Publication Date: 04.03.2010
6. Performing Organisation (Name, Address) ÖKOPOL – Institute for Environmental Strategies GmbH, Nernstweg 32 - 34, D – 22765 Hamburg		**10. UFOPLAN-No.** 3708 93 300
		11. No. of Pages: 133 (German version)
7. Sponsoring Agency (Name, Address): Umweltbundesamt [German Federal Environment Agency], Wörlitzer Platz 1, 06844 Dessau		**12. No. of References:** 63
		13. No. of Tables, Diagrams: 32
		14. No. of Figures: 34
15. Remarks		

16. Abstract:

The report describes approaches, measures and regulation structures for the export of used electrical/electronic equipment and waste electrical/electronic equipment to non-EU countries. It aims at optimising the protection of the environment and resource flows. Emphasis is placed on exports via the Port of Hamburg. The export of the equipment types investigated in non-EU countries took place exclusively as used equipment. Notified waste exports of such equipment are not known. The German Foreign Trade Statistics embrace a part of the actual exports. However, statistics do not differentiate between used and new goods. The total quantity of the exports extrapolated within the framework of the investigation in 2008 lay between 93,000 t and 216,000 t. The specific value of the exports (€/kg) lies significantly below the value of the exports to EU Member States. The equipment originates from a multiplicity of sources (in all >4,000 sources), in part from private end users, in part from commercial sources and partially from the waste regime. Private collection and reloading points represent one of the most important pivotal points for the export of low-value equipment. In the countries of destination, the equipment encounters recovery and disposal structures, which are not suitable to ensure the protection of human health and the environment as well as the extensive recovery of resources. Through this, several hundred of kilos of precious metals and rare earths are lost from the economic cycle. The elaborated measures for the optimisation of material flows cover short-term measures (amendment of the WEEE Directive, export controls, information of the public, obligation of manufacturers and re-marketing firms, return logistics) as well as medium-term measures (modification of the foreign trade statistics, improvement of the situation in the countries of destination).

17. Keywords: Waste shipment, export, e-waste, WEEE, EEE, Electronic scrap, used electrical/electronic equipment, port of Hamburg, controls, waste transports, third countries, Non-EU-countries, Basel Convention, external trade, statistics, recycling/recovery of raw materials, informal recovery/recycling, collection, customs, police, authorities, developing countries

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List of Abbreviations

AbfVerbrG	Abfallverbringungsgesetz – German Transboundary Shipment Law
OJ	Official Journal of the European Union
ATLAS	*Automatisiertes Tarif- und Lokales Zoll-Abwicklungs-System* – Automated Tariff and Local Customs Clearance System
BAG	*Bundesamt für Güterverkehr* – Federal Office for the Transport of Goods
b2b	*Business to Business*
b2c	*Business to Consumer*
BE	*Belgium*
BGBl.	*Bundesgesetzblatt – Federal Law Gazette*
BKA	*Bundeskriminalamt* – Federal Criminal Police Office
BMF	*Bundesministerium der Finanzen – Federal Ministry of Finance*
BMU	*Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit* – Federal Ministry for the Environment,Nature Conservation and Nuclear Safety
BMZ	*Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung* – Federal Ministry for Economic Cooperation and Development
BSU	*Behörde für Stadtentwicklung und Umwelt der Hansestadt Hamburg* – Urban Development and Environment Authority for the Free and Hanseatic City of Hamburg
CRT	Cathodic Ray Tube
DESTATIS	*Statistisches Bundesamt Deutschland* – German Federal Statistical Office
R/yr	*Residents per year*
WEEE	Waste electrical and electronic equipment
EFTA	European Free Trade Association
EC	European Community
ElektroG	*Elektro- und Elektronikgerätegesetz* – Electrical and Electronic Equipment Act
ES	Electrical and electronic scrap, e-scrap
EU	European Union
CFC	Chlorofluorocarbon
FKZ	*Forschungskennzeichen* – Grant No.
UEEE	Used electrical and electronic equipment
GüKG	*Güterkraftverkehrsgesetz* – Road Haulage Law
HH	Hanseatic City of Hamburg
HS	Harmonized Goods Description and Coding System
IMPEL - TFS	Implementation and Enforcement of Environmental Law Transfrontier Shipments of Waste – European network of enforcement authorities on transborder shipments
IT	Information technology
R&F	Refrigerators and Freezers
CN	Combined Nomenclature
LAGA	*Bund/Länder-Arbeitsgemeinschaft Abfall* – Federal/State Working Group for the Handling of Waste
LCD	Liquid Cristal Display
Ni	Nickel
NL	Netherlands
OECD	Organisation for Economic Co-operation and Development
OFD	*Oberfinanzdirektion* - Regional Finance Office

List of Abbreviations (Continued)

Pb	Lead
PC	Personal computer
PCB	Polychlorinated biphenyls
PCDD/F	Polychlorinated dibenzodioxins and -furans
Pd	Palladium
PI-IV, PM	Pentium® I-IV, Pentium® M
SITC	Standard International Trade Classification
TC	Telecommunication
TFT	Thin Film Transistor
TV	Television
UBA	*Umweltbundesamt* – Federal Environment Agency
CE	Consumer electronics
VKS	*Verband kommunale Abfallwirtschaft und Stadtreinigung* – Association of municipal waste management and city cleaning
VKU	*Verband kommunaler Unternehmen e. V.* – Association of Local Utilities
VVA	Regulation (EC) No. 1013/2006 on shipments of waste
WA	*Warenverzeichnis für die Außenhandelsstatistik* – Goods Index for Foreign Trade Statistics
WEEE	Waste Electrical and Electronic Equipment
ZAPP	Zoll Ausfuhrüberwachung im Paperless Port

1 Introduction

At present, significant quantities of used electrical and electronic equipment (hereafter referred to as UEEE) are being exported from Germany. Notified exports (i.e. those with consent by authorities) of waste electrical and electronic equipment (hereafter referred to as WEEE) to countries outside the European Union (EU) have not taken place in any appreciable volume in the past years. The condition and quality of the exported UEEE, however, give rise to the suspicion that a significant percentage of this equipment is not fully functional, or can only be used in the countries of destination as a source of spare parts, or has only a short remaining service life.

In the countries of destination, the equipment enters into waste management structures far below the standard that the European Community considers necessary, for itself, as the minimum level of protection. The treatment of WEEE in these countries of destination thereby poses risks to human health and the environment. Furthermore, valuable resources are lost if, in the countries of destination, the WEEE is not fully collected, and if treatment methods that do not ensure optimal reclamation rates are applied for the WEEE that is collected.

Concrete knowledge of the extent and exact routes of the export flow and the parties or chains of parties involved is, however, very limited.

In light of this situation and with emphasis in this research project on the example of the Port of Hamburg[1] the export of UEEE and WEEE were quantified as completely as possible on an empirical basis, the qualities of the exported goods were recorded, and approaches, measures and regulatory structures were developed with the aim of optimizing environmental protection, human health and resources.

The following terms are used in this report:

- **Country of destination**: The country to which goods from Germany are exported (or from the reciprocal perspective: the country that imports goods from Germany),
- **Country of dispatch** The country that exports the goods**;** in the scope of this report, this refers to Germany in most cases,
- **Used electrical and electronic equipment (UEEE):** Used equipment that is subject to the product regime,
- **Spare parts:** Parts that originate from equipment that is subject to the product regime (newly produced replacement parts are less relevant in the context of this study, but are also included under this term),
- **Waste electrical and electronic equipment (WEEE):** Equipment that is subject to the waste regime according to the WEEE Directive or ElektroG,
- **Equipment components:** Parts from waste electrical and electronic equipment (WEEE) (waste regime),
- **E-scrap (ES):** Fractions from the processing of WEEE (waste regime).

[1] Furthermore, the situations in the ports of Bremen, Antwerp and Amsterdam were taken into account.

2 Legal Framework for the Transboundary Shipment of Waste

There is a series of international and national regulatory instruments, recommendations, compliance guides and guidelines to be considered regarding the monitoring and control of shipment of waste to other countries. The following are of particular importance in conjunction with WEEE/UEEE:

1. Basel Convention of 22 March1989 on the Control of Transboundary Movement of Hazardous Wastes and their Disposal [Basel Convention][2],
2. OECD Council Decision C(2001)107/Final of the OECD Council concerning the revision of Decision C(92)39/Final on the Control of Transboundary Movement of Wastes Destined for Recovery Operations [OECD Council Decision][3],
3. Regulation (EC) No. 1013/2006 on shipments of waste [EC Waste Shipment Regulation][4] ,

3a. Commission Regulation (EC) No. 1418/2007 concerning the export for recovery of certain waste listed in Annex III or IIIA to Regulation (EC) No. 1013/2006 of the European Parliament and of the Council to certain countries to which the OECD Decision on the control of transboundary movements of wastes does not apply [Commission Regulation (EC) No. 1418/2007][5],

4. German Waste Shipment Law [Abfallverbringungsgesetz][6],
5. Instruction for the cooperation of (German) customs offices and (German) environment authorities within the framework of the shipment of wastes [Customs Instruction][7],
6. Revised correspondents' guidelines No 1 - Shipments of Waste Electrical and Electronic Equipment (WEEE) [Correspondents' Guidelines No 1][8],
7. Correspondents' Guidelines No 4 - Classification of waste electrical and electronic equipment according to Annex IV part I note (c) of Regulation (EC) No 1013/2006 on shipments of waste [Correspondents' Guidelines No 4][9],

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2 Basel Convention of 22 March 1989 on the control of transboundary movements of hazardous wastes and their disposal (enacted in *Bundesgesetzblatt* BGBl. II 1994, p. 2703), amended by Decisions on 22 September 1995 and 27 February 1998 (BGBl. II 2002 p. 89), from 9 to 13 December 2003 (BGBl. II, p. 1626) and from 25 to 29 October 2005 (BGBl. II 2005, p. 1122).

3 OECD Council Decision C(2001)107/Final concerning the revision of Decision C(92)39/Final on the control of transboundary movements of wastes destined for recovery operations, last amended 26 October 2005 with Decision C(2005)141.

4 Regulation (EC) No 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of waste, OJ L 190 of 12 July 2006, p. 1, as amended.

5 Commission Regulation (EC) No 1418/2007 of 29 November 2007 concerning the export for recovery of certain waste listed in Annex III or IIIA to Regulation (EC) No 1013/2006 of the European Parliament and of the Council to certain countries to which the OECD Decision on the control of transboundary movements of wastes does not apply, OJ L 316 from 04 December 2007, p. 6, as amended.

6 Act on the monitoring and control of transboundary shipment of waste, *Abfallverbringungsgesetz* of 19 July 2007, BGBl. I p. 1462.

7 Handlungsanleitung für die Zusammenarbeit der Zolldienststellen und Abfallbehörden im Rahmen der Ver¬bringung von Abfällen, http://laga-online.de/laganeu/images/stories/pdfdoc/veroeffentlichungen/Handlungsanleitung%20Zoll_02_2008.pdf

8 REVISED CORRESPONDENTS' GUIDELINES No 1 on the Shipments of Waste Electrical and Electronic Equipment (WEEE), http://www.umweltdaten.de/abfallwirtschaft/gav/Correspondents_guidelines_No_1.pdf.

8. Enforcement guidance for the shipment of waste of the Working Group of the German Federal States and the Federal Government on Waste [Enforcement guidance LAGA][10],
9. Directive 2002/96/EC on Waste Electrical and Electronic Equipment [WEEE Directive][11],
10. Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment [RoHS Directive][12],
11. German Electrical and Electronic Equipment Law [ElektroG][13],
12. Recommendation providing for minimum criteria for environmental inspections in the Member States 2001/331/EC [Recommendation 2001/331/EC][14].

The most important international bases are the Basel Convention and the OECD Council Decision.

The Basel Convention is a global control system for transboundary shipment of **hazardous waste**. An export ban on hazardous wastes from OECD member countries to OECD non-member economies was formally incorporated into the Convention with Decision III/1. However, due to a lack of ratification by a sufficient number of Parties to the Convention, this export prohibition has not yet entered into force internationally; yet it has been transposed by the EU.

The OECD Council Decision is a controlling system for the import and export of wastes **destined for recycling**, in order to allow their tradability **within the OECD member countries**.

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9 CORRESPONDENTS' GUIDELINES No 4 on the Classification of waste electrical and electronic equipment and fly ash from coal-fired power plants according to Annex IV part I note (c) of Regulation (EC) No 1013/2006 on shipments of waste, http://www.umweltdaten.de/abfallwirtschaft/gav/Correspondents_guidelines_No_4.pdf

10 Vollzugshilfe zur Abfallverbringung der Bund/Länder-Arbeitsgemeinschaft Abfall (Mitteilung 25), http://laga-online.de/laganeu/index.php?option=com_content&task=view&id=22&Itemid=35.

11 Directive 2002/96/EC of the European Parliament and of the Council of 27/01/2003 on waste electrical and electronic equipment, OJ L 37 from 13/02/2003, p. 24, as amended.

12 Directive 2002/95/EC of the European Parliament and of the Council of 27/01/ 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment, OJ L 37 from 13/02/2003, p. 19, as amended.

13 Elektro- und Elektronikgerätegesetz (ElektroG) from 16/03/2005, BGBl. I p. 762.

14 Recommendation providing for minimum criteria for environmental inspections in the Member States 2001/331/EC, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2001:118:0041:0046:EN:PDF.

2.1 Basel Convention and OECD Decision

The Basel Convention contains lists of wastes in two annexes (Annex VIII and Annex IX). The wastes listed in Annex VIII are hazardous wastes.

One entry concerning waste electrical and electronic equipment in Annex VIII is A 1180 *"Waste electrical and electronic assemblies or scrap containing components such as accumulators and other batteries included on list A, mercury-switches, glass from cathode-ray tubes and other activated glass and PCB capacitors, or contaminated with Annex I constituents (e.g., cadmium, mercury, lead, polychlorinated biphenyl) to an extent that they possess any of the characteristics contained in Annex III (note the related entry on list B B1110)"*[15].

The wastes listed in Annex IX are not covered by the relevant article of the Basel Convention.

One entry concerning waste electrical and electronic equipment in Annex IX is **B1110**:

"Electrical and electronic assemblies:
– *Electronic assemblies consisting only of metals or alloys*
– *Waste electrical and electronic assemblies or scrap (including printed circuit boards) not containing components such as accumulators and other batteries included on list A, mercury-switches, glass from cathode ray tubes and other activated glass and PCB-capacitors, or not contaminated with Annex I constituents (e.g., cadmium, mercury, lead, polychlorinated biphenyl) or from which these have been removed, to an extent that they do not possess any of the characteristics contained in Annex III (note the related entry on list A A1180)*
– *Electrical and electronic assemblies (including printed circuit boards, electronic components and wires) destined for direct reuse*[16]*, and not for recycling or final disposal*[17]*."*

The wastes regulated in the OECD Decision are grouped into risk categories as two lists (Green and Amber). Green Listed wastes are not subject to any waste-law control, and are treated as goods. Amber List wastes are subject to a control procedure; they require notification (application) and the consent of the applicable authorities. Also required are legally binding contracts from the parties involved in the exporting of wastes, who have legal control of the wastes and the recycling plants [Wuttke, Baehr 2008].

These two waste lists of the Basel Convention have been integrated into the OECD lists in such a way that the "Green Procedure" applies to Annex IX and the "Amber Procedure" applies to the wastes listed in Annex VIII of the Basel Convention.

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15 The Amended Correspondents' Guidelines also list a series of other possible categories of waste electrical and electronic equipment as defined in Regulation 1013/2006.

16 "Reuse can include repair, refurbishment or upgrading, but not major reassembly."

17 "In some countries these materials destined for direct re-use are not considered wastes."

2.2 EC Regulation on Shipments of Waste

Regulation (EC) No. 1013/2006 on shipments of waste is the European transposition of the international body of regulations on shipments of waste.

This Regulation implements the international obligations of the Basel Convention and of the OECD Decision, and includes the internationally agreed objective that wastes shall be disposed of in an environmentally sound manner. It also forbids the shipment of hazardous wastes in particular (see Annex V of the Regulation) from EU to non-OECD countries[18]. The Regulation includes the following waste lists:

- Annex III for Green Listed wastes[19],
- Annex III A for mixtures of Green Listed wastes,
- Annex IV for Amber Listed wastes, and
- Annex V, which covers wastes subject to the export prohibition.
- Annex IX is **B1110**

Table 1 below provides an overview of the scope of Regulation 1013/2006 on shipments of waste out of the EU [Wuttke, Baehr 2008].

Table 1: Overview of the scope of Regulation 1013/2006 on shipments of waste out of the EU[20]

Transboundary Shipment	Export out of the EU into countries to which the OECD Decision applies; Art. 18, 34, 35 and 38	Export out of the EU into countries to which the OECD Decision does not apply; Art. 18, 36 and 37
Wastes for recycling Annex III, III A	Duty to notify within the EU: Art. 18; Art. 38	Duty to notify within the EU: Art. 18; however individual case regulations[21] according to Art. 37
Wastes for recycling Annex IV, IV A	Permissible, notification in accordance with Art. 38	Not applicable
Hazardous wastes for recycling according to Annex V	Not applicable	Prohibited
Waste for disposal	Prohibited, with exceptions[22], notification in accordance with Art. 35	Prohibited

[Wuttke, Baehr 2008]

All Annexes comprise the corresponding lists/annexes of the Basel Convention and the OECD Decision, or of the EU-wide valid waste list according to Decision 2000/532/EC[23].

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18 This ban is not yet in force worldwide.

19 Annex IIIB can still be worked out in a committee procedure. This regards Green wastes not listed at the Basel/OECD level, but which can be shipped between EU Member States without notification.

20 Articles or annexes specified in the Table are articles or annexes from Regulation 1013/2006.

21 Individual case regulations as defined in Commission Regulation (EC) No 1418/2007, as amended.

22 Export is only allowed in EFTA countries that are also Parties to the Basel Convention.

23 *OJ L 226 from 6/9/2000, p. 3, as amended.*

Annexes III and IV list out the wastes that may be exported according to the Green or Amber control procedure. Of relevance to hazardous WEEE is the entry A1180. The entry of relevance to WEEE in the Basel Convention List B (B1110) is not valid in EU law. OECD entries GC010[24] and GC020[25] apply instead.

Annex V additionally contains Waste List 2000/532/EC, which is valid throughout the EU only. The waste classifications in Decision 2000/532/EC relating to WEEE are listed in Table 2All Annexes comprise the corresponding lists/annexes of the Basel Convention and the OECD Decision, or of the EU-wide valid waste list according to Decision 2000/532/EC.

A general prohibition of export to non-OECD countries applies to wastes listed in Annex V Part 1 List A (*inter alia* A1180) and according to Annex V Part 2 (*inter alia* the wastes in Table 2). An explanation of this regulation is given in the Correspondents' Guidelines No 4, which state, *"that hazardous WEEE according to the European list of wastes […] should, for the purposes of Regulation (EC) No 1013/2006, be classified as hazardous WEEE by using the Basel entry A1180, unless another entry contained in Annex IV applies, and that hazardous WEEE cannot be classified appropriately as either GC010 or GC020."*

Table 2: Waste classification according to Decision 2000/532/EC

Waste key	Plain text
16 02 10*	Discarded equipment containing or contaminated by PCBs or PCTs other than those mentioned in 16 02 09
16 02 11*	Discarded equipment containing chlorofluorocarbons
16 02 12*	Discarded equipment containing free asbestos
16 02 13*	Discarded equipment containing hazardous components[26] other than those mentioned in 16 02 09 to 16 02 12
16 02 15*	Hazardous components removed from discarded equipment
20 01 21*	Fluorescent tubes and other mercury-containing waste
20 01 35*	Discarded equipment other than those mentioned in 20 01 21 and 20 01 23 containing hazardous components[27]

[Correspondent's Guidelines No. 4]

Differences from the Basel Convention exist in Annex III, IV and V of Regulation 1013/2006 with regard to WEEE.

A simplified overview of the regulations of these three bodies of regulations is provided in Figure 1 below.

[24] Electrical assemblies consisting only of metals or alloys.

[25] Electronic scrap (e.g. printed circuit boards, electronic components, wire, etc.) and reclaimed electronic components suitable for base and precious metal recovery.

[26] "Hazardous components of electrical and electronic equipment include, e.g., accumulators and batteries listed under 16 06 and classified as hazardous, mercury-switches, glass from cathode ray tubes and other coated glass." [Anlaufstellen-Leitlinien Nr. 4].

[27] See previous footnote.

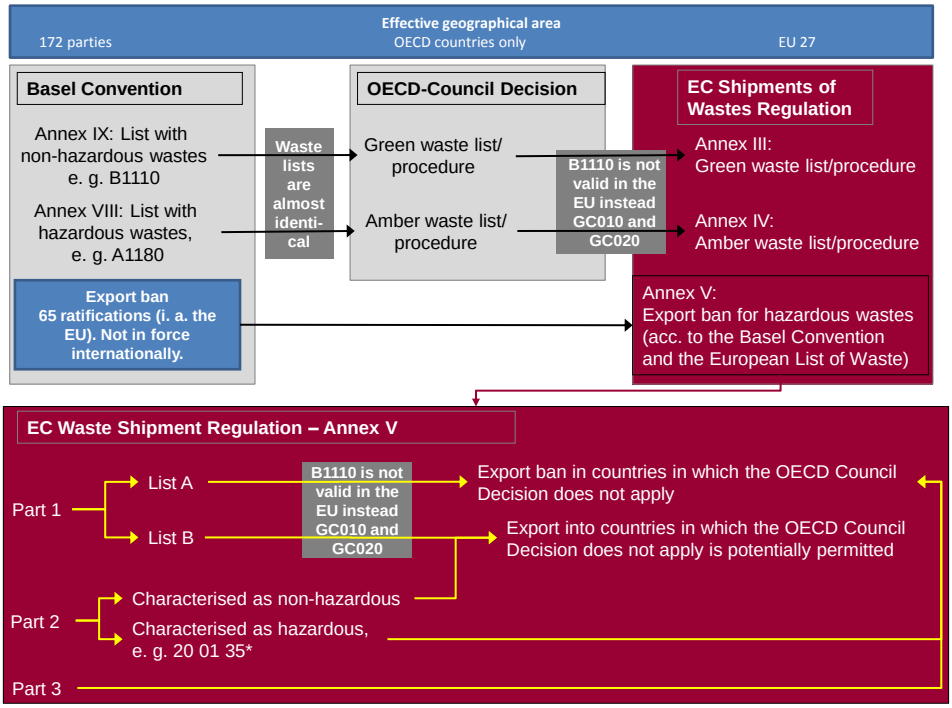

Figure 1: Overview of regulations on shipment of waste

When exporting wastes of Annexes III and IIIA, i.e. non-hazardous wastes for recovery, to a country to which the OECD Decision does not apply, various control procedures according to Art. 37 of 1013/2006 apply. Which procedure is required for specific countries of destination and for specific types of waste is defined in Regulation (EC) 1418/2007. This defines, in tabular form, whether

- *"the export of wastes listed in Annex III to Regulation 1013/2006 to the respective country of destination is prohibited or*
- *a waste may only be shipped to the respective country of destination with prior written notification and approval or*
- *a waste may be shipped without notification under consideration of the general duties to notify of Art. 18 of Regulation 1013/2006"*[28] [Wuttke, Baehr 2008].

[28] The procedure according to Art. 37 par. 2 of 1013/2006 applies to unlisted countries of destination.

2.3 German Waste Shipment Law

The German Waste Shipment Law (*Abfallverbringungsgesetz AbfVerbrG*) is the German transposition of Regulation (EC) No 1013/2006 and the Basel Convention, and supplements 1013/2006 in numerous points. One such supplement that is also of particular importance to the export of WEEE is the allocation of authority responsibilities. Generally, according to Section 14 par. 1, the federal state authorities of the state in which the waste shipment begins or should begin are responsible for measures and duties relating to shipments of wastes out of Germany. Also authorized to conduct inspections according to Section 14 par. 2 are the federal state authorities in whose territory the wastes destined for shipment out of Germany are located, as well as certain federal authorities.

According to Section 11 par. 2 of AbfVerbrG, the Federal Office for the Transport of Goods and the customs offices shall cooperate with the responsible authorities "to the best of their ability" in the inspection of waste shipments. According to state laws, the duty to inspect can also reside with parties other than the authorities responsible for the waste shipment, such as the water police, for example [Kropp 2008, Deutscher Bundestag 2006][29]. [BKA pers. com.] states that *"according to the literature, police authorities in the other federal states are also entitled to conduct waste transport inspections without concrete initial suspicion"*.

Suspicious cases of illegal waste exports are detected during export inspections[30], by customs for example, and then "the responsible waste management authority is called in" [Deutscher Bundestag 2006].

In the case of a suspected violation against the provisions of Regulation 1013/2006 or AbfVerbrG, or an illegal waste shipment (1)[31], the inspection authority may seize or impound the shipment and packaging (2). If there is only initial suspicion, then the inspection authority must gather information in order to clarify the situation (3). This can also be done together with the responsible authorities at the shipping and/or inspection location. In the case of shipments out of Germany, the inspection authority must inform the authority at the shipping/inspection location of their measures (4a and 5). The responsible state authority must decide upon the validity of the suspicion in accordance with Art. 11 par. 4 of AbfVerbrG (4b).

The responsible authority must decide how to proceed with the transport (6) and then forward this decision (7).

Possible further procedures would be: return[32] to the place of dispatch, transport to the place of destination or other recycling or disposal of the waste. The responsible competent authority that finally decides upon the procedure can be the authority at the shipping location[33] [Kropp 2008].

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29 According to [Braun 2009], police responsibility for waste transport inspections only exists in a few federal states, such as Hamburg, Hessen, Baden-Württemberg and Saxony-Anhalt.

30 Which generally relate to goods including wastes.

31 The numbers in the text refer to figure 2.

32 In the past, there have been isolated complaints by exporters against returns. So far, the courts have adjudicated very differently in cases of such complaints. According to statements from parties involved, the different decisions were due, aside from the fact that every decision is in part an individual case review, to the courts' lack of decision criteria to distinguish between UEEE and WEEE. At least one recent case is known of that was won in the first instance by the defendant waste authority [pers com. Regb. Düsseldorf].

33 "Which authority must take the final decision depends on who is responsible for the illegal shipment on the merits of the case. If this is the notifier in the sense of Art. 2 No 15 of Regulation 1013/2006 or the party that should have made the notification, then the authority at the shipping location must decide. If the consignee in the sense of Art. 2 No. 14 of Regulation 1013/2006 is responsible for the illegal shipment, then the

The procedure for notifying the waste authorities, if the inspecting authority is a customs office, is specified in the Guidelines for cooperation with customs offices and waste authorities regarding shipment of waste (Handlungsanleitung Zoll) and is as shown in figure 2.

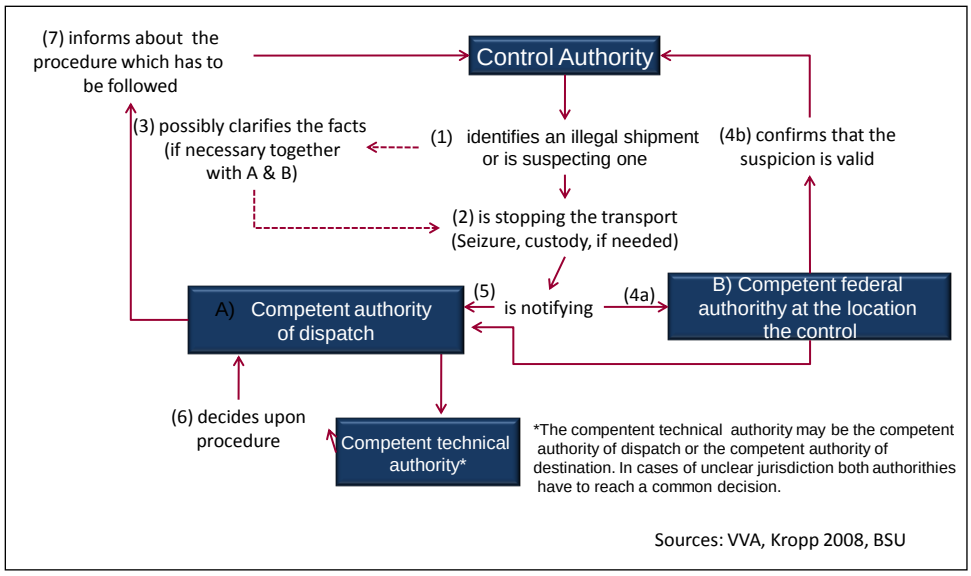

Figure 2: Duties according to AbfVerbrG and Regulation 1013/2006

In the case of Hamburg, the responsible state authorities at the inspection site, the regional authority for environment Behörde für Stadtentwicklung und Umwelt (BSU), the regional water police Hamburg Wasserschutzpolizei (WSP) and customs as the inspecting authorities have agreed that BSU shall initiate and manage the communications with the corresponding state authorities in order to improve pooling of information. In the case of Hamburg, this results in the following communication channels (see figure 3).

decision resides with the responsible authority at the place of destination. If the responsibility cannot be clarified, or cannot be clarified without time-consuming investigations, then both authorities must decide together" [Kropp 2008].

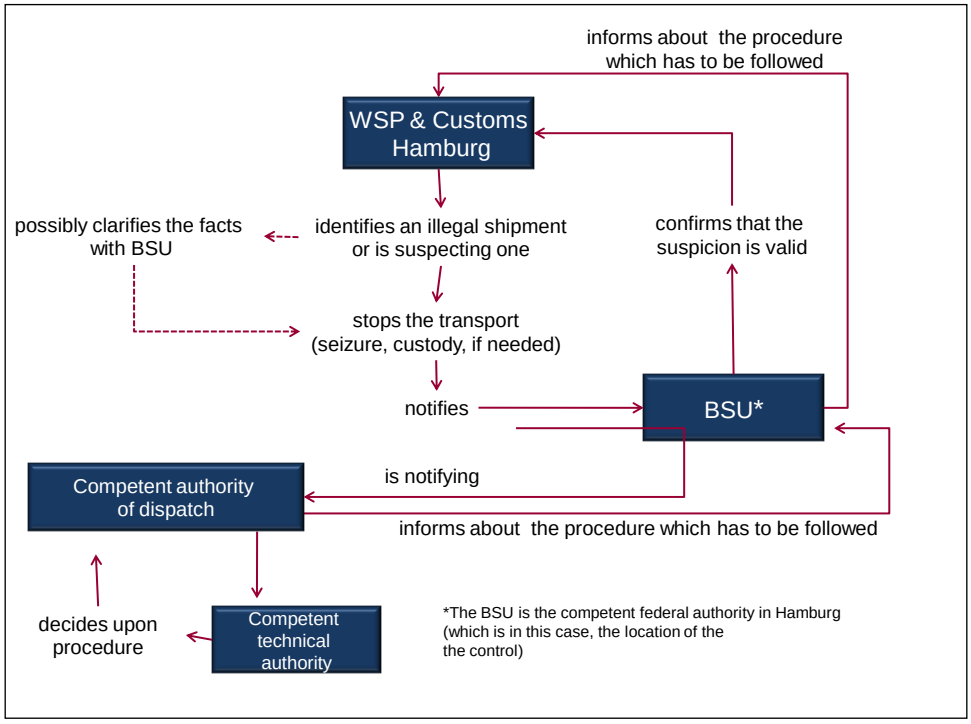

Figure 3: Communication channels in Hamburg

2.4 WEEE Directive and German Electrical and Electronic Equipment Law

Aside from the aims established in Article 1, it is also the intention of the WEEE Directive and its German implementation in the *Elektro- und Elektronikgerätegesetz*, ElektroG (electrical and electronic equipment law) to take into consideration requirements of later disposal and environmentally sound processing, reuse and recycling of equipment at the end of its useful life already in the product design. This Directive and ElektroG apply to the following categories of electrical and electronic equipment:

- Large and small household appliances;
- IT and telecommunications equipment;
- Consumer electronics equipment;
- Lighting equipment;
- Electrical and electronic tools[34];
- Toys, leisure and sports equipment;
- Medical devices[35]
- Monitoring and control instruments;
- Automatic dispensers.

[34] With the exception of large-scale stationary industrial tools.

[35] With the exception of all implanted and infectious products.

Alongside provisions that provide for separated collection and acceptance, they also specify that the best available treatment, recovery and recycling techniques must be used. Such treatment can also be performed outside the European Union, under consideration of Regulation 1013/2006. Nevertheless, in the case of treatment outside the EU, the obligations and targets of the Directive are only considered fulfilled if the exporter can prove that the treatment took place under conditions that are equivalent to the requirements of the Directive.

Paragraph 23 of the preamble of the WEEE Directive states that *"Member States should ensure that inspection and monitoring infrastructure enable the proper implementation of this Directive to be verified, having regard, inter alia, to Recommendation 2001/331/EC […] providing for minimum criteria for environmental inspections in the Member States."*

The WEEE Directive is presently under revision. One of the debated amendments of relevance to this study is the introduction of a provision that shall place the clarification of the property of exported electrical/electronic equipment as waste or non-waste on a legally binding basis. The corresponding annex to the WEEE amendment is oriented along the amended Correspondents' Guidelines No 1[36] and reproduces its essential content.

Material Flows in Germany

According to Germany's reports to the European Commission, approximately 1.8 million t of electrical and electronic equipment was put on the market in 2006 [BMU 2008]. A total of approximately 754,000 t was collected and treated in the system according to ElektroG, of which approximately 19,000 t was in other Member States. In the IT and telecommunication equipment category, approximately 315,000 t was in put on the market and approximately 102,000 t collected and treated in the system according to ElektroG (of which 7,000 t in other Member States) [BMU 2008].

There are no statistics available for the total incidence[37] of WEEE in Germany. In order to approximate the data regarding material flows outside the monitored systems, conclusions must therefore be drawn from other sources. [UNU 2007] determined an average WEEE volume of 16 to 18 kg per inhabitant and year in "old" EU Member States (EU 15). Applying these externally determined figures, one obtains a total WEEE volume in Germany of 1.3 to 1.5 million tonnes per year.

[36] See http://www.bmu.de/abfallwirtschaft/abfallverbringung/doc/39643.php.

[37] Unlike the collected quantities included in the BMU communication to the Commission [BMU 2008].

2.5 Revised Correspondents' Guidelines No 1 for Shipments of Waste Electrical and Electronic Equipment

These guidelines are directed at authorities responsible for implementation of Regulation 1013/2006, and discuss the subject of shipments of waste electrical and electronic equipment. One essential element is the distinction between used equipment and waste equipment. These guidelines are intended primarily as a support for enforcement.

Paragraph 7 of the Guidelines – which, as already mentioned, have no legally binding character – states that, where the holder of the material claims that he intends to ship or is shipping used EEE and not WEEE, the following should be provided to back up this claim to an authority on its request:

"a) a copy of the invoice and contract relating to the sale and/or transfer of ownership of the EEE which states that the equipment is for direct re-use and fully functional;

b) evidence of evaluation/testing in the form of copy of the records (certificate of testing – proof of functional capability) on every item within the consignment and a protocol containing all record information (see below);

c) a declaration made by the holder who arranges the transport of the EEE that none of the material or equipment within the consignment is waste as defined by Article 1(a) WFD; and

d) sufficient packaging to protect it from damage during transportation, loading and unloading."

Paragraph 8 of the Guidelines state that electrical and electronic equipment would (normally) be considered waste if:

"a) the product is not complete - essential parts are missing;

b) it shows physical damage that impairs its functionality or safety, as defined in relevant standards;

c) the packaging for protecting it from damage during transport and loading and unloading operations is insufficient;

d) the appearance is generally worn or damaged, thus reducing the marketability of the item(s);

e) the item has among its constituent part(s) anything that is required to be discarded or is prohibited under community or national legislation[38];

f) the EEE is destined for disposal or recycling instead of re-use;

g) there is no regular market for the EEE (see further indicators); or

h) it is old or out-dated EEE destined for cannibalization (to gain spare parts)."

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38 E.g. asbestos, PCBs, CFCs.

More examples are provided in the annex to the guidelines, which are to make it easier for authorities to distinguish between types of used electrical and electronic equipment. Paragraph 27 of the Guidelines provides that inspections are undertaken by state authorities (e.g. police, customs, and inspectors) at facilities and during the transport.

BSU and the Ministry of Environment Baden-Württemberg[39] have published guidance documents based on the Correspondents' Guidelines. These are intended, *inter alia*, to inform potential UEEE exporters on the criteria that are applied during an inspection of their UEEE.

Since it is still unknown how long it will be until the WEEE amendment is implemented in Germany, and thereby becomes legally binding, the Hamburg BSU has undertaken further action in order to operationalise the requirements of the Correspondents' Guidelines. In this context, a matrix for TV sets and monitors has been developed that should provide inspection authorities with decision aids, based on the criteria functionality/reparability, documents on re-use in the country of destination, type of packaging and the condition of the equipment, to help distinguish between WEEE and UEEE.

It must also be mentioned that at the European level, Regulation (EC) No 2037/2000[40] on substances that deplete the ozone layer includes a prohibition of the trade of CFC-containing refrigerators. This Regulation is being revised, and new requirements are being worked out[41].

3 Quantitative Aspects of Export

This section presents the results obtained from analyzing various statistics. From discussions with parties involved and other publications, it became clear that exports of significant quantities are made above all into the countries Ghana, Nigeria, South Africa, Vietnam, India and the Philippines. Accordingly, focus has been on these countries in the following sections.

3.1 Statistical Systems

Exporters declare their data on goods exported from Germany into other countries[42] to customs using the customs IT system ATLAS, as paper documents, on data carriers and over the Internet. From January to September 2008, approximately 48 % of declarations were submitted in paper form, 33 % via online systems or data carriers, and 19 % directly via ATLAS [DESTATIS 2009]. Given the shift in data flow (see below), the percentage of direct declarations via ATLAS is continually increasing. In the month of October 2008, this was already up to 35 %. Major exporters figure more often among declarations via electronic systems, while the majority of minor exporters make their declarations in paper form.

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39 See .

40 *OJ L 244 from 29/09/2000, p. 1*

41 2008/0165/COD, "Substances that deplete the ozone layer", Strasburg, 25/03/2009.

42 By this, we refer to countries outside the European Union [DESTATIS 2008].

The goods are identified according to the internationally used, six-figure "Harmonized Goods Description and Coding System" (HS), and supplemented with two more digits by the tariff classification and statistical nomenclature of the European Union ("Combined Nomenclature" or CN) [Hoeppner 2005]. In the case of electrical and electronic equipment, the goods codes do not distinguish between used and new goods.

Two significant value thresholds must be taken into consideration when making customs declarations. Generally, in the case of goods to the value of less than € 1,000, the exporters may declare their goods verbally to the respective customs officials. This declaration satisfies the legal customs requirements, and no data is forwarded to the Federal Statistical Office (DESTATIS). If, however, the goods amounting to this value are heavier than 1,000 kg, then the data must still be forwarded to DESTATIS [DESTATIS 2009-1]. In Hamburg, goods to the value of less than € 1,000 are recorded in the ZAPP[43] system belonging to the Hamburger Seehafenverkehrswirtschaft (seaport traffic economy). Communication with the officials involved in the export process is organized in the ZAPP system. In Hamburg these are, for example, the exporter, ship owner, liner agent and broker as well as Ericus customs clearance of the Waltershof customs office for the purposes of export clearance and export monitoring [OFD-HH 2002][44]. The analyses of the export data from these IT systems are presented in Chapters 3.2 and 3.3. Figure 4 illustrates the flow of information between customs and the Federal Statistical Office for 2008.

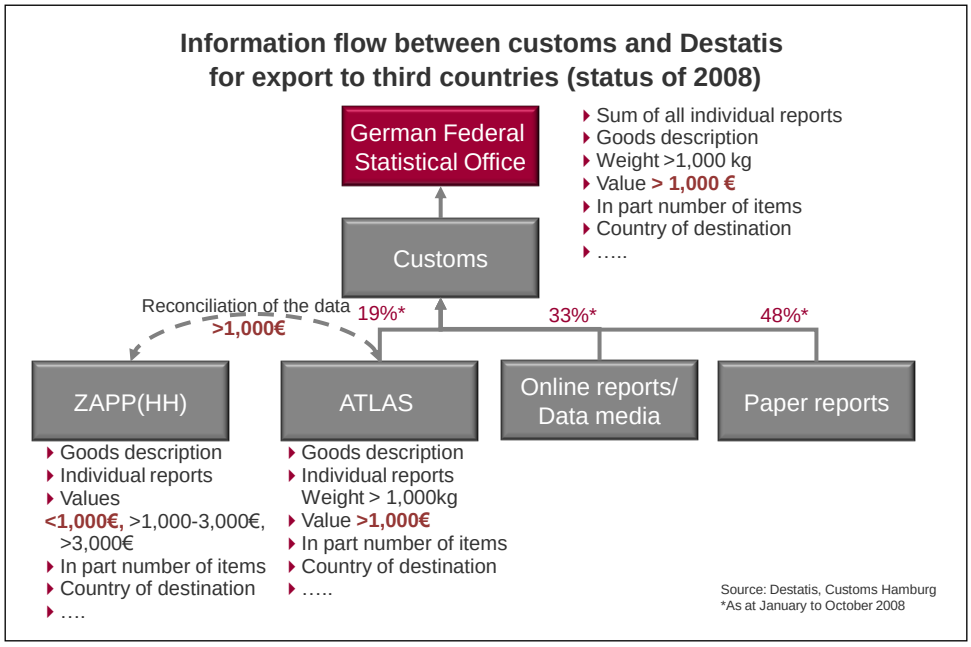


Figure 4: Information flow between customs and DESTATIS up until 31/06/2009

Since 01 July 2009, exports have been declared to the Federal Statistical Office almost exclusively via the ATLAS system. Accordingly, low-valued goods previously recorded in the ZAPP

[43] "**Z**oll **A**usfuhrüberwachung im **P**aperless **P**ort". Goods of greater value are also recorded in this system. These flow into the ATLAS system.

[44] Oberfinanzdirektion Hamburg Hauptzollamt Hamburg-Hafen -Zollamt Waltershof- Abfertigung Ericus- Hamburg, Verbindliche Regeln für die Eingabe zollrelevanter Daten des Hafendatensatzes (HDS)/ der Gestellungsmitteilung (GM01) in ZAPP in drei Teilen, November 2002.

system in Hamburg can also be entered into the ATLAS system [Zoll Hamburg pers.com.]. The ZAPP system will also continue to be used. Figure 5 provides an overview of the now valid procedure.

The data of the Federal Statistical Office were available early on in the project and were analyzed at the end of 2008. The ZAPP data and the Hamburg export data from the ATLAS HH system became available at the end of March 2009 (see Chapter 3.3). The German-wide ATLAS data were provided mid July 2009.

None of the statistics distinguishes between new and used equipment. As a way to derive information relating to the export of used equipment, declared price were referenced in addition to declared quantities, since it can be assumed that the price of exported used equipment is significantly lower than that of new equipment. The basis for this examination was the specific price per kilogram (€/kg).

The statistics are based largely on the exporters' own declarations of the exported goods and their values. Since the declared values are of relevance to the customs duties and involve lengthy verification, it can be assumed that the data regarding values is less precise than the data regarding declared weights, for example.

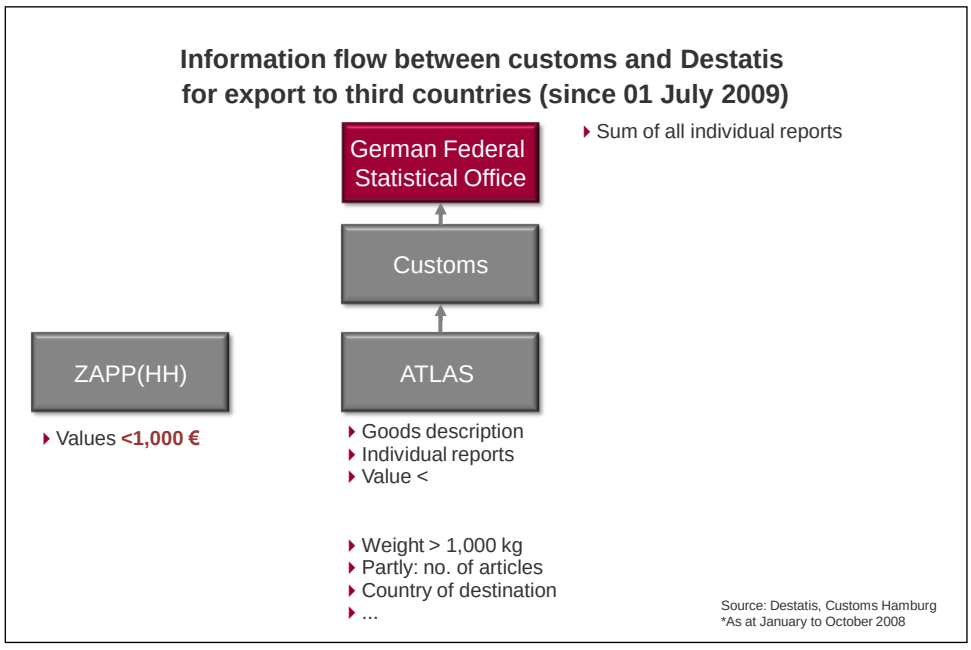


Figure 5: Information flow between customs and DESTATIS from 01/072009

Among the countries of destination, the "Standard International Trade Classification" (SITC) is widely used for foreign trade. Vietnam and Ghana use the SITC, while India, South Africa, the Philippines and Nigeria use the Harmonized System for Goods Classification. Analyses of the data from the countries of destination are presented in Chapter 3.6.

3.2 Data from the Federal Statistical Office (DESTATIS)

The export data in this section are based on data from the Federal Statistical Office of Germany. Accordingly, low-value exports are not included in the data at this stage (See Chapter 3.3 regarding the characteristics of the data systems ATLAS and ZAPP and the corresponding flows of information).

3.2.1 Declared Quantities

Table 3 below summarizes the data from the Federal Statistical Office on export quantities of select goods groups in 2007[45]. According to this source, approximately 22,000 t of electrical and electronic equipment of the 13 goods groups was exported into the 6 selected countries of destination.

Table 3: Export from Germany to select countries of destination (reference year 2007)

Goods code	Plaintext	Ghana	Nigeria	South Africa	Vietnam	Philippines	India
		Weight in t					
WA8415	Air conditioning units	33	32	778	83	46	525
WA8418	Refrigerators, freezers, heat pumps	64	312	791	169	24	517
WA8443	Printing machines and accessories for printing machines	106	722	5.154	754	178	2.875
WA8450	Machines for washing or drying clothes	22	19	358	19	27	49
WA8469	Typewriters, word processing machines	1	-	-	0	1	1
WA8471	Automatic data processing machines	56	152	782	170	24	108
WA8510	Razors, shears with electric motor	0	-	25	-	0	1
WA8516	Electric hot water heaters and immersion heaters	20	56	1.106	3	85	68
WA8517	Telephone sets, telecommunication equipment	10	478	1.234	116	34	1.737
WA8521	Audio/video recording equipment	1	60	6	0	0	0
WA8525	Transmission equipment for broadcast etc., television cameras	1	56	64	24	3	25
WA8527	Receiving equipment for radiotelephone traffic or broadcast	1	4	149	0	0	10
WA8528	Television sets, video monitors	153	787	145	802	1	129
Total		**468**	**2.678**	**10.592**	**2.140**	**423**	**6.045**

[DESTATIS 2008]

3.2.2 Specific Prices

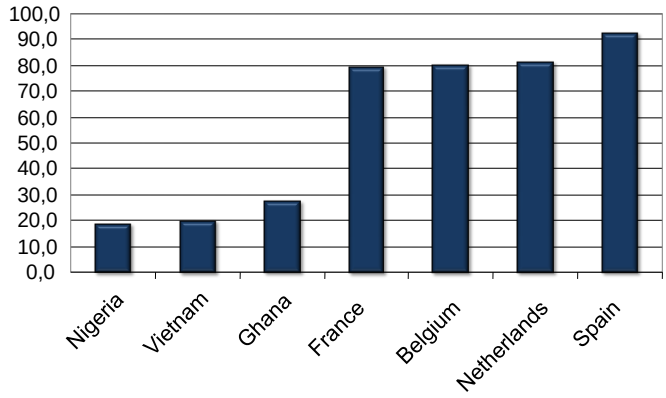
The declared values in the export data from the Federal Statistical Office were analyzed for the selected countries of destination. In order to classify and evaluate the specific price declarations (€/kg) ascertained for the countries of destination, they were compared with the values of exports from Germany to other European Member States.

[45] For details about goods codes and the related equipment, see the Warenverzeichnis für die Außenhandelsstatistik, Issue 2009; or http//:www.destatis.de

When classifying the specific values in an overall context, it must be noted that low-value exports are not accounted for the data from the Federal Statistical Office (see also Chapter 3).

3.2.2.1 Personal Computers

Figure 6 shows specific prices of computers exported out of Germany by country of destination. The average specific price of exports in the EU Member States of interest is ~83 €/kg. This value corresponds relatively well to the average specific price of PCs sold in Europe of ~70 €/kg[46]. The specific prices for the investigated countries of destination reside between 17 €/kg and 27 €/kg.

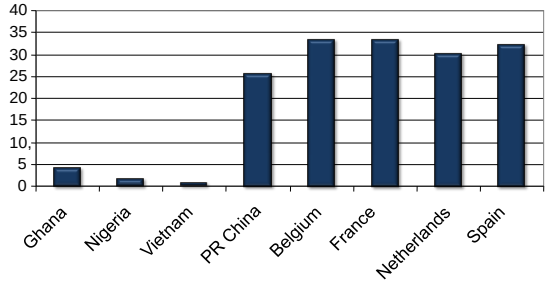


[DESTATIS 2008]

Figure 6: Specific prices of computers exported out of Germany by country of destination (€/kg)

3.2.2.2 Televisions

For television sets / video monitors, the export data from the Federal Statistical Office provides the following picture regarding specific prices (see figure 7).



[DESTATIS 2008]

Figure 7: Specific prices of televisions exported out of Germany by country of destination (€/kg)

[46] This calculation was based on an average PC price of 700 €/piece according to [EITO 2007] and a weight of 10 kg/PC.

It can be assumed that the specific prices of the illustrated **EU Member States** are significantly influenced by high-priced (large format) flat-screen monitors. The average price of CRT TVs sold in Europe in 2007 was € 100 per set [EITO 2007]. At an average weight of 20 kg/piece, this equates to a specific price of 5 €/kg. The average price of screens employing advanced technology (predominantly plasma and LCD screens) was 1,000 €/piece on average. At an average weight of 17 kg/piece, this equates to a specific price of ~60 €/kg.

For the **countries of destination**, there is a relatively widely scattered price/weight ratio with a relatively low coefficient of determination of the relationship between price and weight (see figure 8below). It can be supposed that high-price flat-screens influence the results here, as well.

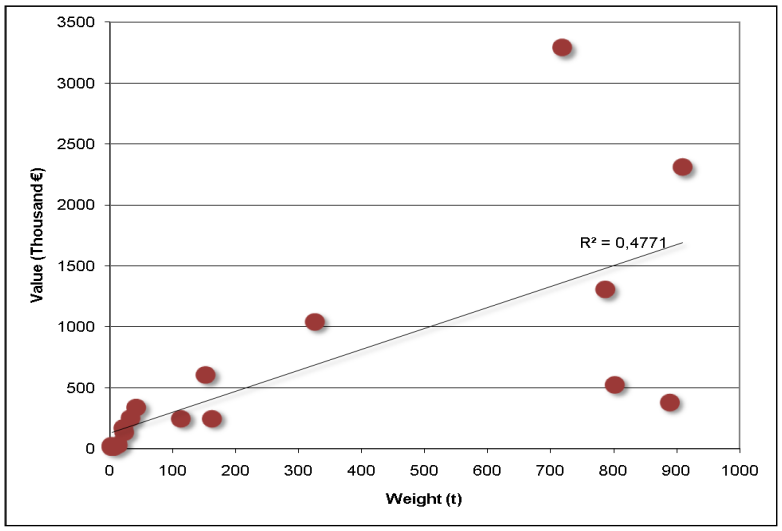
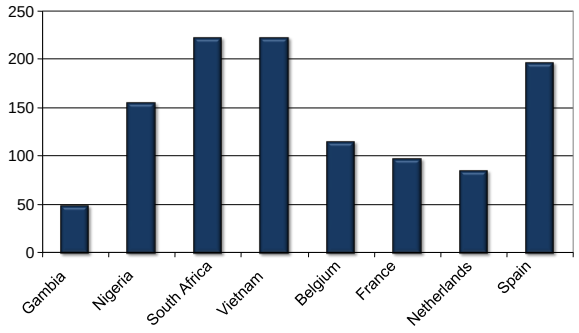


Figure 8: Weight/price ratios of televisions and monitors exported out of Germany for various countries of destination[47]

3.2.2.3 Telephones

For telephones, the export statistics from the Federal Statistical Office reveal relatively large differences in specific prices (see figure 9). The specific prices of exports to Nigeria, South Africa and Vietnam, however, are higher than those to Belgium, France and the Netherlands.

[47] Ethiopia, Burkina Faso, D.R. Congo, Gambia, Ghana, Cameroon, Kenya, Mauretania, Nigeria, R. Congo, Senegal, Togo, Tansania, Hong Kong, Indonesia, Malaysia, Vietnam, Egypt). Data basis: [DESTATIS 2008], [own calculations and illustrations]. The coefficient of determination R^2 is a statistical measure for the declared proportion of variability of a dependent variable Y accounted for by a statistical model. In the case of the linear regression model shown here, R^2 is the square of the coefficient of multiple correlation. The clustering of points near the zero value results from countries that import small quantities at small values.

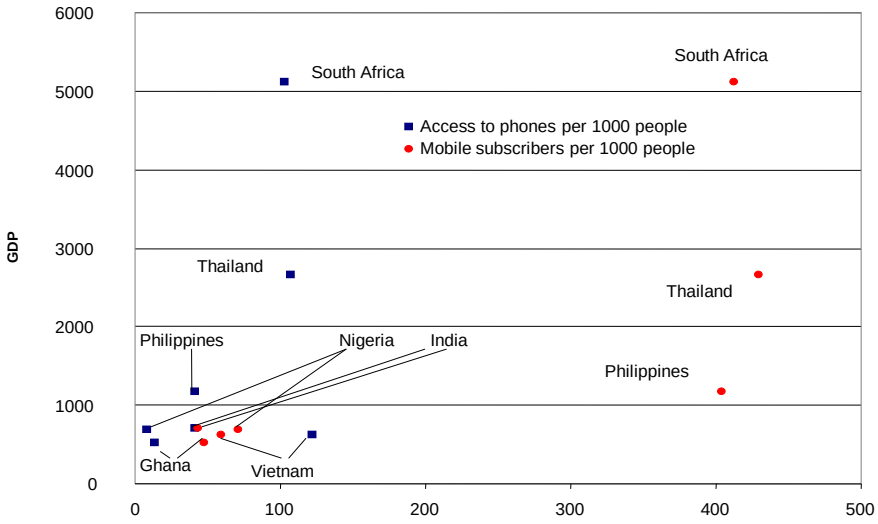


[DESTATIS 2008]

Figure 9: Specific prices of telephones exported out of Germany to other countries of destination (€/kg)

One possible reason for this picture could be that telephone switch boxes are also exported under the same goods code.

The analysis is probably also influenced by the differences in prices and weights between fixed line and mobile phones. The significance of mobile phones becomes clear from data provided by the World Bank on the propagation of mobile phones in the countries of destination which show that, in most of the countries observed, there are more “mobile subscribers” than people with “access to phones” (see Figure 10). It can be assumed that a significant percentage of telephones exported are among the new, mobile technologies, and that there is rather a saturated market for the “old” technologies of fixed line telephones, where the replacement rates for old telephones with new telephones are lower than for (shorter-lived) mobile phones. It can also be presumed that no significant quantities of used mobile phones were exported from Germany to Belgium, France or the Netherlands.

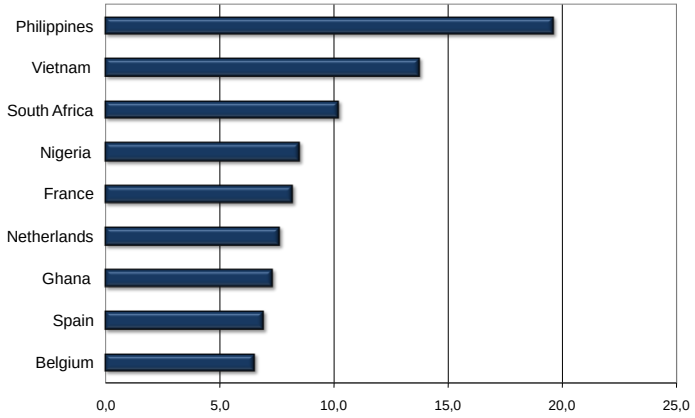


[WDI 2006, own calculations]

Figure 10: Access to mobile and fixed line networks in select countries

3.2.2.4 Refrigerators

The specific values of exported refrigerators and freezers are summarized in figure 11 below.



[DESTATIS 2008]

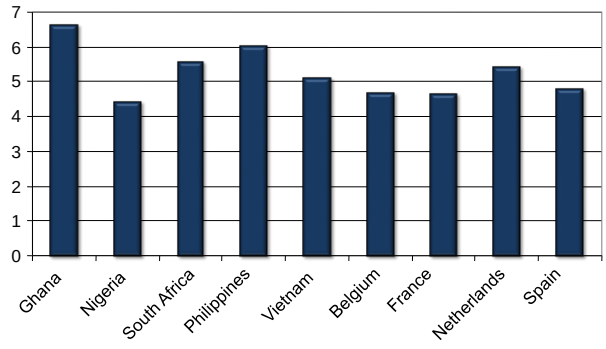
Figure 11: Specific prices of refrigerators and freezers exported out of Germany to other countries of destination (€/kg)

Once again, we see a picture that does not match the patterns determined for other types of equipment (lower valued exports to Africa and Asia). This is probably because higher-priced air conditioning units were also sometimes found to be included under the same goods codes.

The fact that lower-valued exports are not included in the data from the Federal Statistical Office could possibly also affect this (see Chapter 3).

3.2.2.5 Washing Machines

The equipment type “Washing Machines” produced a similarly atypical picture to that of refrigerators (see figure 12).



[DESTATIS 2008]

Figure 12: Specific prices of washing machines exported out of Germany to other countries of destination (€/kg)

The reasons for this atypical pattern are unknown. It is possible that commercial washing machines influence this picture. The fact that lower-valued exports are not included in the data from the Federal Statistical Office could possibly also affect this (see Chapter 3).

3.3 Export Data from Hamburg Port

3.3.1 Description of the Data

In order to make better recordings of the volume flows of UEEE, export data from Hamburg Port was purchased from Dakosy AG. Dakosy AG manages the ZAPP system and has access to the ATLAS system. We were therefore able to obtain data from the ZAPP system as well as the ATLAS data for the city of Hamburg (hereafter referred to as ATLAS-HH).

Both IT systems contain information on transits, i.e. exports, that are only exported via Hamburg, but which originate from other federal states of Germany. Apart from data in Chapter 3.3.4, all depicted data relate only to exports that originated in Germany[48] and were made through Hamburg Port. Exports made through other customs officials are not included.

The data output of DAKOSY AG was divided into the following criteria:

1. Goods code,
2. Country of destination,
3. Number of declarations,
4. Type of packaging,
5. Gross weight of the declaration,
6. Ship name,
7. Value of goods,
8. Description of goods,
9. Year of export.

These criteria are briefly explained below.

1) Goods codes

The data obtained are structured according to the goods codes of the foreign trade statistics. From a total of more than 10,000 codes, 150 were selected (see the Annex to this report in chapter 11.1) that concerned electrical and electronic equipment that was exported predominantly through Hamburg port. For the analysis presented in chapters 3.3, the goods codes were aggregated into groups, for refrigerators and freezers, stoves and ovens, copiers, computers, televisions, monitors and telephones respectively. Given the possible payload of UEEE in used vehicles, seven goods codes for used personal vehicles and caravans were included in the selection.

[48] A comparison of exports from Germany and transits through Germany revealed that the percentage of transit differs between the equipment categories. This was approx. 30 % for refrigerators and freezers and between 2 % and 10 % for the other two equipment categories, based on gross weight.

2) Country of Destination

Based on the analyses of the data from the Federal Statistical Office and from interviews with experts, 53 countries were selected that come into question as countries of destination for the goods codes selected under 1). The list of countries is provided in Annex to this report in chapter 11.2.

3) Number of Declarations

This refers to the number of customs declarations. A customs declaration is defined according to the *Zollkodex-Durchführungsverordnung* (Customs Code Implementing Provision) Art. 4a par. 1 as *"Handling by which a person … announces the intention to move a good in a specific customs procedure"* [BFD 2009].

In the case of the data presented here, it must be observed that one declaration can cover several pieces of equipment as well as the number of outer packaging pieces (see 4 for a more detailed explanation).

4) Type of Packaging

This criterion describes the outer packaging of the goods. This could be containers, crates, cartons, pallets, parcels and much more. Since the packaging may have been included in 3), this factor was required in order to computationally eliminate the outer packaging if necessary in the event of implausible values.

5) Gross weight of the Declaration

This criterion describes the weight of the exported goods. It must be observed here that the gross weight may possibly also include the outer packaging.

6) Ship Name

The name of the ship on which the goods were exported.

7) Value of Goods

In the ZAPP system, the approximate value of the goods must be specified for some declaration types, so as to identify declarations to a value of less than € 3,000 or of less than € 1,000. The value of the declaration was not specified in the ATLAS-HH record provided.

8) Description of Goods

The description of goods is a specification of the goods in plaintext. This could be a highly specific description[49]. The quantity of goods in the individual declaration can also be specified.

[49] There was, for example, one entry under goods code 85183095 "GOODS FOR REPAIR RETURN HEADPHONES" or under goods code 84182191 "USED CFC-FREE REFRIGERATORS".

9) Year of Export

Given the different archiving routines between the ZAPP and the ATLAS-HH systems (18 vs. 6 months), the available data was dated from September 2007 to February 2009 (ZAPP) and from July 2008 to February 2009 (ATLAS-HH). Only the data from 2008 were analyzed.

3.3.2 Method and System of Analysis

Two queries were developed for analyzing the databases. One “Search by Goods Code” and one “Search by Keywords”:

- In the search by **goods code**, the ZAPP and ATLAS-HH databases were searched for 150 relevant goods codes and the selected countries of destination. The queries returned a hit, or a record, if the given goods code appeared together with one of the specified countries of destination in an export consignment.
- The search by **keywords** was performed in order to capture also the volume flows of electrical/electronic equipment that did not fall under the selected goods codes. In the case of all goods codes that were **not** queried in the search by goods code, an additional query was made as to whether the term “old” or the term “used” appeared in the plaintext description of the declaration. A hit was made if one of the terms was included in a declaration for one of the selected countries of destination and the goods code was not included in the first search by goods code. In order to focus the search on used equipment, only exports valued at € 3,000 or less were analyzed.

The data analyses focussed on the aspect of volume relevance. That means, as soon as those countries were identified that made up more than 75 % of the total exports of a group of equipment based on gross weight and/or declarations, no detailed analysis of the remaining countries was made.

Given the data situation described in Section 3.3, it was necessary to have both queries each run on both the ZAPP and the ATLAS-HH system. Only that way could the total statistically recorded quantity of goods exported through Hamburg Port to the selected countries of destination be analyzed. The ZAPP system only archives data for a maximum of 18 months. The ATLAS system only archives data for six months. The data obtained from the ATLAS system were therefore doubled in order to obtain an approximation of the entire year 2008.

3.3.3 Results from the Data Query by Goods Code

3.3.3.1 General Analysis

2,281 records were output on the basis of the selected goods codes for electrical/electronic equipment and for the selected countries of destination for the year 2008. Of these, 1,619 came from the ZAPP system. Of the records from the ZAPP system that contained declared values, 16 % related to declarations valued at >€ 3,000. 78 % resided in the value range between €1,000 and € 3,000, and 6 % in the value range <€ 1,000. 205 records from the ZAPP system contained no declaration of value[50].

The goods in 1,218 of the records from the ZAPP and ATLAS-HH systems are declared as used goods in the plaintext description for customs declaration of the goods. Of these, 950 came from the ZAPP system. Of the records from the ZAPP system that contained declared values, 1 % related to declarations valued at >€ 3,000. 92 % resided in the value range between € 1,000 and € 3,000, and 7 % in the value range <€ 1,000. 268 records from the ZAPP system contained no declaration of value[51].

It must be noted that the number of records cannot be equated with the number of declarations or the quantity of exported equipment. Each record can contain more than one declaration and each declaration more than one piece of equipment.

46 % of the **declarations** in the ZAPP and ATLAS-HH systems related to used goods, and for 54 %, the term “used” was not used in the plaintext description of the goods[52]. The picture becomes clearer from the gross weights declared for those goods that featured the term “used” in the goods description. 78 % (7,700 t) of gross weight falls into this group. Figure 13 and 14 show the results, differentiated according to the databases from which the data originate.

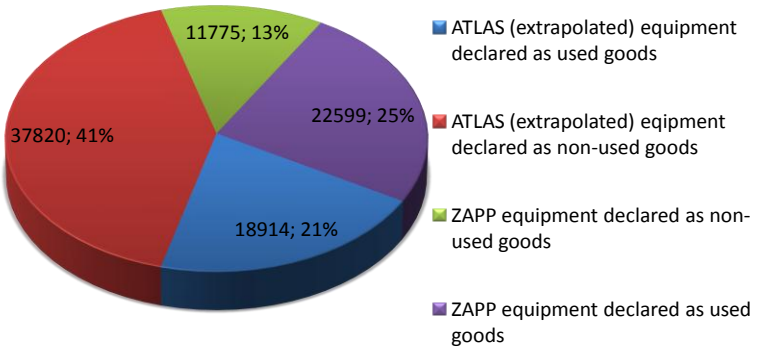


Figure 13: Goods declared as used goods in the respective IT system (reference: number of declarations)

50 The records from the ATLAS-HH system generally contain no value declarations, as illustrated.

51 The records from the ATLAS-HH system generally contain no value declarations, as illustrated.

52 This cannot be interpreted to mean that this must be new equipment, rather it only signifies that the term “used” was not used.

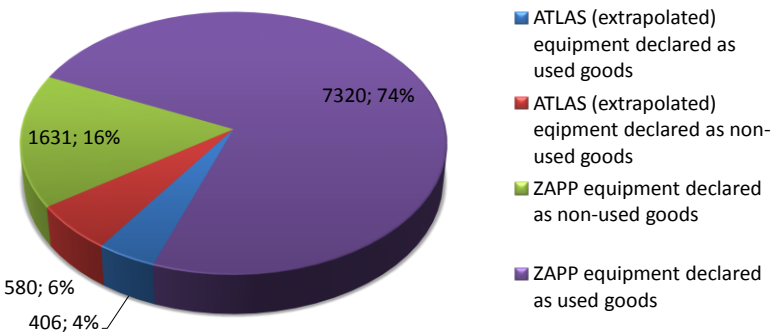


Figure 14: Goods declared as used goods in the respective IT system (reference: gross weight)

It can be seen that the number of declarations of goods not declared as used goods is significantly higher in the ATLAS-HH system than in the ZAPP system. At 74 %, however, the bulk of the weight is made up of used goods from the ZAPP system.

The query by goods code showed that televisions, monitors, ovens, refrigerators and freezers, small appliances and washing machines were quantitatively the most relevant equipment types in the declarations in 2008 (more than 10,000 declarations each). Furthermore, small appliances, washing machines and computers were other equipment types frequently named in the declarations (see also figure 15).

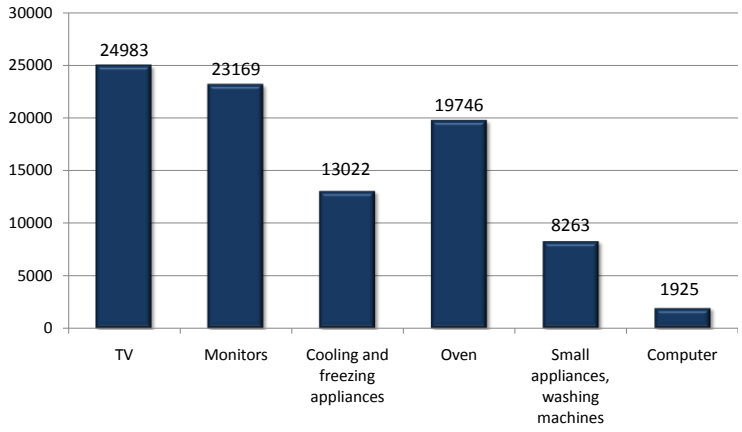


Figure 15: Distribution of declarations over various types of electrical/electronic equipment (reference year: 2008)

Nearly 7,000 t of the declarations were related to televisions. Other equipment types reside around 1,000 t or below 1,000 t (see figure 16).

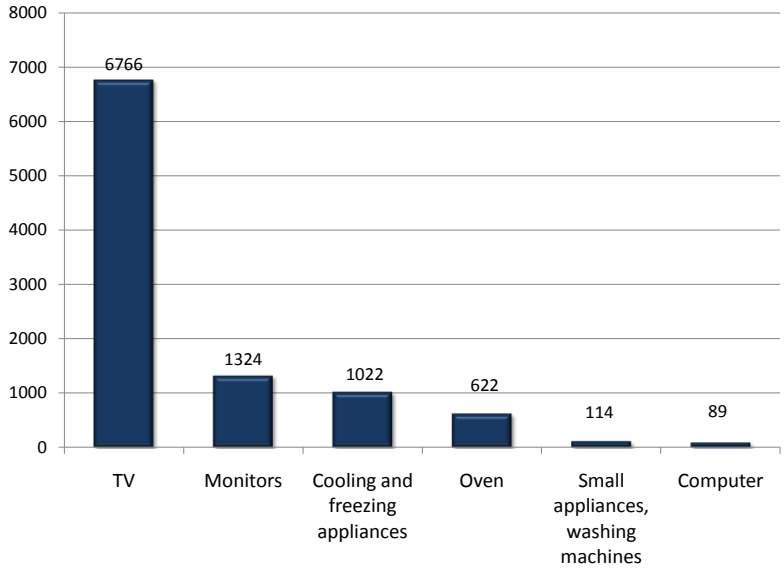


Figure 16: Distribution of gross weight over various types of electrical/electronic equipment (reference year: 2008)

3.3.3.2 Equipment-Based Analysis

Given the large quantity of used electrical and electronic equipment recorded in the ZAPP system, and because reference is only made to the approximate value of the exported electrical or electronic equipment in the ZAPP system, the following analyses are based solely on the data from the ZAPP system. Furthermore, only the equipment types television, monitors, refrigerators and freezers are dealt with, since they make up the bulk of the volume flow.

3.3.3.2.1 Refrigerators and Freezers

In 2008, 862 t of refrigerators and freezers (R&F) were recorded in the ZAPP system as exports through Hamburg Port (see Table 4). R&F made up 75 % of the declarations and 50 % of the gross weight, at a value of less than € 3,000 per declaration. The main countries of destination for these types of equipment were Nigeria and Cameroon (76 % in this value category based on weight). Neither of these countries imported R&F valued at more than € 3,000. Ghana imported only a very insignificant quantity of R&F of greater value.

The data from the ZAPP query did not specify the precise value the exporters had declared for each declaration, rather only specified the value categories, as illustrated. In most cases, however, these are relatively broadly defined (<€ 3,000). An analysis according to specific values (€/kg) would deliver values between 78 €/kg (Ghana) and 1 €/kg (Cameroon) as the maximum values (the minimum values are not meaningfully determinable).

Table 4: Export data returned from the query by goods code in the ZAPP system for refrigerators and freezers

	Number of declarations (minimum)	Gross weight in t	Percentage of declarations	Percentage of gross weight
Total export of refrigerators and freezers (R&F)	**10,114**	**862**	**100 %**	**100 %**
R&F > € 3,000	2,523	429	25 %	50 %
R&F < € 3,000	**7,591**	**433**	**75%**	**50 %**
of which to Nigeria	5,868	233	77 %	54 %
of which to Cameroon	41	96	1 %	22 %
of which to Ghana	1,064	41	14 %	9 %
of which to the remaining countries	618	63	8 %	15 %

The quantity of pieces of equipment was specified for three low-valued export declarations, valued at < € 1,000, to Nigeria (in total 91). If one applies the maximum declared value (€ 1,000 €)[53], then this results in an average value of maximum € 33 per piece of equipment.

3.3.3.2.2 Monitors

In 2008, 947 t of monitors were recorded in the ZAPP system as export through Hamburg Port (see Table 5). Monitors of a value of less than € 3,000 made up 16 % of the declarations and 55 % of the gross weight. The main countries of destination for these monitors were Vietnam and Egypt, which accounted for 30 % of the declarations and 93 % of the gross weight in total. There was no data available on how many of these were valued at less than € 1,000.

Table 5: Export data returned from the query by goods code in the ZAPP system for monitors (MT)

	Number of declarations (minimum)	Gross weight in t	Percentage of declarations	Percentage of gross weight
Total exports	**985**	**947**	**100 %**	**100 %**
MT > € 3,000	830	422	84 %	45 %
MT < € 3,000	**155**	**525**	**16 %**	**55 %**
of which to Vietnam	16	296	10 %	56 %
of which to Egypt	30	203	19 %	39 %
of which to the remaining countries	109	27	70 %	5 %

Of the declarations to Vietnam valued at < € 3,000, the quantity of shipped monitors was specified in the goods descriptions of only three declarations (at a total of 2,700 pieces). The average weight for these declarations was calculated to be 20 kg per piece of equipment. If this weight is then used as the basis for the other declarations as well, then this equates to an exported volume of monitors to Vietnam alone of approximately 14,505 pieces. If one assumes that each declaration is valued at maximum € 3,000, then this equates to a maximum average price of € 3.31 per monitor.

[53] The value of € 1,000 is a category and not the actual value. Accordingly, the value of the goods could vary between € 1 and € 1,000.

3.3.3.2.3 Televisions

In 2008, 6,594 t of televisions were recorded in the ZAPP system of Hamburg Port (see Table 6). Televisions of a value of less than € 3,000 made up 99 % of the declarations and 98 % of the gross weight. The main countries of destination for these televisions were Nigeria and Ghana, which accounted for 92 % of the declarations and 96 % of the gross weight. Of the televisions that were exported to Ghana, the bulk of the volume of sets was also valued at less than € 1,000. Both countries imported no or only an insignificant volume of televisions whose value exceeded € 3,000 per declaration.

Table 6: Export data returned from the query by goods code in the ZAPP system for televisions

Type of EEE/Value of EEE/country of destination	Number of declarations (minimum)	Gross weight in t	Percentage of declarations	Percentage of gross weight
Total exports of televisions (TV)	**17,793**	**6,594**	**100 %**	**100 %**
TV >€ 3,000	132	127	1 %	2 %
TV <€ 3,000	**17,661**	**6,468**	**99 %**	**98 %**
of which to Nigeria	6,317	5,787	36 %	89 %
of which to Ghana	9,852	426	56 %	7 %
of which to the remaining countries	1,492	255	8 %	4 %

7 declarations valued at less than € 1,000 per declaration, amounting to 2,360 sets in total, were recorded in the provided data. The average price per set, assuming each declaration was the maximum value of € 1,000, is € 2.97.

3 declarations valued at less than € 1,000 were declared for export to Nigeria, amounting to 720 sets in total. The average price per set, assuming each declaration was the maximum value of € 1,000, is € 4.17.

3.3.4 Search by Keywords

The results of the database query by keywords include also transits, i.e. quantities from other countries that were merely exported through Hamburg. Based on the number of declarations, the most notable results of this query were televisions, copiers and removal goods[54] (see Table 7).

[54] The Hamburg police pointed out that WEEE/UEEE is also declared as removal good.

Table 7: Export quantities of the most quantitatively relevant goods returned from the query by keywords in the ZAPP and ATLAS-HH systems (reference year: 2008)

Total exports	Gross weight in t
Removal goods	1,227
Copiers	681
Other equipment[55]	381
Televisions	162

The countries of destination for these goods differ for each type of goods. In summary, it can be stated, however, that television sets were shipped primarily to Ghana and copiers primarily to India, Egypt, Thailand and Malaysia. Removal goods are spread relatively evenly over a series of countries, but greater quantities of removal goods were observed moving into China and the United Arab Emirates.

Other types of equipment were exported primarily to Egypt, China, Ghana and Nigeria in 2008.

A detailed analysis reveals that the exports to Egypt were in fact exclusively CRT and TFT monitors, and the exports to China were almost exclusively microwaves (4,611 pieces).

The Ghanaian and Nigerian goods comprised many different types of goods, as Table 8 below shows. The fact that, despite the specification of gross weight, there is no specification of quantity in the declaration is not plausible. However, the reason for such entries could not be explained. The other seemingly implausible entries were payloads [Dakosy pers.com.].

[55] "Other equipment" covers a series of electrical and electronic goods (e.g. clothes irons, vacuum cleaners, laser printers and coffee machines) that figure in relatively low quantities in their respective categories.

Table 81: Examples of exports of "other equipment" to Ghana and Nigeria[56]

Number of declarations	Gross weight (in kg)	Description of goods
Ghana		
0	60	6 gas stoves, used
0	70	1 wood charcoal grill, used
0	2	Camping stoves, gas, used
1	75	Used gas stoves
0	15	1 set 10 kg scales, used
25	375	Printers
0		Printers, used
19	635.93	Used printers
4	48	Fax machines, used
0	300	6 washing machines, used
10	70	Netbooks, used
8	58	Used netbooks
260	3,140	DP units, used PC PIII, PC P4 and server with keyboard, mouse
991	391	Keyboards, as input devices for automatic data processing machines
1216	741.76	Used input or output units
100	35	Hard disk drives, used
324	324	Used drives
79	79	CD-ROM drives, used
0		Clothes irons, used
0	70	1 quick heating hot water tank 80 ltr., used
0		Rice cooker, used
0	200	10 music systems, used
150	750	Used video recorders
0		DVD players, used
572	8,645.32	Used monitors, not with cathode ray tubes, for colour picture
Nigeria		
86	1,270	Used printers
5	50	Used fax machines
2	13,857	166 used netbooks
0	0	Output units for DTP, in this case: monitors, used
30	60	30 loudspeakers, used
210	2,550	190 music systems, used
0		DVD machines, used
50	200	50 TFT monitors, used
0		Monitors for colour picture, used

3.3.5 Summary

In summary, it can be stated that a series of records contained no information on the value categories, and that these could therefore not be analyzed in the country-specific and value-related scenario. Furthermore, the most numerous records were those that contained goods valued between € 1,000 to <€ 3,000. The majority of exports[57] were goods that were not declared as used in their description. Of these values, the majority were also recorded in the ZAPP system.

The exported equipment types that make up the greatest quantities in the ZAPP and ATLAS-HH databases were televisions, refrigerators, freezers and monitors.

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56 From the query by keywords in the ZAPP system.

57 Based on gross weight.

Of the six countries of destination originally focussed on – Nigeria, Ghana, Vietnam, South Africa, Philippines and India –, Nigeria, Ghana and Vietnam imported the greatest quantity of low-valued electronic equipment in the value category <€ 3.000 or <€ 1,000. South Africa and the Philippines did not stand out in any of the analyses. For India, only removal goods and copiers were recorded in significant quantities.

3.4 Used Cars

Since used cars and used caravans (hereafter referred to collectively as "used cars") often contain UEEE as a payload, a separate analysis of the exports of used cars was conducted[58] (see figure 17). In total, 55,159 records were related to goods codes that identify used cars. The results of this analysis include also transits, i.e. quantities from other countries that were merely exported through Hamburg.

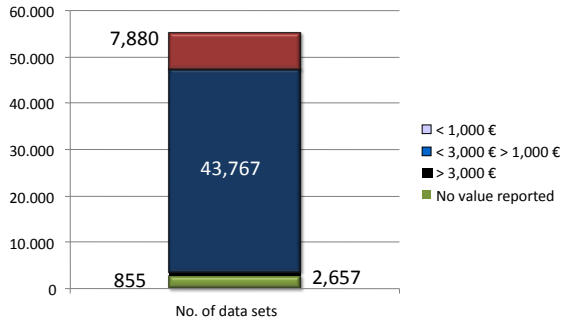

Figure 17: Number of records relating to used cars, according to different value thresholds

The majority of records (79 %) regarding used cars were in the value category between € 1,001 and € 2,999. 14 % were valued at less than € 1,000 and 2 % at € 3,000 or more. 5 % of the used cars were not assigned to an individual value category[59].

[58] In fact, only 17 refrigerators and 28 televisions were identified as used car payloads in the data. While it would have been possible in principle to determine the equipment payloads in a separate query, this would have involved an excessive amount of effort.

[59] The number of records cannot be equated with the number of declarations or the number of exported used cars, since each record can contain more than one declaration and each declaration more than one vehicle.

Table 9: Export of used cars (ZAPP)

	Number of declaration cases (minimum)	Gross weight in t	Percentage of declarations	Percentage of gross weight
Total exports	**153,608**	**71,268**		
of which to Nigeria	115,948	26,285	75 %	37 %
of which to Benin	15,382	15,894	10 %	22 %
of which to Cameroon	2,779	3,082	2 %	4 %
of which to Ghana	4,641	5,707	3 %	8 %
of which to other countries	14,858	20,300	10 %	28 %

According to the information from the ZAPP system (see also Table 9), 71,268 t of used cars were exported in 2008. If one assumes an average weight of 1,000 kg per used car, and one declaration per vehicle, then the number of declarations ought to be of equal magnitude to the tonnage.In reality, however, the number of declaration cases is more than twice this quantity.One reason for this could be that the respective weight of the goods was not always specified upon declaration, and that the quantities given in the ZAPP system are far too low.

Despite this uncertainty in the data, the ZAPP system does reveal a trend of exports to Nigeria, since 75 % of declarations and 37 % of the gross weight were exported to this country.

Table 10: Export of used cars (ATLAS-HH)

	Number of declaration cases (minimum)	Gross weight in t	Percentage of declarations	Percentage of gross weight
Total exports	**5,682**	**3,091**		
of which to Benin	596	700	10 %	23 %
of which to Ghana	3,578	236	63 %	8 %
of which to Nigeria	676	1,132	12 %	37 %
of which to Togo	163	210	3 %	7 %
of which to Cameroon	129	172	2 %	6 %

In the data from the ATLAS-HH system, there was no specification of gross weight in 2,480 of the declarations of used cars destined for Ghana. This is why these declarations amount to only 8 % of the gross weight while they also amount to 63 % of the total number of declarations. The actual weights of the used cars exported to Ghana should therefore be many times higher than the 236 t we see in Table 10 above. The volume of exports to Ghana of 5,707 t as shown in Table 9 also bears out this supposition.

Making an allowance for the abovementioned uncertainty in the data and assuming each used car weighs 1,000 kg, one can assume the number of exported used cars is approximately 70,000.

Experience at Hamburg Port shows that the electrical and electronic equipment exported as payloads in used cars are less frequently white goods and more frequently equipment from the consumer electronics, IT, telecommunications and small household appliances segments. The exported vehicles are often station wagons and vans. Assuming that every second used car ex-

ported contains a payload of used electrical or electronic equipment, one can estimate a total export volume in used cars through Hamburg Port of 3,500 t/a[60].

According to expert estimates, approximately 20 % to 30 % of UEEE exports are made in used cars. Based on this estimate and on the ZAPP/ATLAS-HH data, the total export quantities of the relevant equipment types in used car exports would be 3,000 t to 6,000 t[61].

3.5 Analysis of the German Federal ATLAS Data

Upon analyzing the Federal German ATLAS data according to federal states, equipment groups and countries of destination, it becomes clear that there are considerable regional differences regarding the information on exported volumes (see Table 11).

Table 11: Analysis of the German federal ATLAS data (reference year 2008)

Equipment group	Specific weight (t)	Value (€)	Percent specific weight (%)	Percentage (%)
Selected equipment groups in total	**32,837**	**46,334,252**		
Televisions in total	**138**	**1,172,439**	**0.4 %**	**3 %**
Refrigerators	**141**	**689,340**	**0.4 %**	**1 %**
Monitors	**5,470**	**1,613,387**	**17 %**	**3 %**
Monitors from Bavaria	4,857	501,436	89 %	31 %
Monitors from Bavaria to Egypt	3,121	48,296	64 %	10 %
Computers	**26,748**	**16,260,815**	**81 %**	**35 %**
Computers from Bavaria	24,429	6,115,632	91 %	38 %
Computers from Bavaria to Egypt	13,058	717,775	53 %	12 %
Computers from Bavaria to Tunisia	5,684	952,003	23 %	16 %
Computers from Bavaria to Morocco	3,555	564,836	15 %	9 %

Based on their weight and value, only minor quantities of televisions and refrigerators were declared in 2008. Computers and monitors made up the greatest quantities by weight. The majority of these declared monitors and computers originated from Bavaria (89 % and 91 % respectively). These equipment types were exported primarily to North Africa.

Overall, for the countries of destination focussed on – Nigeria, Ghana, Vietnam, South Africa, Philippines and India –, only very little export quantities were recorded in the individual federal states in comparison to the North African countries and the total volume. Figure 18 below shows the federal states of origin that exported more than one tonne of monitors.

The only export quantities greater than 50 t are to Vietnam, India and South Africa. These originate from Brandenburg in the case of Vietnam, and from Bavaria in the case of India and South Africa. 52 t were declared for export to Vietnam from Hamburg.

The price of monitors exported from Brandenburg to Vietnam was € 3.44 per piece.

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[60] Assuming: 10 pieces of equipment per vehicle and an average combined equipment weight of 10 kg.

[61] This only accounts for the quantities for Hamburg, since it can be assumed that there are relatively few used car exports through other German ports to the select countries of destination.

The picture is more homogeneous for computers. Of these, export quantities greater than 30 t were declared exclusively from Bavaria. A total of 284 t of computers were declared for export to South Africa from Bavaria.

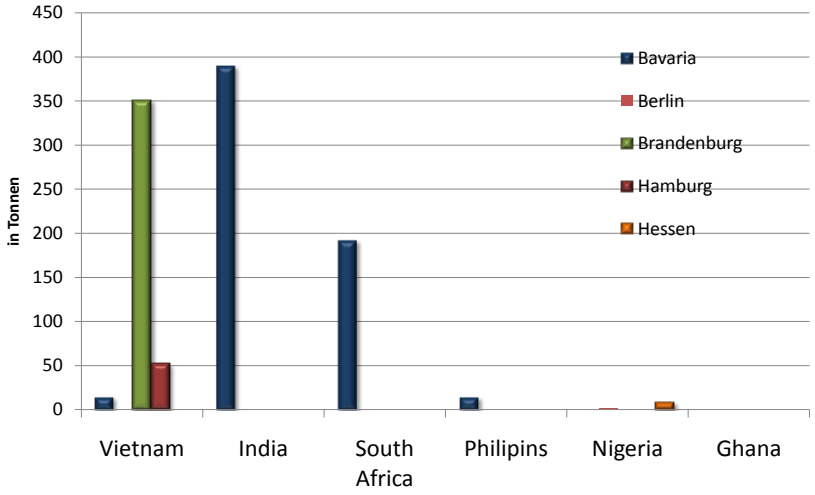

Figure 18: Monitor exports >1 t out of the German federal states to the selected countries of destination

The value of this equipment per piece varies considerably according to the country of destination, but is not always plausible[62]. This is due to the fact that, according to statements from the ministry of finance (Bundesministerium für Finanzen BMF), it is not stipulated that the quantity of pieces of equipment is always specified in the available data [BMF 2009 pers. com.].

In the case of monitors from Brandenburg and Hamburg, the piece price was similarly low to that determined in Chapter 3.3.3.2.2, at 3.44 €/piece and 4.66 €/piece.

3.6 Import Statistics

Wherever available, the import statistics of the countries of destination were analyzed with regard to the same data as the German statistics. In the case of Nigeria (Table 12 and Table 13) there was information on quantities and prices, and for South Africa (see Table 14) there was only information on values. These data are evaluated in Chapter 3.3.5.

[62] The average price per exported computer from Bavaria to South Africa, for example, was € 4,752.

Table 12: Total Nigerian imports of select product groups (reference year 2006)

Goods code	Plaintext	Weight (t)	Value (€)	€/kg
WA8415	Air conditioning units	41,724	52,419,181	1.26
WA8418	Refrigerators, freezers, heat pumps	105,547	58,373,305	0.55
WA8443	Printing machines and accessories for printing machines	72,087	290,279,235	4.03
WA8450	Machines for washing or drying clothes	15,783	2,450,057	0.16
WA8471	Automatic data processing machines	399,777	134,530,407	0.34
WA8516	Electric hot water heaters and immersion heaters	297,622	19,616,052	0.07
WA8517	Telephone sets, telecommunication equipment	4,081	90,908,720	22.28
WA8521	Audio/video recording equipment	124,577	5,879,726	0.05
WA8525	Transmission equipment for broadcast etc., television cameras	79,654	235,746,864	2.96
WA8527	Receiving equipment for radiotelephone traffic or broadcast	128,120	22,258,748	0.17
WA8528	Television sets, video monitors	1,617,026	51,133,790	0.03
Total		**2.885.999**	**963.596,085**	**0.33**

(Data basis [NBS 2008 pers.com.], own calculation)

The quantities imported from Germany according to the Nigerian statistics are shown in Table 13 below.

Table 13: Nigerian imports of select product groups from Germany (reference year 2006)

Goods Codes	Plaintext	Weight (t)	Value (€)	€/kg
WA8415	Air conditioning units	250	1,266,546	5.07
WA8418	Refrigerators, freezers, heat pumps	41,438	1,499,668	0.04
WA8443	Printing machines and accessories for printing machines	5,849	7,143,154	1.22
WA8471	Automatic data processing machines	65,684	5,098,886	0.08
WA8517	Telephone sets, telecommunication equipment	1,980	18,240,274	9.21
WA8521	Audio/video recording equipment	22,945	325,644	0.01
WA8525	Transmission equipment for broadcast etc., television cameras	17,878	1,173,474	0.07
WA8527	Receiving equipment for radiotelephone traffic or broadcast	30,713	276,862	0.01
WA8528	Television sets, video monitors	349,738	2,307,553	0.01
Total		**536,475**	**37,332,061**	**0.07**

(Data basis [NBS 2008 pers.com.], own calculation)

What stand out here are the very large quantities declared for some equipment types, such as WA8528 television sets and video monitors at a quantity of 349,738 t or WA8471 automatic data processing machines at a quantity of 65,684 t.

Sources in Nigeria [Osibanjo, Oboro pers.com.] and country reports [BAN 2005] estimate the quantities of imported used PCs to Nigeria at approximately 4,000 t/a. The imports to Ghana can be estimated at a comparable basis at 2,000 t to 3,000 t. The percentage of those coming from Germany could not be quantified for these two countries.

Table 14 summarizes the value declarations for South African imports of select product groups from Germany.

Table 14: South African imports of select product groups from Germany (reference year 2006)

Goods code	Plaintext	Value (€)
WA8415	Air conditioning units	3,829,659
WA8418	Refrigerators, freezers, heat pumps	2,990,898
WA8443	Printing machines and accessories for printing machines	28,044,640
WA8450	Machines for washing or drying clothes	985,660
WA8469	Typewriters, word processing machines	883
WA8471	Automatic data processing machines	58,267,712
WA8516	Electric hot water heaters and immersion heaters	5,302,982
WA8517	Telephone sets, telecommunication equipment	52,288,894
WA8521	Audio/video recording equipment	65,357
WA8525	Transmission equipment for broadcast etc., television cameras	111,350,335
WA8527	Receiving equipment for radiotelephone traffic or broadcast	762,320
WA8528	Television sets, video monitors	1,937,031
Total		**265,826,371**

3.7 Comparison of Declared Quantities

The statistics from the Federal Statistical Office (DESTATIS) state a total export quantity of 22,344 t for the selected groups of goods and the selected countries of destination in 2007.

The data from the ATLAS database state corresponding export quantities of 32,837 t for 2008.

The Hamburg ZAPP database states export quantities for the selected groups of goods and countries of 8,951 t for 2008.

In the ATLAS-HH system, 986 t were recorded for the goods codes and countries investigated in 2008.

A comparison of the declared quantities from ZAPP and ATLAS for Hamburg shows that lower valued goods are systematically undervalued in the data from DESTATIS. Table 15 below compares data from the ZAPP system with the corresponding data from the foreign trade statistics by way of example.

Table 15: Comparison of select ZAPP data with corresponding data from the Federal Statistical Office (reference year 2008)

	IT system	DESTATIS 2008	ZAPP	
	Area	Germany	Hamburg	
	Represented value range	> 1.000 €	<3.000 €	DESTATIS minus ZAPP
	Units	Tonnes (t)		
Refrigerators and freezers to Nigeria		144	233	-89
Televisions to Nigeria		3,000	5,787	-2,787
Televisions to Ghana		174	426	-252
Monitors to Vietnam		840	421	419

For refrigerators and freezers, the data from the ZAPP system records almost double the quantity recorded in DESTATIS. It is a similar picture for televisions. Only for monitors to Vietnam were significant percentages of exports valued above € 3,000 seen alongside the quantities valued <€ 3,000.

Table 15 shows all quantities for Germany in total[63]. The ZAPP data listed in the table describe only exports through Hamburg Port valued <€ 3,000. It must also be observed that the reference weights are different. The data from DESTATIS specify specific weight. The ZAPP data, on the other hand, could only be analyzed according to gross weight[64].

While the illustrated declarations from the ZAPP data account more precisely for low-valued goods than the data from DESTATIS, they still underestimate the goods of very low quality:

- It is to be assumed that an excessive proportion of export declarations made on paper documents were not picked up in the performed analysis[65]. Paper documents were used more frequently by small exporters in the past (see also Chapter 3.3). In 2008, ~40 % of declarations were made on paper.
- The query by goods code also does not capture quantities that were declared without goods codes or with inapplicable goods codes. In the query by keywords, records that did not contain the keywords in the plaintext descriptions were not captured.
- There was also the possibility of verbal customs declarations for values of <€ 1,000 and weights <1,000 kg per declaration.

Table 16 below compares, as an example, Nigeria's declarations of quantities for imports from Germany with the declarations from the Federal Statistical Office on exports to Nigeria.

Table 16: Comparison of import and export declarations for Nigeria based on the Nigerian import statistics and the German foreign trade statistic

Goods code	Plaintext	Nigerian imports from Germany		German exports to Nigeria	
		Weight (tonnes)	Value (Euro)	Weight (tonnes)	Value (Euro)
WA8471	Automatic data processing machines	65,684	5,098,886	295	11,132,000
WA8443	Printing machines and accessories for printing machines	5,849	7,143,154	532	17,036,000
WA8527	Receiving equipment for radiotelephone traffic or broadcast	30,713	276,862	4,7	402,000
WA8528	Television sets, video monitors	349,738	2,307,553	326	1,004,000
WA8517	Telephone sets, telecommunication equipment	1,980	18,240,274	61	10,042,000
WA8415	Air conditioning units	250	1,266,546	52	877,000
WA8418	Refrigerators, freezers, heat pumps	41,438	1,499,668	407	1,948,000
WA8469	Typewriters, word processing machines	8	235,000	**n/a**	**n/a**
WA8525	Transmission equipment for broadcast etc., television cameras	17,878	1,173,474	83	18,504,000
WA8521	Audio/video recording equipment	22,945	325,644	4	152,000

[63] That means this includes such quantities that were exported through other border checkpoints and which are not included in the Hamburg-related statistics (e.g. exports from Antwerp and Rotterdam as transit ports).

[64] The gross weight can include information on the outer packaging.

[65] This can happen when query routines do not find the information that was copied from paper into the IT systems.

It can be seen that the German export statistics consistently show significantly lower quantities. Two essential factors possibly influence this data picture:

- The Nigerian import statistics also include new equipment. From the analyses of the data on the situation in Hamburg Port, the specific values of the exports lead one to assume that these relate above all to used equipment. The export of new equipment (of the selected groups of goods) plays a minor role in the available data. It is possible that transit goods that passed through Hamburg Port play a role in the Nigerian import statistics. There are no indications of a significant data gap with regard to new equipment made in Germany.
- In regard to the absolute quantities of the imports to Nigeria, it must be observed that the Nigerian ports are also important import sites for imports into other African countries, where Nigeria plays the part of a transit country only.

Table 17: Comparison of import and export data: Ghana (reference year 2006)

Goods code	Plaintext	Imports out of Germany according to data from country of destination			Exports into countries of destination according to data from Federal Statistical Office		
		Weight (t)	Value (€)	€/kg	Weight (t)	Value (€)	€/kg
WA8415	Air conditioning units	100	159,608	1.60	38	320,000	8.42
WA8418	Refrigerators, freezers, heat pumps	1,157	613,765	0.53	97	1,243,000	12.81
WA8443	Printing machines and accessories for printing machines	107	458,580	4.29	77	1,132,000	14.70
WA8471	Automatic data processing machines	303	898,189	2.96	35	1,024,000	29.26
WA8517	Telephone sets, telecommunication equipment	27	249,659	9.25	1	126,000	126.00
WA8521	Audio/video recording equipment	410	464,903	1.13	3	33,000	11.00
WA8525	Transmission equipment for broadcast etc., television cameras	20	379.700	18.99	3	589,000	196.33
WA8527	Receiving equipment for radiotelephone traffic or broadcast	376	374.656	1.00	2	95,000	47.50
WA8528	Television sets, video monitors	3,391	1,029,731	0.30	147	374,000	2.54

There is a similar picture for Ghana as for Nigeria, although without the extreme differences in declared quantities (see Table 17). There is even a similar trend for the value declarations as with the statistical comparison for Nigeria. Overall, the picture confirms the suspicion that the exported volumes are systematically underestimated, and the reason for this is exports of low value, which according to the data from the countries of destination make up significant volumes.

Possibly, the bigger differences in the case of Nigeria can be taken as indicator that the volumes exported to Nigeria were of very low value, e.g. because Nigeria has an essential function as transit country for imports into other African countries.

Table 18: Comparison of import and export data: South Africa (reference year 2006)

Goods code	Plaintext	Imports out of Germany according to data from country of destination			Exports into countries of destination according to data from Federal Statistical Office		
		Weight (t)	Value (€)	€/kg	Weight (t)	Value (€)	€/kg
WA8416	Air conditioning units	342	5,298,922	15.49	890	16,124,000	18.12
WA8418	Refrigerators, freezers, heat pumps	749	4,157,191	5.55	561	7,369,000	13.14
WA8443	Printing machines and accessories for printing machines	3,051	38,798,562	12.72	1,795	40,316,000	22.46
WA8471	Automatic data processing machines	1,319	80,624,538	61.13	1,523	138,437,000	90.90
WA8517	Telephone sets, telecommunication equipment	831	72,388,484	87.11	332	69,395,000	209.02
WA8521	Audio/video recording equipment	5	90,424	18.08	5	923,000	184.60
WA8525	Transmission equipment for broadcast etc., television cameras	941	154,133,324	163.80	711	184,634,000	259.68
WA8527	Receiving equipment for radiotelephone traffic or broadcast	33	1,084,737	32.87	189	20,778,000	109.94
WA8528	Television sets, video monitors	157	2,704,278	17.22	70	4,919,000	70.27

There is a different picture for South Africa (see Table 18). Here, the information from the Federal Statistical Office shows bigger volumes in 4 of 9 cases. However, the specific prices are also higher in the German export statistics here.

Table 19: Comparison of import and export data: India (reference year 2006)

Goods code	Plaintext	Imports out of Germany according to data from country of destination			Exports into countries of destination according to data from Federal Statistical Office		
		Weight (t)	Value (€)	€/kg	Weight (t)	Value (€)	€/kg
WA8415	Air conditioning units	538	5,300,393	9.85	370	5,894,000	15.93
WA8418	Refrigerators, freezers, heat pumps	547	4,611,553	8.43	1,008	9,116,000	9.04
WA8443	Printing machines and accessories for printing machines	5,175	70,698,321	13.66	5,329	121,609,000	22.82
WA8471	Automatic data processing machines	405	21,900,350	54.07	287	25,590,000	89.16
WA8517	Telephone sets, telecommunication equipment	495	28,749,939	58.08	275	28,016,000	101.88
WA8521	Audio/video recording equipment	22	394,154	17.92	0	163,000	
WA8525	Transmission equipment for broadcast etc., television cameras	64	10,409,120	162.64	643	20,137,000	31.32
WA8527	Receiving equipment for radiotelephone traffic or broadcast	64	1,979,997	30.94	7	9,074,000	1.296.3
WA8528	Television sets, video monitors	88	2,450,879	27.85	54	5,180,000	95.93

For India (see Table 19), the Indian import statistics also only give higher volumes than the German export statistics for 6 of 9 goods codes. The specific values are also higher except for one goods code.

Table 20: Comparison of import and export data: Philippines (reference year 2006)

Goods code	Plaintext	Imports out of Germany according to data from country of destination			Exports into countries of destination according to data from Federal Statistical Office		
		Weight (t)	Value (€)	€/kg	Weight (t)	Value (€)	€/kg
WA8415	Air conditioning units	17	206,563	12,15	28	592,000	21.14
WA8418	Refrigerators, freezers, heat pumps	56	682,076	12,18	32	950,000	29.69
WA8443	Printing machines and accessories for printing machines	55	1,455,026	26,46	36	1,567,000	43.53
WA8471	Automatic data processing machines	18	1,911,097	106,17	35	11,237,000	321.06
WA8517	Telephone sets, telecommunication equipment	594	29,220,480	49,19	28	6,936,000	247.71
WA8521	Audio/video recording equipment	2	118,808	59,40	0	83,000	
WA8525	Transmission equipment for broadcast etc., television cameras	3	501,922	167,31	488	27,916,000	57.20
WA8527	Receiving equipment for radiotelephone traffic or broadcast	0	3,261		0	164,000	
WA8528	Television sets, video monitors	0	25,476		1	197,000	197.00

For the Philippines (see Table 20), again, the volumes specified by the Federal Statistical Office are lower, with the exception of three cases. The specific values are higher in all comparable cases except for one in the DESTATIS statistics.

3.8 Summary

For the selected goods groups (see Table 21 below) that proved to be of significant volume for this study, estimates of the export quantities out of Germany were derived on the basis of the available statistics.

Table 21: Investigated goods groups[66]

Goods code	Plaintext
WA8415	Air conditioning units
WA8418	Refrigerators, freezers, heat pumps
WA8443	Printing machines and accessories for printing machines
WA8450	Machines for washing or drying clothes
WA8469	Typewriters, word processing machines
WA8471	Automatic data processing machines
WA8510	Razors, shears with electric motor
WA8516	Electric hot water heaters and immersion heaters
WA8517	Telephone sets, telecommunication equipment
WA8521	Audio/video recording equipment
WA8525	Transmission equipment for broadcast etc., television cameras
WA8527	Receiving equipment for radiotelephone traffic or broadcast
WA8528	Television sets, video monitors

[66] For details about goods codes and the corresponding equipment, see the Warenverzeichnis für die Außenhandelsstatistik, Ausgabe 2009 or http//ec.europa.eu/taxation_customs/dds/tarhome_de.htm.

Total volume: In the year under report, alongside ZAPP and ATLAS, 33 % of declarations were recorded from data carriers / online declarations and 48 % from declarations in paper form. Taking into account the volumes recorded in ZAPP (8,951 t) as well as the volumes that were probably exported as payloads in used cars (20 % of the volume for the reference year), one obtains – in a maximum variant – a total export volume of **216,000 t** (2008). If it is assumed – in a minimal variant – that a greater percentage of the total export volume is recorded in ATLAS, then by the same calculation route, one obtains a total export volume of **93,000 t** (2008) (weighted averaged of the variants: **155,000 t**).

The value and goods analyses showed that the exported equipment can hardly be new equipment. The very low price and the results of various export inspections show that a significant proportion was equipment in very bad condition. An indeterminable volume was illegally shipped as used equipment when it was in fact waste equipment. It is assumed that the bulk of the waste equipment from the 155,000 tonnes did not pass through the system according to the Electrical and Electronic Equipment Law (ElektroG).

By comparison: In 2006[67], 1.8 million tonnes of new equipment were put on the market in Germany. The volume collected in the system in accordance with ElektroG was 754,000 t [BMU 2008].

Value of the exported equipment: Detailed analyses of the statistics from Hamburg Port regarding the values of the export declarations lead one to assume that the volume-relevant exports of the studied goods codes consisted primarily of used equipment, even in the case of the derived "best-case estimates"[68]. Even in these cases, the prices seen were still low, such as € 3 per video monitor, € 4 per television or € 20–30 per refrigerator or freezer. Yet, the actual value will certainly not match the best-case scenario, and will be significantly lower.

Exported Mixture of Equipment: When differentiating according to equipment types, an additional, significant data uncertainty arises because, presumably, the customs declarations were not made as differently in every case as one would expect from the contents of the export containers. The results of container inspections revealed, for example, that there was not always a precise distinction between televisions and video monitors in the declarations. Given undifferentiated declarations, it is the small appliances (e.g. consumer electronics) that tend to be underestimated, and equipment that is exported in smaller quantities per declaration (e.g. PCs). The high total quantity of relevant declarations must be taken into account here (e.g. approx. 600,000 in 2008). The volumes of smaller appliances are also underestimated because they are more frequently payloads in used cars than are large appliances.

Two variants of the mixture of equipment were therefore developed for the calculation. In Variant 2, the percentage of exported small appliances was increased in comparison to the specifications in the customs declarations (see also figure 19 below).

[67] No monitoring data according to ElektroG exists for the year 2008.

[68] There is substantial uncertainty in the data regarding the actual declarations of values, since no specifications were made on this in the provided ZAPP data, rather only value ranges for each declaration (e.g. <€ 3,000 per declaration). It was therefore only possible to make a best-case estimate, in that the highest possible value was assumed.

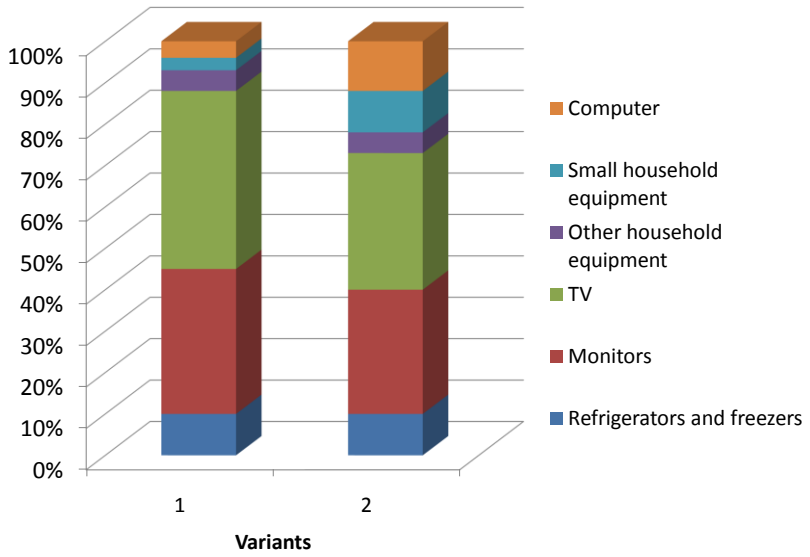

Figure 19: Variants of the exported mixture of equipment

The volume of exported **refrigerators and freezers** in the studied countries of destination is probably to the order of 15,000 t per year, taking into account the volumes not represented in the export statistics. Different sources estimate the present-day percentage of waste refrigerators that are CFC-free at 10 % to 30 % of the total incidental volume [Becker RAL pers. com., UBA pers. com., Weigelt pers. com.]. It is presumed that the volume of CFC-free refrigerators arising in Germany in 2008 was less than 10,000 t/a. Based on this assumption, it can be presumed that relevant volumes of CFC-containing refrigerators were exported.

The export volume of **monitors**, in the averaged variant, is approximately 50,000 t (weighted average; range: 28,000 t to 76,000 t); this equates to about 2 million pieces. For this type of equipment, again, this can hardly be new equipment, rather a significant proportion must be equipment in very bad condition. **By comparison**: In Group 3 (IT and telecommunications equipment), a total of 315,000 t was put on the market in Germany in 2006, and 102,000 t collected separately in the system according to ElektroG.

Note: It must be noted that the exported quantities and the mixture of equipment are probably significantly influenced by innovation cycles in the countries of dispatch. In 2008, CRT screens (monitors, televisions) were the most relevant equipment type exported in terms of weight, which was significantly influenced by the replacement of CRT screens with flat-screens. Inasmuch, the view of 2008 can only be regarded as a “snapshot”.

4 Situation in the Countries of Destination

4.1 Approach

The situation in the countries of destination was investigated firstly by direct contact with people on location, and secondly by analyzing country reports and other subject-related literature.

4.2 Nigeria

4.2.1 Treatment Situation

The Nigerian Harmful Waste Decree No. 42 of 1988[69] restricts the import of wastes for recycling and final disposal. Recoverable wastes may only be imported with an approval from the Nigerian ministry for the environment [Basel 2006-1]. According to the Nigerian ministry for the environment, no approvals were applied for [BAN 2006]. According to [BAN 2006], there is no special legislation related to WEEE[70]. According to the Bundesagentur für Außenwirtschaft (Office for Foreign Trade), the Nigerian Federal Executive Council had announced import restrictions for waste electrical and electronic equipment in 2008 [BFAI 2008]. Whether concrete measures followed this announcement is unclear. According to [Basel 2006-1], there are no official installation specialized specifically on the recycling of electrical and electronic equipment. There are (clinical) waste incineration plants as well as plastic and paper recycling facilities.

According to [Oboro pers.com.], about 500 containers with electrical and electronic equipment reach Nigeria every month. He estimates that approximately 400,000 used computers are imported every month. Of these, only about 25 % to 75 % are functional [Osibanjo, Oboro pers.com, BAN 2005]. About 45 % of the equipment comes from Europe and the USA each and 10 % from Asia. About 95 % of the computers imported into Nigeria are used [Osibanjo 2009].

There are two major trans-shipment centres for electrical and electronic equipment, the “Alaba market” and the “Computer village”, both in Lagos. All types of equipment are imported. Explicitly named were refrigerators, mobile phones, microwave ovens and computers. Reference was also made to the importance of equipment imported in used cars.

As a rule, the equipment is directly delivered to the dealers. These have their own grading system according to which they evaluate the supplied equipment. Equipment that can be repaired is repaired immediately or sold to people who repair the equipment [Adesanya pers.com, Osibanjo pers.com]. Irreparable equipment is sold to scrap dealers, who are attributable to the informal sector [Adesanya pers.com]. Useful fractions are obtained using very simple means, such as breaking open the cases and burning off the cable sheathing [Osibanjo pers.com]. There are no laws of any kind in Nigeria prohibiting this approach. In order to change this situation, it would be necessary to raise awareness of the problem in Nigeria [Osibanjo pers.com].

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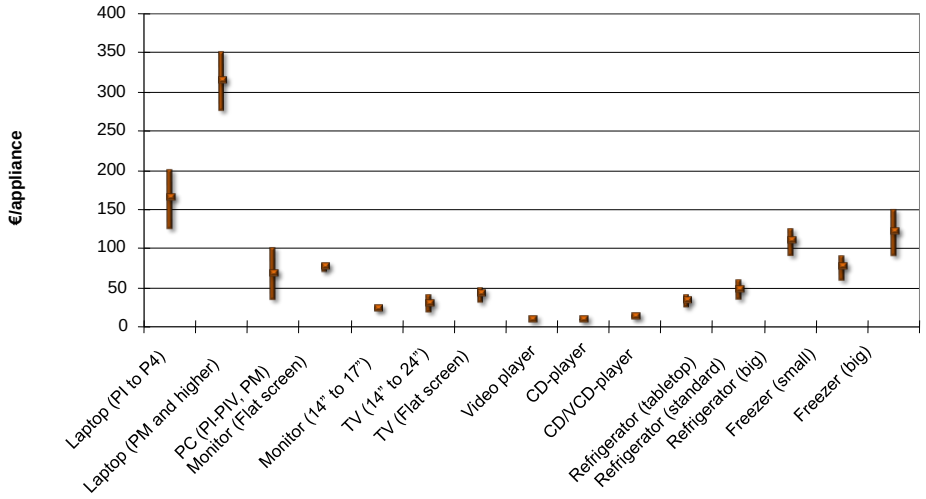
69 See http://www.unep.org/padelia/publications/comp3Nigeria.pdf.

70 This is still of no consequence since no equipment is imported as WEEE.

4.2.2 Pricing Situation for the Sale of Equipment and Components

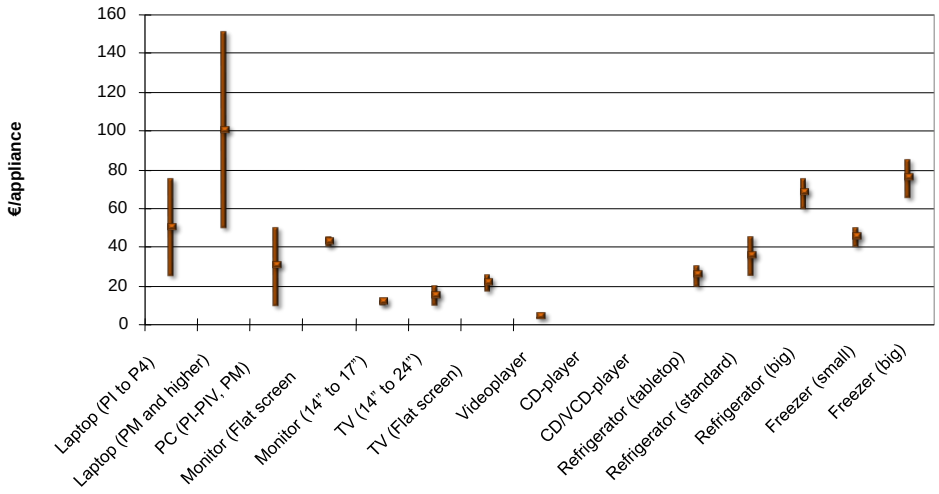
Research was conducted February and March 2009 on the prices of used equipment and components on the markets in Lagos, Nigeria. Since there is a relatively broad range of qualities available, a distinction was made between equipment in good quality and equipment of low quality. The results are summarized in Figure 20 and Figure 21 as price ranges per piece of equipment. It must be noted that the prices drift over the years, and are also influenced by global market prices or raw materials. Inasmuch, the situation presented here must be regarded as an isolated "snapshot" of the beginning of 2009.

In the low-qualities group, the average price for PCs was € 30 and for CRT monitors was € 10. CRT televisions cost € 15 on average and refrigerators (medium size) € 35.



(Data basis [Adesanya 2009 pers.com.])

Figure 20: Prices for different types of electrical and electronic equipment in Lagos (good quality)

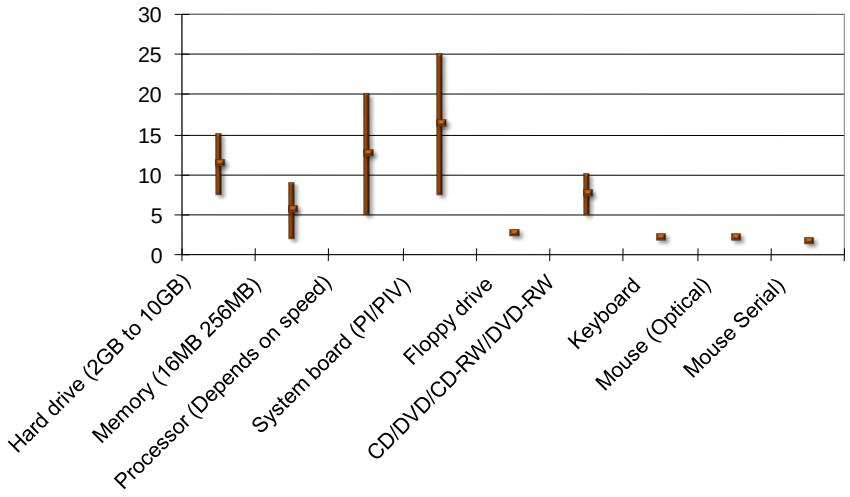


(Data basis [Adesanya 2009 pers.com.])

Figure 21: Prices for different types of electrical and electronic equipment in Lagos (low quality)

Imported non-functional equipment is also sold at the markets. The prices, however, vary more greatly between vendors and buyers than those for functional equipment. In one case, non-functional CRT monitors were reported to be priced between 1 €/piece and 3 €/piece.

More research was conducted on the prices of components from electrical and electronic equipment on the Lagos market (see Figure 22). It was seen that relatively high prices were attained in some cases in comparison with the European market. RAM modules of 256 MB, for example, were sold for as much as € 10, motherboards (P IV) for up to € 25.



(Data basis: [Adesanya 2009 pers.com.])

Figure 22: Prices of used components from electrical and electronic equipment in Lagos

4.3 Ghana

According to [Basel 2006-2], there is no direct waste-related legislation in Ghana other than the Basel Convention, which has still not been effectively implemented yet [Anane, pers.com.]. According to [Basel 2006-2], there are no relevant final disposal or recycling facilities for electrical and electronic equipment apart from one plant for recycling lead from car batteries.

The centre for handling electrical and electronic equipment in Ghana is the Agbogbloshie Market in the capital Accra, at which many little workshops for dismantling UEEE exist [Greenpeace 2008]. More workshops are scattered throughout the entire country [Greenpeace 2008].

About 300 containers of UEEE/WEEE reach Ghana every month, according to [Anane pers.com.], and the trend is increasing. Primarily computers, televisions and monitors are imported into Ghana through the ports of Tema. These pieces of equipment often still bear stickers from the original owners. Most European equipment comes from Germany, the Netherlands and the United Kingdom. Some of the equipment from the Netherlands is purchased by civic amenity centres. About 75 % to 80 % of the imported UEEE/WEEE cannot be reused. The transport appears not to be the cause of the faultiness of the equipment, since the traces on the casing resemble signs of wear from normal use more than damage in transit [Anane pers.com.].

The Ghanaian must pay for the containers in the port upon arrival of the containers, and generally have no opportunity to test the goods. There are apparently also cases in which containers are directly taken for dumping. At markets such as that of Agbogbloshie, the valuable materials

such as aluminium and copper are manually separated from the worthless materials such as plastic. [Anane pers.com.] explains that this manual dismantling also involves breaking open the cases and burning off the plastic sheathing of copper cables.

Side Note – Destination Inspection

Some third countries such as Nigeria and Ghana employ Destination Inspection (DI) instead of Pre-Shipment Inspection (PSI). Taking Nigeria as an example, the following article by [*Marfels* 2006] explains this procedure:

"With effect from 1 January 2006, the Nigerian government abolished the Pre-Shipment Inspection (PSI) system previously in operation and replaced it with a Destination Inspection regime for imports. *According to the new regulations, goods imported into Nigeria are no longer inspected by inspection agencies of the country of origin, rather are subject to inspection only upon arrival in the ports of entry of the country of destination. Traditionally, PSI was supposed to prevent, by documents officially issued in the country of origin, goods declared below value or declared as inferior from reaching the country, thereby evading the actual corresponding duties and taxes. One significant reason for this changeover is the magnitude of corruption that had grown under the old regime in the customs clearance of the country of destination.*

The implementation of a Destination inspection regarded as advanced in developing countries generally involves setting up modern scanning methods and risk assessment systems by international inspection agencies. In the process of introducing such systems, import transactions are commonly divided into different risk groups. That way, customs authorities and inspection agencies can concentrate on deliveries evaluated as a higher risk, while at the same time, customs can be sped up by low-risk imports through so-called "green channels". […] Alongside the national customs authorities, three international inspection agencies are also commissioned with introduction and performance […], namely Swiss agency Cotecna, SGS and Global Scan. It must be clarified with the importer in each case which company must perform the inspection on site."

4.4 South Africa

There is no special legislation regarding WEEE in South Africa. The National Environmental Management: Waste Bill of 2007, however, does affect the handling of WEEE, since, in addition to establishing a national waste information system, it also prescribes concepts for producer responsibility and for acceptable pollution through the collection and recycling of waste.

The Second-Hand Goods Bill of 2008 aims to regulate the business of dealers in second-hand goods and pawnbrokers, in order to limit trade in stolen goods, and to promote ethical standards in the second-hand goods trade [Finlay, Liechti 2008].

Computer reconditioners import between 20,000 and 100,000 computers per year to South Africa, and about 60,000 used mobile phones [Finlay, Liechti 2008]. More precise figures regarding UEEE/WEEE are not known, since the customs statistics do not distinguish between used and new equipment [Finlay, Liechti 2008, Ecroignard pers.com.] and the import statistics provided reveal only total values (see Chapter 3.6). There is said to be a good network between European exporters and South African importers and recyclers [Ecroignard pers.com.]. Donated computers pose one of the biggest problems, since they are usually too old (< Pentium 4) to be of further use [Ecroignard pers.com.].

Figure 23 shows the interplay between the formal and informal sector, taking the chain of parties involved for refrigerators, washing machines, microwaves, televisions, stationary computers, printers and mobile phones.

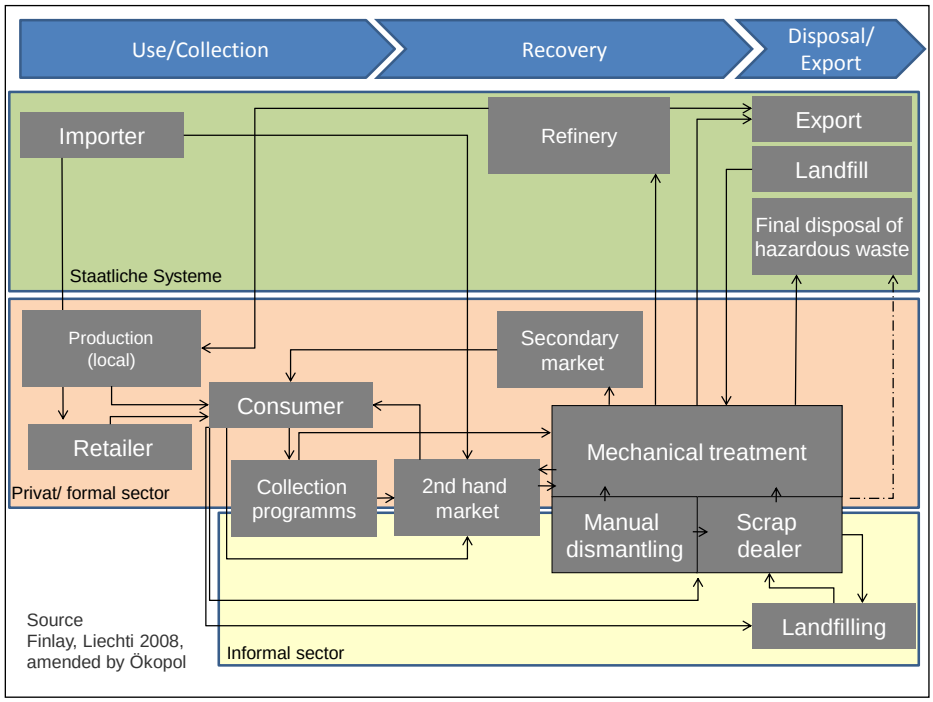


Figure 23: WEEE flow chart for select product groups in South Africa

It is estimated that there are roughly between 40,000 – 50,000 informal recyclers in South Africa who deal, among other things, with WEEE. This handling includes burning off cables to obtain the copper and dismantling CRT televisions.

In the formal sector, plastics are, according to [Finlay, Liechti 2008], recycled in various fashions (e.g. in furniture or construction materials) [Ecroignard pers.com.]. Computer circuit boards are brought to smelters to extract precious metals. Computer circuit boards, nonferrous metals and plastic are also exported, according to [Ecroignard pers.com.]. Computer circuit boards are, for example, exported to Belgium to Umicore (thermal treatment) and to Singapore (wet chemical treatment). Parts are exported to China for further manual separation of plastic and copper. Finlay and Liechti deem it possible that the quantity of imported used computers and the quantity of exported fractions from computers (metals, circuit boards and plastics) are balanced so that the problem of domestic treatment is not so serious in the countries of destination, at least in relation to these fractions [Finlay und Liechti 2008].

Material fractions for which no market exists, such as batteries, plastic and cathode ray tubes, are stored or deposited [Finlay und Liechti 2008]. Where, only a minor percentage even of hazardous substances are disposed of at appropriately designed disposal sites. According to Ms. Ecroignard, the recycling of CRT and plasma televisions, mercury-containing light bulbs, and plastics that contain bromated flame retardants is not yet sufficiently clarified or controlled. Furthermore, there is still no depollution of refrigerators, and coolants leak uncontrolled on the scrap yards.

4.5 India

Between 50,000 t/a and 478,000 t/a of UEEE/WEEE/e-scrap is imported into India each year [Rochat et al. 2008, E-Scrap 2009]. The rate of increase of these imports is given at 10 % per

year [E-Scrap 2009]. The majority of this (approx. 80 %) originates from the USA and about 20 % from Europe [Krishna pers.com.].

[Schreiber pers.com.] reports of cases in which pre-treatment is conducted in India, in order to export the material subsequently to another Asian country [Krishna, Schreiber pers.com.]. There is now a large, informal recycling sector in each of Delhi, Mumbai, Chennai and Bangalore [Rochat, Krishna, Schreiber pers.com.], which recycles about 95 % of the UEEE/WEEE or the fractions obtained from processing WEEE [Schreiber pers.com.].

Mixed scrap batches cost about 31 €/t. For older equipment that contains even more precious metals payment is done sometimes per appliance [Krishna pers.com.].

The contents of containers or their destination or purpose are often incorrectly declared. The container contents are declared as steel scrap, where they in fact contain UEEE/WEEE. Often, UEEE/WEEE has been declared as donations for schools, without this ever reaching any school. Mainly computers and printers are imported, and also monitors, mobile phones, audio systems, motherboards and circuit boards [Krishna, Schreiber pers.com.].

Corruption is said to be a major problem in this sector, in particular at ports and in customs [Krishna, Schreiber pers.com.]. Aside from sea routes, there is also said to be an important land trade route that runs from Dubai, via Pakistan, to Delhi [Krishna pers.com.]. The equipment was imported by import/export firms and then sold to wholesalers, who in turn the equipment into batches and then sell or auction these to the informal sector [Krishna, Schreiber, Venkatesh pers.com.]. A large number of jobs depend on the informal sector.

Copper, silver and gold are extracted using wet-chemical processes and acid leaching [Krishna, Schreiber pers.com.]. The recovery rate for precious metals from circuit boards is around 20 %, but it is enough to be profitable in the informal sector [Krishna, Schreiber pers.com.]. Gold is mainly destined for the Indian jewellery market [Venkatesh pers.com.]. Details on the recycling techniques are given in Table 22.

Table 22: Dismantling and recycling techniques in the informal sector

Component	Dismantling and recycling techniques
Monitors	Manually using screwdrivers and pliers; unusable monitors are pulverized with hammers
Processors and other gold-containing components	Manually using screwdrivers, hammers and pliers. Gold extraction by chemical stripping at river banks and open wastewater channels using hydrochloric and sulphuric acid
Circuit boards	Removal of functional components, copper recovery by open burning
Printers	Motors reused in toys
PVC-insulated cables	Burn-off or manual stripping of the insulation
Hard disks	Manual separation of individual components, melting of metals
Capacitors	Open burning for metal recovery
Plastics	Reduction to small pieces and low-temperature melting for re-use in low-quality products (downcycling)
Toner cartridges	Toner cartridges frequently cleaned with old toothbrushes without any breathing protection. Plastic casings are sold for filling or melting down

[Subramanian 2007, E-Parisaraa 2007]

Only primary products of the Indian market are actually repaired or re-used in appreciable quantities; non-functional imports serve only for recycling [Krishna pers.com.].

In recent years, partly due to an Indian-German-Swiss partnership[71], two processing plants were opened in which UEEE/WEEE processing can be monitored and processed according to certain guidelines[72]. These plants are E-Parisaraa Ltd. in Bangalore and Trishyiarya Recycling India Private Ltd. in Chennai. A third plant with a capacity of 12,000 t per annum is currently being built in Hardiwar [Lalchandani 2008] near Delhi.

These plants process equipment from the country's local producers and from official collection points, but not equipment from imports. The informal sector is said to be very well organized, so that some manufacturers still sell their equipment to this sector in spite of these plants [Krishna pers.com]. Furthermore, it can happen that even the formal sector passes equipment down to the informal sector, or that the applicable methods are not followed entirely [Schreiber pers.com]. Reasons for this include "the fact that volumes are not coped with, that knowledge or sensitivity are not yet sufficiently developed, and that the development of downstream recyclers is taking a long time to get underway" [Schreiber pers.com.].

Figure 24 below provides an overview of the collection and recycling infrastructure in India.

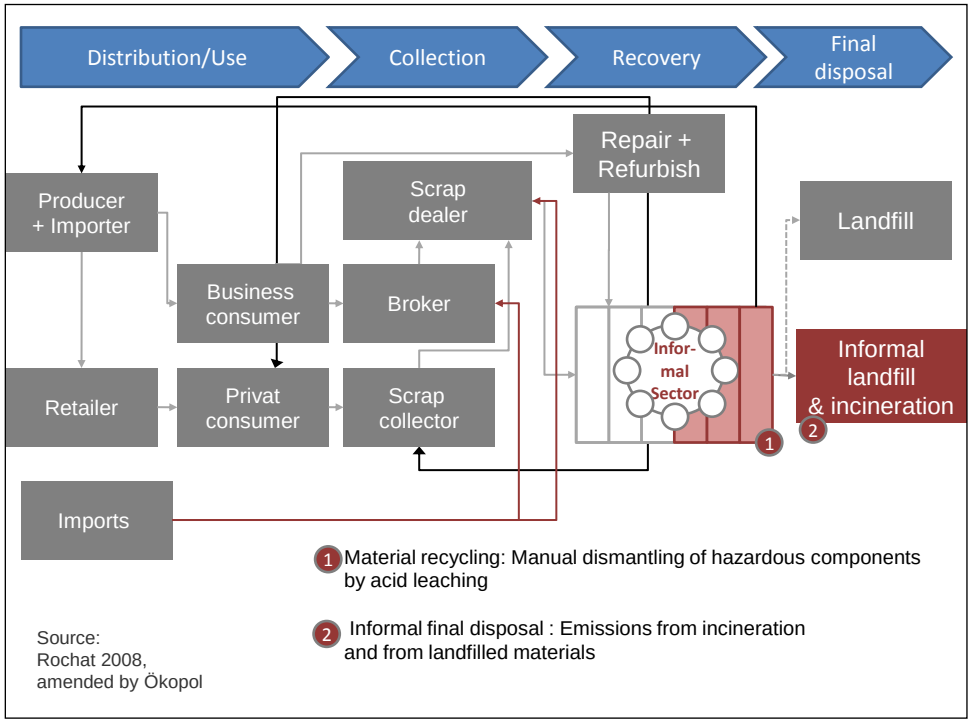


Figure 24: WEEE flow chart for select product groups in India

According to [Rochat pers.com], the situation in the big cities in India is essentially comparable with the contents of the chart. There are apparently certain differences, however, that need to be taken into account. Since Delhi is the "capital" of the informal recycling of UEEE/WEEE and of fractions from WEEE, many informal recyclers sell the dismantled equipment directly to Delhi

71 See http://www.ewa.co.in/index.html.

72 See http://www.cpcb.nic.in/e_Waste.php.

for further processing. Seeing as Chennai and Mumbai are port cities, the percentage of imported UEEE/WEEE is probably greater there than in other cities [Rochat pers.com].

Certified plants dismantle and recycle primarily used electrical and electronic equipment from information technology (76 %), telecommunications (12 %) and consumer electronics (7 %) [Seemann et al 2008]. Cases are pulverized, granulated and mixed with primary plastics in order to produce new cases or cable conduits. The quality loss this involves is said to be immaterial for the Indian market. Certain flows are put into storage, probably to be dumped or used as landfill later, e.g. coatings from cathode ray tubes, dust and residue from pulverization, coatings of fluorescent tubes and dry-cell batteries. Circuit boards are apparently transported to Umicore in Belgium. Prerequisites for this are a high percentage of recyclables in the circuit boards and a high market price for the metals [Schreiber pers.com].

For materials that originate from certified operations in India and are dumped, it would also be generally conceivable to organize return logistics, even if it would be necessary to pay for the recycling in Europe. This would only work, however, if the revenues from the recyclables cushion this appropriately. At current prices, this would not be possible [Schreiber pers.com].

4.6 Philippines

In Philippine legislation, there have so far been no specific regulations on WEEE or any distinction between used electrical and electronic equipment and WEEE [UNCTAD 2006].

The Interim guidelines for the importation of recyclable materials[73] containing hazardous substances (DAO 94-28)[74] allow the import of electronic parts and scrap under the condition that written approval is obtained from the Department of Environment and Natural Resources (DENR) and under the condition that hazardous residues from recycling that cannot be re-used in the Philippines are sent back[75]. The handling of hazardous wastes is regulated in the Procedural Manual on the Guidelines on Hazardous Wastes Management[76], and according to [Rativo 2008] WEEE shall also be included in the waste catalogue of this manual in future.

Mainly used computers and household appliances are imported and either repaired and resold or recycled in processing plants [Rativo 2008].

There are two processing plants for UEEE/WEEE, one that pulverizes or reconditions computers and one that extracts nonferrous metals and precious metals. Although the capacities of these firms would actually not be adequate to process the incident wastes from this sector, one of the firms was on the brink of giving up because considerable volumes are exported to other Asian countries, such as China, Taiwan or Thailand [Garcia 2006].

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[73] "Recyclable material" is defined as "any material which is re-used following its original use, for any purpose of commercial, industrial, agricultural or economic value".

[74] See http://www.emb.gov.ph/laws/toxic%20substances%20and%20hazardous%20wastes/dao94-28.pdf.

[75] However, no hazardous wastes may be exported from the EU to the Philippines.

[76] See http://www.emb.gov.ph/hazardous/index.htm.

4.7 Vietnam

All import of hazardous wastes, including UEEE/WEEE is legally prohibited in Vietnam[77]. Only temporary imports for re-export, including wastes, are allowed [Basel 2006-3, Yen pers.com.]. According to [Yen pers.com.], UEEE/WEEE also only enter the country as transit, and are then forwarded on to China, for example. This type of input is only possible with approval from the Vietnamese Ministry of Industry and Trade.

There are about 20–30 approved plants that may recycle hazardous wastes. Other recycling is limited according to [Basel 20006-3] to paper, plastic, metals and glass, which may be performed by small recycling communes in the north of Vietnam. There is a series of disposal sites and (clinical) waste incineration plants in Vietnam. According to [Ahn 2007], there are no treatment plants for WEEE or processing guidelines for handling WEEE. A series of illegal imports of monitors, refrigerators and washing machines into Vietnam were discovered in 2007 [Ahn 2007].

For the South East Asian region, the Asian Network for Prevention of Illegal Transboundary Movement of Wastes[78] exists, initiated by the Japanese government and is recognized by the Basel Convention, which documents the progress of the implementation of the Basel Convention, delivers background material and has a total of 11 South East Asian countries as members[79].

4.8 Other Countries

In addition to the abovementioned countries, telephone and written contact was made with Indonesia, Malaysia and Thailand[80]. The BCRC[81] of Indonesia only responded generally to the questionnaire and communicated that the import of hazardous wastes including UEEE/WEEE is legally prohibited and the nationally incidental WEEE is for the most part informally recycled. Furthermore, Indonesia exports WEEE and computer circuit boards in particular, mainly to Japan. There is no legal distinction made between UEEE and WEEE in Indonesia [Jinhui, Nana 2008].

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77 See Decree No 12/2006/ND CP ND-CP at http://www.dncustoms.gov.vn/web_Eglish/english/nghi_dinh/59_ND_CP_12_06_2006.htm and http://www.dncustoms.gov.vn/web_Eglish/english/btm/04_TT_BTM_06_04_2006.htm.

78 See http://www.env.go.jp/en/recycle/asian_net/about.html.

79 Cambodia, China, Hong Kong, Indonesia, Malaysia, Philippines, Republic of Korea, Singapore, Thailand, Vietnam and Japan.

80 This contact was predominantly written, since the large time difference made telephone contact difficult, and the telephone connections were generally of very bad quality. Malaysia and Thailand did not respond. Details on the persons and institutions contacted are given in Appendix 11.1. Furthermore, one Chinese-Malaysian company was contacted that apparently installs used cathode ray tubes into new television casings. The General Manager confirmed the written answers to some questions, but reacted no further than this.

81 Basel Convention Regional Centre.

4.9 Summary

Analysis of the treatment situation in the countries of destination showed that, in most cases, no infrastructure for treatment exists that is even remotely comparable with the infrastructure that the European Member States regard, for themselves, as the minimum standard of environmental and health protection[82].

In some countries of destination (e.g. South Africa or India), processing and recycling plants do exist for certain types of equipment and fractions from the processing of equipment. Nevertheless, there appear to be no management or control mechanisms effectively established that ensure the imported equipment actually makes it to these plants.

The highly manual dismantling of equipment often achieves good separation of the materials in the first stage of the recovery chain. This, however, only applies to fractions that can generate sufficient returns on the respective regional market. This dismantling is essentially done by the informal sector. In African countries, especially, the degree of organization of the informal sector is low. As a result, the market access for selling fractions is very strongly dependent on local conditions. The prices that can be reached on the global market for fractions obtained from dismantling WEEE are therefore often difficult to carry over. The discussions and research showed that market access for such fractions is becoming an increasingly significant factor for the future development of waste management.

As concerns resources, the most relevant problem is above all equipment that contains relatively large amounts of raw materials that cannot be recovered or cannot be marketed in the existing treatment infrastructures of the countries of destination, or for which the environmental consequences of recycling are most particularly problematic. This is above all equipment containing circuit boards and nonferrous metals that are present in low concentrations inside components (e.g. gold in circuit board components).

The recovery rates for precious metals or rare earths are generally lower in the recycling methods employed in the most significant countries of destination than in the state-of-the-art methods according to European standard. The recovery of ferrous metals is classified as less problematic.

[82] Here we refer above all to the Waste Framework Directive (Directive 2008/98/EC of the European Parliament and of the Council of 19/11/2008 on waste and repealing certain Directives, OJ L312 of 22/11/2008) and the WEEE Directive.

In light of the treatment infrastructures in the countries of destination, risks to human health and the environment can be posed in the four following areas:

- Treatment steps in which a mechanical disassembling involves destruction of the material structures (e.g. the smashing of cathode ray tubes);
- Hazardous substances which are contained in the products and which might be emitted e.g. by thermal processes. The quantity and number of these substances are reduced through the ecological optimisation of the products within the scope of manufacturers' activities and the limitation through the RoHS-Directive from 2007. The use of such equipment as used equipment in the destination countries takes place, however, time-delayed (commensurate with the service life in Germany);
- Auxiliary products from separation and/or recycling processes (e.g. liquids and sludge from leaching);
- Substances which result from the handling or recycling (e.g. PCDD/F with thermal processes).

With the last two points, a modification of the processes in the countries of destination is necessary if a level of protection comparable with Europe is to be achieved.

The reduction of hazardous substances in newly produced electrical and electronic equipment taking place currently is an important step in reducing the environmental and health risks from treatment, also in the countries of destination. In addition, it is however, necessary also to incorporate in the overall consideration the risks from the use of auxiliary products from the handling (e. g. leaching agents, cyanide), as well as the emissions from handling and recycling processes (e. g. PCDD/F emissions from thermal processes, wastewater, secondary wastes such as, for example, sludge).

Against the background of the treatment situation in the countries of destination, an extensive differentiation of equipment types, components and fractions with the estimation of the environmental and health risks appears to be sensible. For this, Appendix II of the WEEE Directive can be used.

Environmental and health problems, which arise through a lack of or insufficient waste management structures, also from own stock equipment, are also significantly increased through imported equipment which, following import, has no utilitarian use (and is to be treated immediately as waste). But even equipment with curtailed service life[83] leads to treatment problems arising more quickly. Through the shortened usage period, there is often no acceptable balance between usefulness and environmental loading from treatment.

Against the background of the presented relationships it appears to be sensible to undertake a differentiation of the exported equipment using their characteristic and/or usage profiles which covers seven groups (see Table 23).

[83] Compared with new equipment.

Table 23: Overview of property profiles of electrical and electronic equipment for export

Equip-ment cate-gory	Property	Condition accord-ing to Correspon-dents' Guidelines No 1 paragraph…	Type of use
A	New or as new, fully functional	/	Use of equipment
B	Used, fully functional	8a	
C	Used, limited function		
D1	Used, non-functional, non-waste-status	8b	Equipment does not remain in the country, and is sent back
D2	Used, non-functional, no used equipment status	9	Use for parts
E	Use as source of spare parts		
F	Use as source of raw materials (extraction of valuable fractions)		Material use
G	Direct dumping	/	No use

Equipment of Groups D2 to G is, with the following work steps, treated as problematic groups for export. Equipment of Group D1 primarily covers equipment which is shipped collectively for repair by the manufacturer or their repair centres within the scope of warranty. Groups A to D1 are treated below as less problematic groups of exported equipment.

5 Parties involved in the export chain

Preliminary remark: When the term “exporter” is used in the following, this describes exporters who export to countries outside of the European Union and in particular to those countries which are considered in depth in this study.

5.1 Collection points

Collection points are important centres of the export business between collection of equipment in Germany and export to countries of destination (see the examples in Figure 25 and Figure 26). A distinction can be made between various types of collection points in the context of this project:

a) Collection points where equipment is traded (purchase and sale at the location) and where equipment suitable for export are packed either on location or at another location into sea containers and vehicles (the operator of the collection point and the exporter are not necessarily the same individual; it is also possible for example that the operator of the collection point acts as an agent from whom the exporters purchase).

Figure 25a to d: Collection points (trade)

Billstraße in Hamburg for example is a well-known agglomeration of such points. Here around 20 companies trade in electrical equipment. Most are import and export companies whose covered warehouses contain often new and returned goods in their original packaging. Some of the companies trade exclusively in used equipment in a poor condition.

Two site inspections took place and traders were interviewed. Basically, as expected, they did not want to talk openly about the issue. Nevertheless, it was possible to ascertain that most traders seemingly sell a mixture of used equipment and new and returned goods. In some cases, they specialised in particular types of equipment. One trader stated for example that he only exported electronic tools from traders. There is also specialisation with regard to destination countries; this is due among other things to the operators of the collection points or the exporters having contacts in these countries. They often have contacts in the countries of destination because they come from there or have relatives there. As well as countries in Africa and Asia, countries in Eastern Europe (Poland, Ukraine and Russia) were also stated as countries of

destination. The exporters dynamically adapt their choice of countries of destination though to market conditions[84].

Some traders traded mainly in returns which originate from a particular technology market and German technology company. It was stressed in interviews that returns are not as popular as they once were as often only around 20 % of the appliances still work.

In some cases, minor repairs are made at the sites.

Of the equipment which appeared to be as good as new, in particular televisions, DVD players/records, compact music systems and occasionally white goods were seen. The appliances which had clearly already been used mainly involved ovens, refrigerators, televisions and monitors.

b) Collection points where there are containers in which the equipment is consolidated for a longer period and then packed into sea containers which are located at the site for a limited period (e.g. collection in consolidated containers for several weeks or even months; the sea containers are packed in three days) (see the example in Figure 26).

Figure 26a to b: Collection points (no trade)

Large collection points of this kind hold around 50 consolidation containers, while smaller ones hold around 5 containers. When such collection points were visited at the end of 2008 and start of 2009, the contents of the consolidated containers and sea containers were inspected among other things. There were used televisions and televisions

[84] One trader stated that before Poland joined the EU a lot of goods were exported to Poland and then onto other countries in the former Soviet Union, and in particular to Russia, and that this trade has now shifted to West Africa.

which looked as good as new, compact systems, CD-radio decks and loudspeaker boxes, cookers and refrigerators in the sea containers which had just been filled[85].

c) Temporary stores in which normally larger batches of commercial equipment are stored before export:
In view of the number of this type of temporary store, there is no basis upon which an assessment could be made.

The authorities in the cities in which collection points were visited (among others Hamburg and Bremen) monitor them with regard to the requirements for compliance with environmental standards for commercial companies and the storage of such goods. There are no waste-related permit requirements. Occasionally (e.g. in Amsterdam) spot checks are carried out on the contents of containers with regard to export regulations (visual condition of the equipment for a first rough assessment of the waste characteristics, inspection of cooling equipment for CFCs, compliance with packaging regulations, loaded with materials with export restrictions).

Based on expert estimates, the number of such collection points in Germany can be estimated at several hundred to over a thousand.

Experience from export controls shows that at the collection points very often equipment of varying quality is mixed in containers. Often equipment which still works is mixed with faulty equipment and high-quality equipment. As a rough guide, it can be assumed that they are separated into three types of quality in the country of destination ("non-working and non-repairable" – "source of replacement parts" – "useable equipment") (even if the exporter pre-selects the appliances in Germany).

The research has shown that a few large and many smaller exporters are active. The exporters who only export a small number of appliances are often so-called "waste tourists" who come to Germany, buy and load material for one or more containers and then receive the container again in the country of destination (in particular in West Africa) and sell on the contents.

5.2 Other parties involved

As well as the operators of collection points (and the exporters in those cases where they are not the same), a range of other parties are involved in the export of equipment. The chain after the collection points (or the other points from which equipment is exported) includes agents, forwarding agents, other service providers for logistics and formalities and shipping lines.

These other parties have hardly any influence on what is actually exported. Therefore, only a cursory description is provided here.

Agents often form the link between exporters and shipping lines. If required the agents also organise the sea containers and the stowing of the equipment in the containers. The agents often have a very close relationship in terms of personnel or premises with the exporters.

According to the Hamburg police, exports to West Africa are normally handled by forwarding agents. It was estimated that there are around 10 forwarding agents handing significant vol-

[85] There are also significant volumes of other products such as used tyres. Some containers were filled with only tyres.

umes. Exports to South East Asia on the other hand are normally handled directly by the shipping companies without the use of a forwarding agent [Hamburg police pers.com. March 2009].

There is in particular significant use of shipping lines to transport UEEE (as opposed to occasional transport). For the West Africa route, around 10 lines are significant. Exports to Asia are currently handled by primarily around 10 shipping lines. According to the exporters on both routes, mainly fully loaded containers are exported; the volume of containers where exporters stow their goods in containers of other exporters is less significant. As a result the containers are rarely stowed with equipment in the ports themselves (on the quayside) or at specialist container-loading companies, but in most cases at collection points.

The shipping lines stop at many ports in Africa or Asia on their routes. By way of example, Figure 27 shows a route which starts in Poland (Stettin) and then stops at Hamburg, Antwerp, Nigeria and the Ivory Coast.

A close relationship in terms of organisation and personnel between exporters and shipping lines and specialisation in certain goods, for example the export of used cars (e.g. ships of the Grimaldi Lines) is not noticeable with the shipping of UEEE. In the container business, the shipping line has less contact with the goods (although the shipping line receives information on the load via the shipping documents).

The shipping lines have more contact with the UEEE exported when the appliances are loaded into used cars. These cars are often welded shut to prevent theft during transport. Normally the owner of the appliances in the used cars is the owner of the car.

Figure 27: Example of an Africa route

6 Origin of the equipment

Hardly any information is available on the origin of the equipment. When exporters were questioned in the interviews and by the police, flea markets are most often stated as the origin. It is assumed, though, that this area of origin is only stated because here normally no receipts are issued with purchases and sales [pers.com. Bremen and Hamburg police, November 2008 and January 2009].

According to the police they could gather more detailed information on the areas of origin if, for example, after a transport is stopped the authority leading proceedings issued such a request to the police; this was hardly ever the case though.

During the course of the investigation, it was revealed that exported equipment has many areas of origin. In this chapter the results of the research will be summarised and the export-related "profile" of the equipment from the areas of origin will be described in relation to

- quantity,
- quality,
- efforts of procuring the equipment for the exporter and
- price.

As there is little sense due to the poor data and greatly fluctuating volumes in estimating the precise tonnage when looking at volumes, quantification is by volume category[86].

6.1 Collection of bulky waste

The collection of bulky waste is used by commercial collectors or individual persons to sort out usable components before collection by the municipality.

The collection of bulky waste is organised in various ways in Germany:

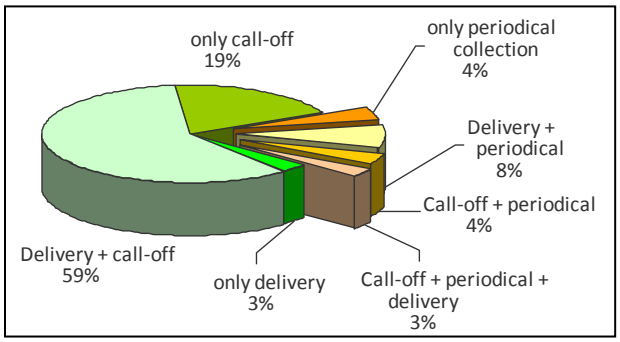
- Collection at fixed, published times (times are published in the Bulky Waste Calendar or in the Official Journal) and collection on a rota basis,
- Collection at individually determined times. Here the holder of the waste requests the collection of bulky waste (e.g. by "bulky waste ticket", by telephone or online) and is given an individual time. These times are normally regionally pooled by the municipality for reasons of efficiency.

The bulky waste is actually most often collected from the roadside and sometimes by personnel from homes or storage rooms (e.g. Hamburg).

[86] Volume category I: <10,000 t/a, volume category II: 10,000 t/a to 50,000 t/a, volume category III: >50,000 t/a.

When the bulky waste is collected by the municipalities at individual times, the bulky waste provided may be stolen if the regions served were known to the commercial collectors or individual persons, which according to expert interviews often happened. With call-off collections, collection times are consolidated into regions. According to [VKS 2008] a vehicle stops at an average of 40 loading points per day.

[VKS 2008] shows based on a survey of municipal waste treatment companies that ca. 80 % of the 161 companies surveyed collect bulky waste by call-off and ca. 12 % collect periodically; the remaining 8 % are hybrid forms or systems with central receiving points (see Figure 28).

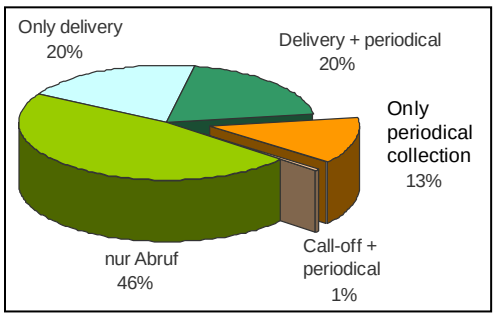


[VKS 2008]

Figure 28: Type of bulky waste collection in Germany 2006

Details on the number of residents associated with each type are not provided by VKS. Of the 30 largest cities in Germany, 6 cities carried out periodical road collections in 2006 while 24 cities used a call-off system [VKS 2008].

Concerning the question of which system is used most, 22 % replied with “delivery to the recycling yard” (for more details see Figure 29 below) [VKS 2008].



[VKS 2008]

Figure 29: Most used type of bulky waste collection in Germany 2006

Concerning the question of what collection intervals are offered, 11 % stated “once a year” 41 % stated “twice a year” and 48 % stated “several times a year” [VKS 2008].

With regard to the effectiveness of controls and regulatory measures against the theft, the following is found: “For some years the city’s police has been carrying out regular spot-checks. If they come across people stealing objects, fines are imposed and in some cases, vehicles are even confiscated. However, this has neither prevented nor reduced the cases of theft [Wuppertal waste balance 2006].” Other municipalities report similar experiences (e.g. the District Government of Düsseldorf).

Based on this experience theft is most likely prevented when the bulky waste is collected by the municipality from homes (as in Hamburg for example). There is no information available on how many municipalities are doing this.

Quantification: The average number of collections per year per collection district is 2.8[87]. The number of collection districts is >1,000. In 10 % to 15 % of the collection districts (periodical collection) the risk of theft is according to the above information very high, in 50 % (call-off) a reduced risk is assumed.

Based on the experience in several major cities in Germany, with periodical collections it is estimated that in periods of high metal prices, as in 2008, 75 % of white goods are stolen from. For collection by call-off, a reduced theft rate is estimated (50 %). This results in a volume in volume category II (10,000 t/a to 50,000 t/a)[88] which is mainly comprised of white goods, consumer equipment, small household appliances and IT[89].

What share of this is actually exported to countries outside of the EU is unclear.

The number of points of origin can be roughly estimated at >1,000.

Qualification: In contrast to equipment which is sold via barter exchange, free papers, flea markets, internet portals or internet auction sites, the equipment disposed of via bulky waste are considered by the user to no longer have a monetary value which would justify the cost of a sale. The quality of the equipment is normally poor to very poor.

Price: By stealing from bulky waste the thief obtains the material at virtually “no cost”.

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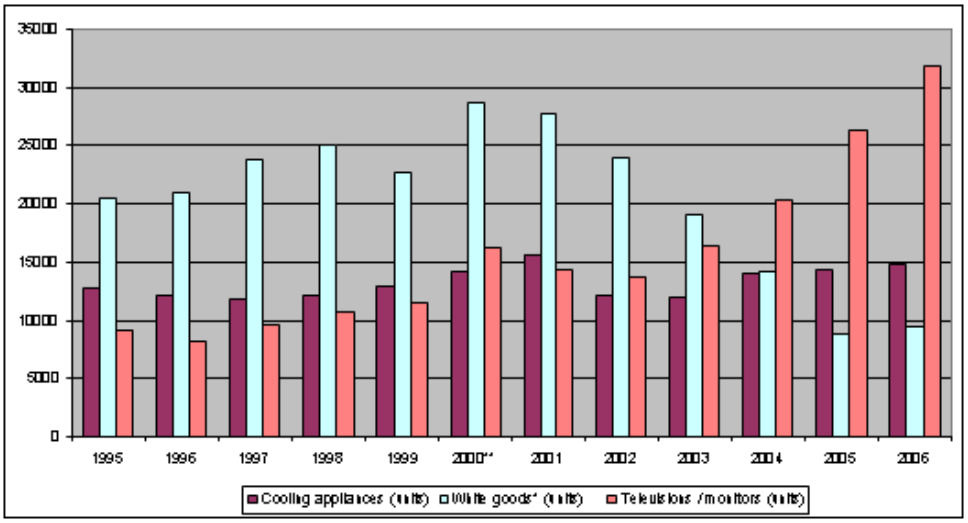
87 This is a weighted average of the data from [VKS 2008].

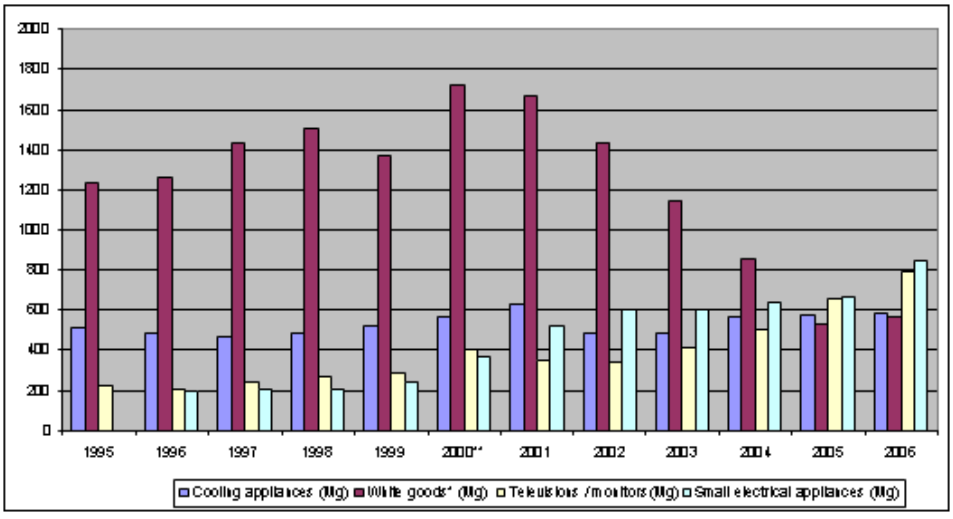
88 It should be noted that these figures were greatly influenced by the situation in 2008 where very high raw materials prices resulted in a rise in thefts. In the rough estimate of volumes it was assumed that 700,000 t of EEE come from private collections. The share collected via collections is estimated at roughly 1/3. This results in a total theft volume of 26,500 t per year for periodical collections (15 % of collections) and a volume of 58,250 t per year for collections by call-off (50 % of collections). As the estimate was made based on the situation in major cities and at a time when metal prices were high, the estimated volume was conservatively classified in the category to 50,000 t/a.

89 The volume of EEE stolen by waste collectors is estimated by [Janz et al 2009] using a different method at between 36,000 t and 122,000 t. As the volume estimation by [Janz et al 2009] was made against the background of material flows to Eastern Europe, it is assumed that these volumes were all exported. In our estimate of export volumes we assumed that only a part of the stolen volume is exported. Some is fed to the European scrap metal market. The relevant volumes in this study are therefore lower than the total volumes as only exports to the selected non-EU countries are considered.

Example of Wuppertal (switched to collection on a rota basis in 2000)

"Similar to the development with bulky waste volumes, there was initially a dramatic rise in large electrical equipment with the introduction of road collections on a rota basis. While bulky waste volumes have since remained roughly the same, the number of white goods recorded has since fallen by two thirds." (Note: See also Figure 30a and b).) "The reasons for this are that, due to the high scrap prices, the equipment is sometimes handed over by people to mobile scrap collectors, retailers also sell returned equipment to the scrap trade and "wild collections" are carried out before the bulky waste collection times. In addition, compressors were stolen from many of the refrigerators left with the bulky waste, (…).The huge rise of 30 % in the number of televisions and monitors disposed of is probably due to the increased switch to flat screens. The volume of small electrical equipment handed over continued to rise. This may be attributable to increased environmental awareness and a larger number of collection points" [Wuppertal 2006].





[Wuppertal waste balance 2006]

Figure 30a and b: WEEE volumes recorded separately by the city of Wuppertal

With regard to theft from refrigerators, it is estimated that in ca. 40 % of refrigerators left for collection, the compressors were removed and stolen.

6.2 Collection of scrap metal by commercial collectors

Scrap metal is collected by commercial collectors of scrap from homes. In many cases, information is distributed to households stating that they can collect or buy metallic objects. “Scrap collectors” also collect equipment from traders. The higher the prices of raw materials, the greater the activity reported.

Quantification: There is no information available on the number of scrap collectors and their turnover. [Janz et al 2009] roughly estimate that in areas close to the border in Eastern Germany between 0.4 kg and 1.5 kg per resident per year of in particular white goods were collected and exported by scrap dealers in 2008. If this value were extrapolated for the whole of Germany, according to this source volumes would be between 36,000 t/a and 122,000 t/a. For the investigated regions in Mecklenburg-Western Pomerania, Brandenburg, Saxony and Bavaria volumes between 2,000 t/a and 7,000 t/a were estimated. Also included in this are volumes stolen from bulky waste and volumes which are picked up by people outside recycling yards.

As well as the number of commercial collectors and the volumes recorded per collector, it is also unclear what share of equipment collected is actually exported to Africa or Asia. It is assumed that equipment is only handed over to exporters if the purchase price paid by the exporters is above the material value of the equipment.

Qualification: It tends to be equipment where the user no longer sees a value beyond the raw material value which is disposed of via scrap collectors. The quality of the equipment is normally poor to very poor.

Price: The price of equipment collected is very low, often far below the metal market price for the Fe metal content of the equipment.

6.3 Print media

In Germany, ca. 1,300 free papers (titles) are published. Circulation was ca. 90 million copies in 2008 [Federal Association of German free papers (BVDA)].

Free papers are normally financed by advertising revenue. The price of small ads is based on the number of columns and lines or the number of words and the circulation. A small ad for a used electrical equipment costs in most researched cases >10 €[90].

In particular equipment is offered when the owner is of the opinion that the equipment still has a value which justifies the cost of placing the advertisement. With the possibility of placing advertisements online, the cost has fallen here in recent years. A systematic evaluation of offer prices was not possible within the scope of this project. A survey conducted on behalf of eBay showed that comparatively few online advertisements were used for private sales[91].

Used electrical equipment is also offered in the advertising sections of newspapers (including regional editions > 1,000 titles), however obviously to a lesser extent than in free papers. Here too advertisements are increasingly being placed online.

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90 The range was between € 8 and € 22 (one column, 5 rows; or minimum number of words).

91 Vgl. [*http://www.ecc-handel.de/der_verkauf_ueber_online_-_auktionen_ist.php*].

The cost of procurement per appliance is considered by the potential exporter to be relatively high compared to the value of the product. While free papers and newspapers are obviously an important way for exporters to reach customers for used cars, this does not appear to be the case for electrical equipment. Online access to both newspapers and free papers is now possible almost everywhere. Sometimes an evaluation or filter function is provided for advertisements in the internet. This makes it much easier for the buyer to have access to the equipment.

Quantification: The wide range of print media results even with a few advertisements per paper in a high total number of advertisements. With the weekly appearance of the advertisements and 10 advertisements per paper and edition, this produces a total number of 1.2 million advertisements per year. A success rate of 50 % for the advertisement would therefore result in 600,000 sales per year.

The total volume is estimated at around 10,000 t/a.

Qualification: The quality of this equipment is considered better than that of the equipment which is collected by scrap collectors or via bulky waste. The lower quality limit is certainly also determined by the costs for an advertisement.

Price: The range of prices for UEEE is very wide and at the upper end can reach those of new equipment. The lower end is certainly determined significantly by the price of the advertisement. If a factor of between 5 and 10 is assumed for the difference between the price of the equipment and the price of an advertisement, the lower end of the price scale is often between € 50 and € 80.

6.4 Flea markets

Flea markets are stated by many exporters as a source for the exported equipment.

There is no extensive information on the number of flea markets where electrical and electronic equipment is sold. 100 to 150 meetings per week are mentioned on relevant sites in the internet for Germany alone. It can be assumed that only the major flea markets are registered with such sites.

Analyses on the relative importance of flea markets (compared to online trade, see below) show that online auctions are more popular than sales at traditional flea markets. In a survey conducted on behalf of eBay 70 % of the 1,004 people questioned stated that they had already sold something via an internet auction, while only 36.1 per cent used flea markets. 15.3 % had used an online advertisement[92].

At flea markets in particular small household appliances, consumer equipment and IT equipment are sold by private individuals.

Quantification: As with the free papers, it can be assumed that there is a significant volume of sales of electrical and electronic equipment in flea markets due to their large number. The lower weight of the types of equipment sold compared to for example white goods results in a relatively lower mass (volume category I <10,000 t/a).

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92 Cf. [*http://www.ecc-handel.de/der_verkauf_ueber_online_-_auktionen_ist.php*].

With regard to the statement by exporters that they bought the goods at flea markets, it is assumed that they are mentioned as the source because there are no invoices or receipts at flea markets and therefore proof of purchase is not possible [pers.com. Bremen and Hamburg police].

Qualification: The quality of flea market equipment is also considered better than that of the equipment which is collected by scrap collectors or via bulky waste. However, the quality is often lower than the quality of equipment from print media. It is often equipment which is difficult to sell due to their age or condition.

Price: The range of prices is probably much more limited than with online sales and it is assumed that equipment is also offered at a price of € 1.

6.5 "Cascading values"

In the event of "cascading values", last users sell their equipment to second-hand retailers. These in turn sell such equipment which is otherwise unsalable to exporters. The number of small dealers is probably very high; however, precise numbers are not available.

The quality of other equipment sold will cover the whole range of equipment for which there is no market in the region.

As the other appliances sold are goods which cannot otherwise be sold in the region, very low prices are assumed.

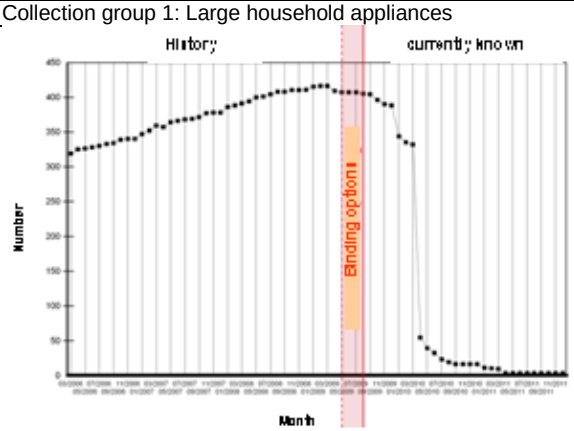
6.6 Recycling yards, first treatment operators

The municipal collection points accept WEEE from private households. Traders can also deliver returns of WEEE by prior arrangement to the municipal receiving points.

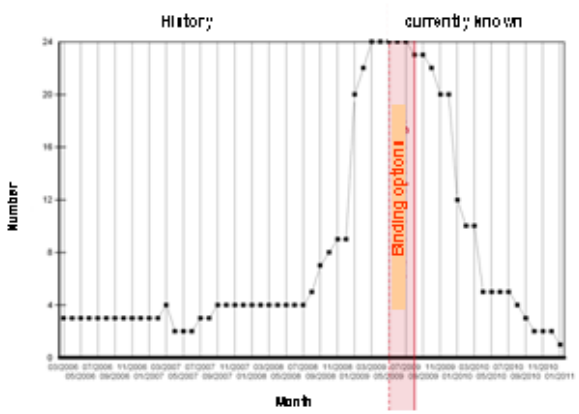
According to the official statistics [BMU 2008], in 2006 ca. 710,000 t of "business to consumer" (b2c) WEEE were collected via all collection routes (distributors, producers, municipal collection points). There is no data available on the volumes collected solely by the municipalities.

Municipalities can treat or recycle waste themselves based on § 9 of the Electrical and Electronic Equipment Law (ElektroG). Figure 31(a-f) below reflect the changes in the number of municipalities which have opted for the respective collection group.

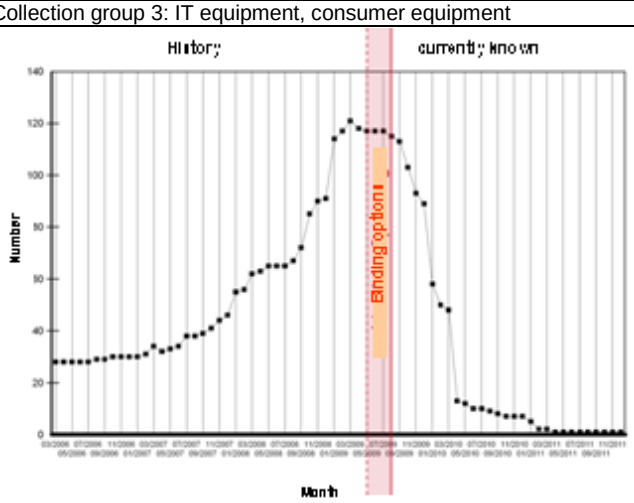
Collection group 1: Large household appliances



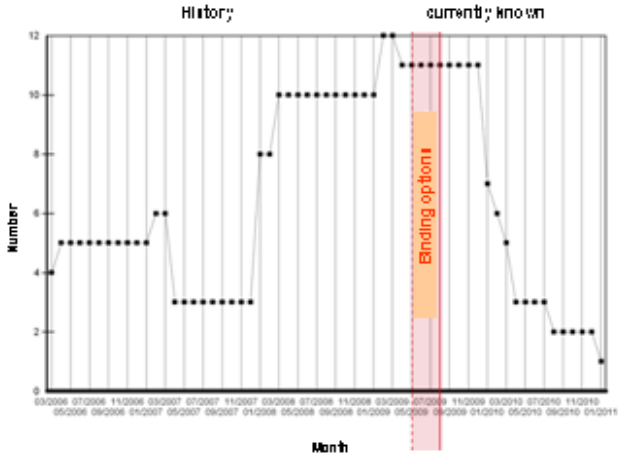
Collection group 2: Cooling appliances



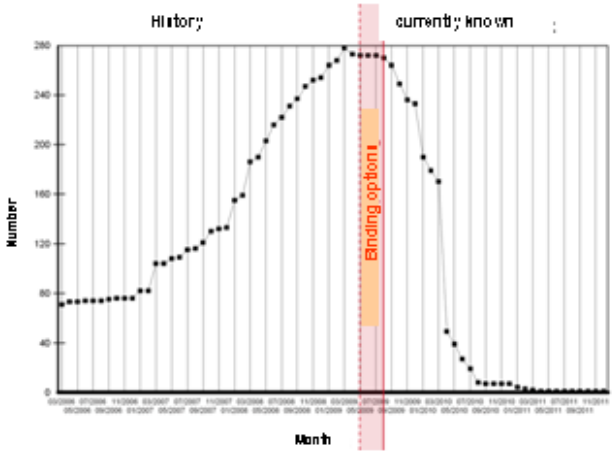
Collection group 3: IT equipment, consumer equipment



Collection group 4: Gas discharge lamps



Collection group 5: Small household appliances, lighting equipment, electrical and electronic tools, toys, leisure and sports equipment, medical devices, monitoring and control instruments



[stiftung ear 2009]

Figure 31 a to f: Number of municipalities which have opted for the respective collection group

It is not known what volumes are collected by the municipalities which have opted for the respective collection groups. This data is neither published by the “stiftung ear” nor centrally by the municipalities.

Some producers of white goods[93] tend to get the contracted waste treatment company to recycle or dispose of the goods in collection group 1 and do not check the re-use in detail. It is also viewed as unlikely by some producers that significant volumes of white goods from the waste regime are exported outside of Europe for material recovery. The reason given is that the achievable prices for the raw materials (Fe fraction, NE fraction) result in domestic fractionation of the equipment. Collection group 2 is according to the producers primarily disposed of by the producers themselves as the costs of treatment are higher than the proceeds from the raw materials. For the volumes collected by this route according to some producers, the volumes disposed of and the treatment routes are monitored in detail [Welpotte 2009 pers.com]. For collection group 5, ca. 40 larger and several 100 smaller companies have found a joint treatment route. According to producers [Welpotte 2009 pers.com] economic drivers are making large waste treatment companies take the volumes relating to these contracts to their own treatment installations (use full capacity of the installations, long-term orientation of the business model of major waste treatment companies instead of short-term gains).

The municipal collection points and first treatment operators also give equipment to re-use organisations. These may be specific re-use organisations (in the sense of chapter 6.7 below), other resellers for sale in Europe or exporters. The equipment has been handed over by the last users as waste to the waste regime. When the equipment is sold to exporters, they leave the waste regime. If they are given to resellers or exporters, a test has to have taken place, the result of which justifies their transfer from the waste regime to the product regime.

We are aware of cases where cooling appliances and consumer equipment have been handed over by first treatment operators without a technical test to parties outside of the waste regime. While the suspicion has been expressed time and again that the volume here is significant, it was not possible to quantify or substantiate this in more detail.

Electrical equipment is also sometimes collected by people outside of recycling yards; they ask those who are arriving for waste equipment. Here, too, information that is more detailed was not available.

A more detailed investigation of the significance of the volume and the actual routes of the equipment was not possible within the scope of this research project. Information that is more detailed could be obtained with the help of the police (see also the recommendations in chapter 9.2).

6.7 Re-use organisations

In contrast to professional re-marketing companies, the re-use organisations considered here often have both a socio-economic background (e.g. job-creation and training companies). End users hand over equipment which they still consider usable to these organisations. They also receive equipment from municipalities, businesses and authorities (replacement business) or

[93] This statement concerns ca. 60% of market participants.

actively collect equipment themselves (sometimes on behalf of the municipalities). The business models of these organisations vary greatly.

Quantification: Within the scope of an expert survey and discussion in February 2009, estimates differed greatly. According to this, most re-use organisations do not export themselves and also do not knowingly hand over equipment to exporters who export equipment outside of the EU. The annual export volume of individual business to non-EU countries is very likely to be well below 5,000 t.

Qualification: In most cases working equipment exported appear to go to destinations outside of the EU. However, an apparently small number of appliances are also exported which do not work, but can be repaired in the country of destination.

Prices: The prices of the equipment sold range from “free” to prices which are offered by commercial re-marketing companies (see below).

6.8 Waste transporters

In expert interviews, it was pointed out that contracted transporters collect equipment from the municipal collection points and take them to the first treatment operator’s plant and that this treatment step is subject to inadequate monitoring. At the municipal collection points the container is collected as "full" (in accordance with the collection requirement) without the weight of the content being documented on an exit weighing machine (in most cases no weighing machine is available). On the way to the first treatment operator, where the containers are weighed on a weighing machine upon arrival, useable equipment would be separated.

A more detailed investigation of the significance of the volume and the actual routes of the equipment was not possible within the scope of this research project. Information that is more detailed could be obtained with the help of the police (see also the recommendations in chapter 9.2).

6.9 Online auctions and trade – example of eBay

In the internet, there are a large number of online trading platforms where used equipment has been offered and bought. The number of online auction platforms is estimated at between 150 and 200.

In the period between 1 January 2009 and 27 March 2009, the sales of used electrical and electronic equipment on eBay.de, by far the largest online auction platform, were followed and evaluated (see Table 24). In total approximately 100,000 sales[94] of the following types of products were evaluated:

[94] The exact number of appliances offered was 103,748.

- washing machines,
- refrigerators,
- televisions,
- monitors,
- personal computers,
- printers.

The sales rate[95] per equipment type without any further sub-categorisation was between 56 % and 77 % in the observation period. A much different picture is provided by the sub-categories "CRT monitors" and "CRT monitors faulty", in which only 35 % and 6 % of the appliances respectively offered were actually sold (see also Table 24).

Table 24: Selected used equipment traded on ebay.de between 01.01.2009 and 27.03.2009

			Television		CLCP		Monitor			Printer	
	Washing machine	Refrigerator	CRT and non-CRT	Only CRT	All	of which faulty	CRT and non-CRT	Only CRT	CRT faulty	All	Faulty
Offered (number)	10,172	4,054	18,817	10,750	4,023	65	25,446	7,710	128	20,456	2,127
Sales rate	71%	77%	70%	73%	64%	78%	56%	35%	6%	64%	61%

The average price of the equipment per equipment types (without any sub-categorisation) was between € 44 and € 79 per item.

[95] The sales rate describes the relationship between the number of appliances sold and the number of appliances offered.

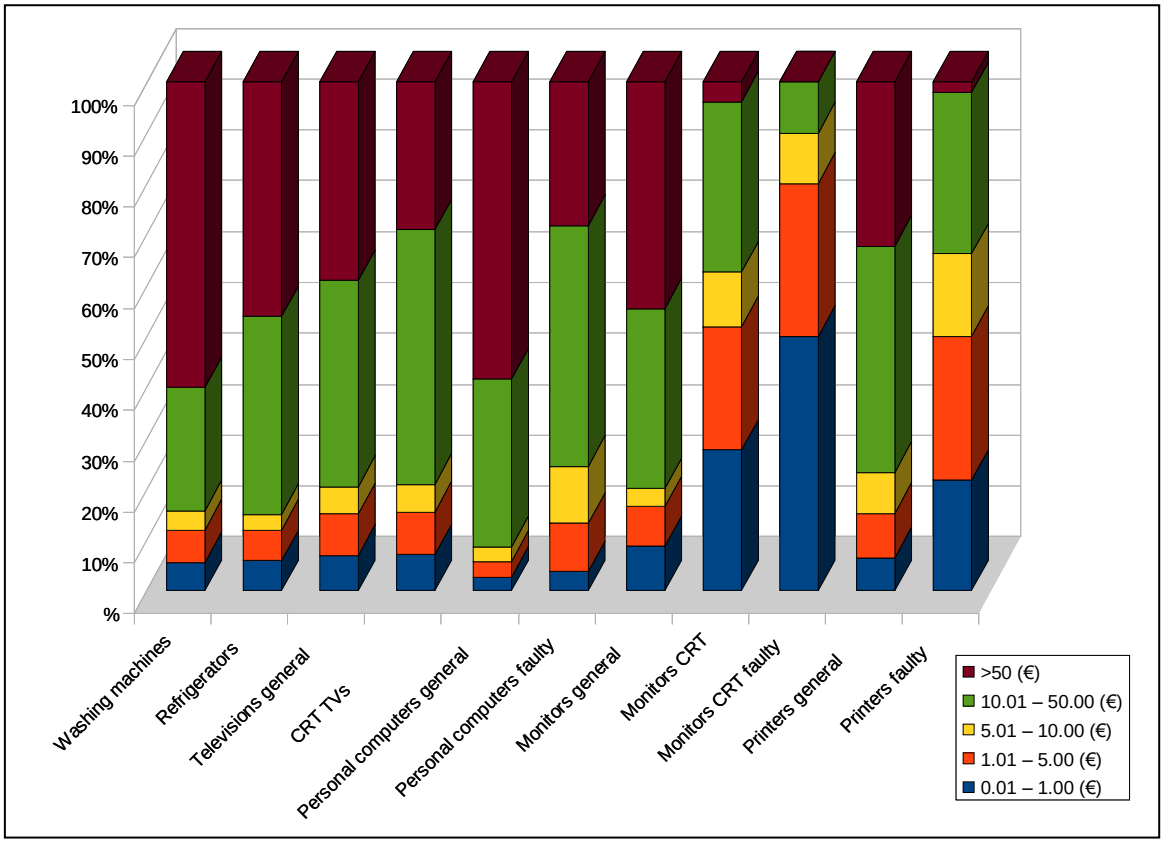


Figure 32: Price distribution of selected used equipment traded on ebay.de (1. 1. 2009 and 27. 3. 2009)

The analysis of the number of equipment sold per price category (see Figure 32) shows that most of the appliances were sold at prices between € 10 and € 50 and over € 50 (ca. 31,000 in each category). In the price categories € 0.01 to € 1 and € 1 to € 5 ca. 7,000 equipment was sold in each category.

Shipping charges and the costs for self-collection have to be added to the prices.

The observation period covers approximately a quarter of the year. The investigation of sales figures and average prices over a period of two years shows that, averaged over a year, in most cases there were relatively low fluctuations in sales figures and prices.

Extrapolated for the whole year, 323,000 appliances of the selected product types were sold on ebay.de. The distribution of appliances sold is shown in the following Table 25.

Table 25: Price distribution of selected used equipment traded on ebay.de[96]

Price category	Number of appliances sold
0.01 – 1.00 (€)	26,784
1.01 – 5.00 (€)	28,952
5.01 – 10.00 (€)	18,244
10.01 – 50.00 (€)	124,644
>50 (€)	124,276

Quantification: Overall, online trading platforms such as e-bay sell a large number of appliances. While the volume potential with free papers is created by the large number of papers, most sales per "marketplace" are made with a relatively small number of large online trading platforms. The large number of smaller online trading platforms also has to be taken into account. The volume is therefore estimated to be in volume category II (10,000 t – 50,000 t).

Qualification: The quality of the equipment ranges from new equipment with tiny visual defects to faulty waste equipment. Approximately 20 % of sales are made in the lower quality levels in the price range between € 0.01 and € 5.

Faulty equipment is seemingly not easy to sell via the auctions, but they are still offered. It is not known how many appliances are still traded post-auction after they have not been sold on eBay.

Price: The entire range of prices from (almost) new equipment to the symbolic price of € 1 is seen. Most of the prices are between € 10 and € 50.

6.10 Re-marketing companies

Re-marketing companies take equipment from various commercial sectors and authorities. The type and origin of the equipment varies, e.g. remaining stock of new products, returns (e.g. guarantee cases), batches which are not for domestic sale and used equipment from replacement business (deliver new equipment, take away used equipment).

Many of these re-marketing companies sell not only to the commercial sector, they also have branches or sub-units which sell equipment to private customers. Many re-marketing companies also offer support for exports, e.g. with customs formalities or with packing of equipment into sea containers.

The exporting of used equipment is often an important part of their business strategy. The goods are of varying quality levels, from as good as new to faulty. Sales for export are made by the pallet. These often contain a mixture of different qualities, including faulty or non-tested equipment. Re-marketing companies also prepare all of the export documents required and provide export advice.

It is difficult to estimate the number of re-marketing companies. It is assumed that there are up to one hundred companies operating in the market.

Quantification: Due to the relatively large volumes per re-marketing company,[97] volumes in volume category III (>50,000 t) are expected.

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[96] Extrapolated for one year based on the monitoring of one quarter.

Qualification: The quality of the equipment ranges from new equipment with tiny visual defects to faulty old equipment.

Price: The entire range of prices from (almost) new equipment to the (symbolic) price of € 1 is seen.

6.11 Hand-over to retailers – private sector

The Electrical and Electronic Equipment Law (ElektroG) requires retailers to take back equipment from end users free of charge. Unrelated to this, appliances are also handed over to traders outside of the waste regime. It is often difficult to differentiate between the two types of returns.

It is assumed that lower volumes of **information technology and consumer equipment (IT and CE)** are handed over to retailers than volumes of white goods. With the category IT and CE the old equipment is often stored temporarily after the new equipment has been purchased before being disposed of. [Trend Büro 2008] estimates on the basis of a survey for example that "3.7 million old PCs and countless hard drives" and more than 12 million old mobile phones are not disposed of directly after their utilisation phase. The routes of treatment, when they are eventually disposed of, are more often municipal hand-over points or online sales.

In the case of distance trading (e.g. via the internet) it is normally assumed that the share of returns is lower than is the case with delivery by local traders. Distance trading has been continually gaining in market share for years. While the overall share of distance trading in total purchases per household was only 11.4 % in 2002, it rose in 2006 to 12.4 % [GFK Universal panel Non-Food 2007]. There were distinct differences between the product groups. In the segment Computer/CE/Photo/Telecommunications the share of distance trading in the total expenditure of a German household rose from 14 % in 2004 to 17.6 % in 2006 [GFK Universal panel Non-Food 2007. With large and small electrical appliances the share fell from 17.6 % to 17 % [GFK Universal panel Non-Food 2007]. However, only 5.7 % of flat screen televisions were bought via distance trading [GFK Panel service 2007].

It is not known how high the volume of returns is for distance traders.

Quantification: The equipment taken back by traders or handed over to traders is not normally re-sold directly, but are instead passed or sold on to professional resellers. The volumes passing through this route have already been taken into account in the respective chapters above.

Qualification: In terms of quality the equipment taken back probably cover a very wide range. Compared to areas where the last user tries to sell the equipment (internet, newspapers, etc.), in the case of goods being taken back free of charge this involves more often non-working appliances.

Price: The equipment is taken back free of charge and the retailer normally does not pay for the equipment. The owner of the old equipment is often charged for the cost of transport. The resale price covers the whole range of quality levels taken back.

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[97] One company stated an average of up to half a million units per year, another stated that it exported over 100,000 units per year from the IT sector alone.

6.12 Economic aspects

An extensive economic analysis was not possible within the scope of this study. A few relevant economic aspects which have become clear during the research are described here however.

An important basic condition for continued exports is that as a minimum the transport costs have to be covered. In 2008 the price offered for the full logistics for a container to West Africa (e.g. delivery of the sea container to a collection point, collection of the container after three days and transport to the shipping location, loading, shipping, unloading) approximately € 1,500 per 40 foot sea container.

The costs in the country of destination for the stand or shack in the market and for the sale of the appliances in the market were not communicated. There is also no detailed information on the import costs in the country of destination (customs, where applicable destination inspection, etc.) and the personnel costs of the exporters.

The inspections of the contents of containers as part of export controls showed that in most cases there was a mixture of appliances of all characteristic profiles A to G (see chapter 4.9). As a result, this means that a wide range of prices is possible for all appliances due to the mixed calculation. With the estimation of transport costs it is assumed here for reasons of simplification that only one type of appliance is transported in the container[98]. On average with space-efficient stowage approximately 900 CRT monitors, 2,000 PCs, 100 refrigerators or 2,800 CD/DVD players can be packed into a container.

Table 26 below shows the market prices in Nigeria for selected appliances of a low or very low quality (utilisation profiles D2 to G) against the calculated logistics costs.

With a range of appliances such as CRT it also has to be considered when looking at economic factors that the treatment of a CRT monitor in Germany costs between € 3 and € 4 and these costs are saved by exporting them. This represents an additional economic driver for low-quality appliances. As the demand for CRT monitors has fallen dramatically in Germany and there are a lot of CRTs waiting for treatment after being replaced by flat screens, the price for used appliances is currently very low (including used appliances which still work). With other appliances, fluctuating raw materials prices mean that sometimes profits can be achieved from treatment in Germany, and sometimes not.

[98] This is though actually only the case in a few containers which are relevant in the context of this project.

Table 26: Price structure for the acquisition of appliances in Germany (estimate)

	Scenario A (low prices)					Scenario B (high prices)				
	CRT monitor	PC	CRT TV	Refrigerator	VCD player	CRT monitor	PC	CRT TV	Refrigerator	VCD player
Ø market price in Nigeria Utilisation profiles D2 to G (see chapter 4.9)	€ 11.30	€ 30.12	€ 15.06	€ 35.14	€ 4.52	€ 22.59	€ 67.77	€ 28.87	€ 47.69	€ 12.55
Logistics	€ 1.60	€ 0.66	€ 2.25	€ 12.92	€ 0.53	€ 1.60	€ 0.66	€ 2.25	€ 12.92	€ 0.53

On average a CRT monitor contains approximately 700 g of copper [UNU 2007]. Although wholesale prices occasionally reached well above € 5/kg in 2008 and an average price level of € 2/kg to € 2.50/kg can be assumed over several years, much lower prices are achieved with small volumes in the informal sector in West Africa (ca. € 0.50/CRT). Profits from the informal sector for other components (e.g. steel, platinum, etc.) can roughly be estimated at € 0.20/CRT. There are no costs for the final disposal of the non-recyclable material.

With some types of appliances profits from the sale of fractions play a greater role (e.g. white goods, PCs), and with others profits from the sale of components (e.g. IT appliances).

For the cost situation in Germany research has shown that a distinction can be made between two different situations:

- For appliances with treatment **costs**, such as CRT monitors, exporting saves treatment costs. This saving is made if the appliance was once in the German system for the treatment of waste electrical equipment and as a result treatment costs have been incurred by those who are financially responsible for the waste treatment (the producers in terms of the Electrical and Electronic Equipment Law (ElektroG), unless the material comes from the area of an opting municipality)[99].
- Appliances with treatment **profits** (such as washing machines) are primarily collected by traders or exporters before they reach the German system for the treatment of waste electrical equipment or before they are handed over to first treatment operators. Potential profits from the raw materials can therefore not be achieved by those responsible for the product in accordance with the ElektroG.

If, for example, half of the treatment costs saved with CRT monitors are passed on to the exporters, after transport costs have been deducted this would leave a profit of € 0.50 to € 1 per non-working appliance.

6.13 Summary

Table 27 below summarises the results of the investigation concerning the quantification, qualification, prices and costs for procuring appliances by exporters.

[99] We do not assume though that the waste treatment costs saved are passed on 1:1 to the exporters.

With regard to developing recommendations to improve the control of the flow of materials, the number of possible intervention points is also relevant. This is shown by a breakdown into the following categories:

- Category I: 1 to 10 intervention points,
- Category II: 11 to 100 intervention points,
- Category III: 101 to 1000 intervention points,
- Category IV: >1000 intervention points.

Table 27: Export relevance of different areas of origin

Area of origin	Main equipment groups	Quantifying quantity class[1]	Qualification[2]	Price[3]	Outlay for acquisition[4]	Number of intervention points[5]
Pilferage of bulky waste collection	White goods, brown goods, small domestic appliances, Information Technology (IT), consumer electronics (CE)	II (highly erratic, depending on the level of the metal prices)	3	3	2	IV II (Information for the public)
Scrap collection	White goods, brown goods	II to III (highly erratic, depending on the level of the metal prices)	3	3	2	IV II (Information to public)
Classified ads in print media	All	I	2	2	1	II (Information to public)
Flea markets	Small domestic appliances, IT, telecommunication (TC), CE	I	2-3	2-3	1	IV II (Information to public)
Value cascades	Small domestic appliances, IT, TC, CE	I to II	2 - 3	3	3	III
Recycling centres, First treatment company	White goods, brown goods, small domestic appliances, IT, CE	No details	2 - 3	3	2	IV
Re-use-organisations	White goods, brown goods, small domestic appliances, IT, CE	I	2[6]	3	3	II
Waste transporter	No details	No details	No details	No details	2	IV
Online advertisements/ auction houses	All	II	2 – 3[7]	1 - 3	3	II (Information to public)
Re-marketing-firms[9]	White goods, brown goods, IT, CE	III	2 – 3[8]	2-3	3	III
Handing over to trade – private area	Primarily white goods, less CE and IT	III (already taken into account with re-marketing firms)	2 – 3	2 – 3	3	II

[1] 3-stage scaling; quantity classes I: <10,000 t/a, II: 10,000 t/a to 50,000 t/a, III: >50,000 t/a to 100,000 t/a; the estimate of quantity relates to the total quantity from the respective area of origin. The actual amounts exported into countries in Africa and Asia are a subset there from.

[2] 3-stage scaling; 1 = high value product profiles A and B, 2 = medium quality product profiles C and D1, 3 = low quality product profiles D2 to G

[3] 3-stage scaling; 1 = high price, 2 = medium price, 3 = low price to free of charge

[4] 3-stage scaling; 1 = high, 2 = medium outlay, 3 = low

[5] 4-stage scaling; I = 1 to 10 intervention points, II = 11 to 100 intervention points, III = 101 to 1000 intervention points, IV = >1000 intervention points.

[6] Although non-functioning equipment is exported from re-use organisations, the quantities are, however, smaller than the quantities of equipment which are processed or repaired by the re-use organisations.

[7] This takes into account that non-functioning equipment is also offered (often as equipment "for hobbyists").

[8] The commercial resellers take over a large part of the equipment from take back of used equipment from private customers through retailer, for example when the retailer supplies new equipment.

The financing of exports is determined through a series of factors. In the countries of destination, functional equipment and components are traded at higher prices than would be the case in Germany. The transport itself is relatively inexpensive. Often a mixed financing takes place via functional equipment, equipment which is used as source of spare parts and via equipment which will no longer be employed and used either for production of raw materials or treated immediately. A financing of exports exclusively on the basis for raw material appears improbable. For a CRT monitor, in countries such as Nigeria, less than € 1 is realised, the transport, however, costs significantly more than € 1. Equipment with a high recyclable fraction (e.g. washing machines and also PCs) with an exclusively resource-based financing of the export, the difference from the revenues in Germany and in the country of destination must act as economic driver of the export. This, however, is probably not the case. Continuing to be effective are costs saved for the treatment of non-recyclable fractions and the lower costs of the separation of the fractions in the countries of destination.

Furthermore, it is to be noted that a cross-financing with some types of equipment via treatment costs saved probably takes place (e.g. CRT screens). The costs are saved if the equipment was to be collected in accordance with the ElektroG and the waste management company does not pass lower costs to the (financially responsible) producer who already paid for treatment. Herein the types of equipment with treatment costs (e.g. CRT screens) differentiate themselves from the equipment types with revenues from treatment (e.g. washing machines). The latter do probably not arrive frequently in the collection system in accordance with the ElektroG but rather are captured for export.

7 Export monitoring

Both the sources of UEEE and the collection points where sea containers are loaded for shipping are found in various federal states in Germany. The states therefore have in practice a monitoring and control function, which in the cases of Hamburg and Bremen, because they are export ports, is extended by a (central) control function in the ports.

This chapter describes the essential points of the situation in some federal states.

7.1 Hamburg

7.1.1 Office for Urban Development and Environment

Hamburg's Office for Urban Development and Environment (BSU) employs 4 full-time people in the area of waste shipment who, among other things, process ca. 200 notification procedures a year. As well as processing notification procedures, the BSU is also responsible for controlling waste shipments and coordinating suspected cases of illegal waste shipments which are reported by the inspection authorities.

In Hamburg a total of 102 suspected cases of illegal waste shipments detected during inspections were reported to the BSU by the police and customs in 2008. 45 suspected cases relate to electrical and electronic equipment (29 inspections of cooling appliances, 15 of monitors or used televisions). In 22 cases the appliances came from Hamburg, in the remaining cases the appliances came from other federal states or European countries such as Finland and Norway.

Nigeria, the Ivory Coast, Malaysia, Egypt, Hong Kong and Togo were stated as countries of destination for used electrical and electronic equipment. Due to data protection reasons no further details on exporters were given.

In order to bundle information better, the BSU and the police are in agreement that the BSU initiates and controls the communication with the appropriate state authorities.

Under the direction of the BSU information and experience has been exchanged since the start of 2007 between the inspection authorities (customs and police) and the BSU on a regular (half-yearly) basis in order to continually optimise and adapt enforcement to the actual circumstances.

The BSU does not have access to the ZAPP system of Dakosy AG or the ATLAS system of customs.

The BSU considers the following open questions for enforcement to be important for its control activities:

- How can it be proved in a legally watertight manner that the appliances are non-repairable?
- What packaging/packaging method actually maintains the value of the shipment and how can it be proven that it does not maintain the value?
- How should the appliance-specific information, which the Correspondents' Guidelines recommend, be checked and what cost is reasonable here?

The BSU has prepared a matrix which provides an overview of the indications of the product and waste characteristics of appliances for export which are easy to detect. After an evaluation phase the matrix was revised and is now being used in the revised version.

7.1.2 Police

Hamburg's police is responsible for inspecting cross-border waste shipments in Hamburg and carries out appropriate inspections with regard to the export of suspected waste electrical equipment.

The police has access to the ZAPP system and can identify with the use of police records containers which appear to be suspicious with regard to the export of used electrical equipment.

According to the Correspondents' Guidelines, the exporter has to have performed a function test on the appliances and also be able to document this. In spite of this, non-working appliances are found time and again during spot checks. The exporters then normally state that the appliances will be repaired in the countries of destination and that these repairs will be done with new parts. They state that they do not cannibalise the appliances (cannibalisation would establish the waste characteristic of the appliances). It is difficult to disprove this within the scope of the waste transport inspection. In the opinion of the authority responsible in Hamburg, the BSU, the question of whether the appliances can be repaired at an economically viable cost is to be assessed in accordance with the prevailing standards in the countries of destination.

A peculiarity for the instigation of criminal proceedings is that the legally relevant assessment of whether the appliances are waste electrical and electronic equipment in terms of the Electrical and Electronic Equipment Law (ElektroG) or are used electrical and electronic equipment is the responsibility of the administrative authority and in this respect this decision has a direct influence on whether the matter will be prosecuted as a criminal offence or not. Criminal proceedings are regularly not pursued when the administrative authority, after establishing the facts under administrative law, refuses to recognise the term waste.

In this context, there have in the opinion of the interview partner been different views of the export situation in the past. In the view of the police a clear framework for distinguishing between waste and product, e.g. the Correspondents' Guidelines being legally binding, would be helpful for dealing with this situation in future.

In the meantime, cooperation between the police and the BSU has further intensified and improved.

7.1.3 Customs

Exports via the Port of Hamburg are recorded electronically either in the ZAPP or ATLAS-HH system.

This data is only available to customs for the last three months. Data which is one year old can only be obtained from the computer centre of the Federal Finance Administration (ZIVIT[100]) at a cost. Customs only has very limited access to the resources of ZIVIT through a framework agreement.

The data in the ATLAS system is subject to tax secrecy and the customs administration is bound by this; other authorities are therefore not allowed to have general access to customs data [BMF 2009].

The data in the ZAPP system is only available for 6 months and is archived for 12 months, it is therefore possible to search over 18 months.

The amended Correspondents' Guidelines No. 1 are available to all customs office via the Intranet [pers. com. Federal Finance Office South East].

7.2 Bremen

7.2.1 Bremen Environment Office

At the Bremen Environment Office around 120 notification procedures were processed by one full-time person[101] in 2007. To date there have been three suspected cases concerning refrigerators.

The Environment Office stated that they are getting on well with the amended Correspondents' Guidelines No. 1. The Environment Office experiences difficulties in that it bears the burden of proof before the courts, that the reverse processing of a shipment is not clearly regulated and the Office can potentially incur costs.

7.2.2 Bremen Police

According to the Bremen Police it is not known that UEEE/WEEE is exported by parties with a high degree of organisation. Instead, they are normally individual persons or small groups. Mainly televisions, hi-fi systems, car radios and CD players were collected and exported. It was estimated that around 60-100 containers are shipped per year from Bremen via Hamburg mostly to Nigeria, Ghana, Benin and the Ivory Coast. The respective hirers of the consolidated containers state that they have acquired the appliances from flea markets, from collecting bulky waste and from electrical repair businesses.

The police in Bremen has no access to the databases which comprise goods codes, unlike the Hamburg Police. It inspects the collection and packing points in Bremen for potentially illegal activities.

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100 Centre for Information Processing and Information Technology, see http://www.zoll.de/dienststverz/dvz_sonst_zivit/index.html.

101 Zusätzlich gibt es noch eine halbe Stelle, die sich hauptsächlich um die Datenerfassung kümmert.

The police's lack of decision-making authority in suspected cases was stated as a difficulty. It is also very difficult for a state authority to decide as an administrative authority in cases which are not clear. There was a risk that the state authority would have to bear costs if a shipment were prevented, only for it to be decided later that it is allowed to be exported. There was also one case where the costs of treatment and storage had to be borne by the authority because the exporter was no longer within reach.

In the view of the Bremen Police the consistent application of the amended Correspondents' Guidelines No. 1 would be an effective tool which would greatly reduce the export flows of low-quality appliances.

The activities of the IMPEL[102]-Seaport TFS[103] project, which intends to standardise practices in ports, was considered very helpful and sensible and should be continued in order to have a European-wide standard guideline concerning the export of UEEE/WEEE to non-EU countries. It was also stated that networking in Germany would also make sense as there are considerable differences in decision-making practice in the federal states.

7.3 North Rhine-Westphalia - District Government of Düsseldorf

The District Government of Düsseldorf had 8 suspected cases of illegal waste shipment in 2008 which were reported by the customs offices in Antwerp and Rotterdam. It is estimated though that the number of unreported cases is a lot higher. Exports travel mainly via Rotterdam and Antwerp.

In one case the District Government ordered the recall of a container from Rotterdam. The content of the container had been stated as used televisions, the actual contents though were ironing boards, computers and other objects. There was no outer packaging. The amended Correspondents' Guidelines were consulted when making the decision. An appeal was made against the recall order. However, the District Government won in the first instance and also considers its chances to be good before the Upper Administrative Court (OVG) in Münster. It has already won another case. However, it was noted that the cost in terms of time of such recall orders and the potential legal consequences were considerable.

Suspected cases are always reported by the customs offices in Antwerp or Rotterdam. The appliances which are exported come according to the District Government of Düsseldorf from points which are established before municipal collection points and used car sites, as well as from flea markets and stealing from bulky waste. The District Government is not aware of any cases in which appliances are exported after being handed over to municipal collection points.

It was noted that the inspection activities which were carried out together with the IMPEL-TFS network were helpful and that they should be continued. The national cooperation between the Federal Office for the Transport of Goods, customs and the police should be further intensified.

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[102] Implementation and Enforcement of Environmental Law.

[103] Transfrontier Shipment of waste; one of the goals of the project is to harmonise activities in ports.

7.4 Federal Office for the Transport of Goods

The Federal Office for the Transport of Goods (BAG) is an independent federal authority in the Federal Ministry of Transport, Building and Urban Affairs. It watches over among others the transportation of waste by vehicles for road freight[104]. The BAG's inspections are carried out on motorways, federal and state roads in part undertaken in cooperation with the police and other supervisory authorities[105].

It is difficult for the BAG to gain an overall picture on this topic as the individual state authorities have different views on what is waste and what is not. More uniform decision-making by the authorities involved would according to the BAG make sense as it essentially always decides on a case-by-case basis whether it temporarily prevents a stopped shipment of electrical equipment which is suspected of being waste from continuing its journey in order to inform the responsible authorities. The amended Correspondents' Guidelines No. 1 are used by the BAG. Statistics are not recorded on non-compliant transport relating to electrical equipment, however UEEE/WEEE have in the past been the subject of waste inspections by the BAG's road inspection service time and again [BAG pers. com. 2009].

7.5 Criminal Police Offices

The Federal Criminal Police Office (BKA) has replied in writing to a questionnaire.

According to the BKA in the period between 2004 and 2008 a total of 27 suspected cases relating to the export of UEEE/WEEE were registered in which the state police instigated preliminary proceedings in accordance with § 326 para. 2 of the Penal Code (StGB) (illegal handling of hazardous waste). The majority of the preliminary proceedings were instigated by the police (Water Protection Police) in Hamburg and Bremen. The actual number of preliminary proceedings may be higher though as the BKA is not informed in every case.

Police waste transport inspections to gather evidence were identified as crucial for enabling proceedings.

The probing and carrying out of targeted inspections is in the opinion of the BKA helped by cooperation between police and customs authorities.

The current legal uncertainty in administrative enforcement relating to the difference between UEEE and WEEE has proven to be a hindrance to instigating criminal proceedings[106].

There would be more legal certainty if existing legal regulations (e.g. the Electrical and Electronic Equipment Act) were amended with certain content (here in particular the criteria for differentiating between used electrical and electronic equipment and waste electrical and electronic equipment) of the Correspondents' Guidelines No.1. This would also strengthen enforcement and the fight against illegal practices.

The BKA stresses the need for sufficient and available government resources as a requirement for enforcement and the fight against illegal practices.

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[104] Road Haulage Act (Güterkraftverkehrsgesetz) § 11 para. 2 letter j.

[105] Kropp, O., "Zuständigkeiten und Vorgehensweise bei der Kontrolle grenzüberschreitender Abfalltransporte" (Responsibilities and procedures for controlling cross-border waste transport) Mainz. UPR 6/2008.

[106] Apart from cooling appliances containing CFCs.

It was stated that the ATLAS and ZAPP systems would enable improved detection and inspection of loads possibly containing WEEE as they enable access to certain export data.

In a range of detailed questions the state police forces were referred to.

According to the BKA's public relations department its goals for 2009 involved focusing on "shipments of waste electrical equipment" and it has been actively participating in Interpol's current "e-waste" project since the end of 2008.

8 Recovery of raw materials

8.1 Exported raw materials volumes

Due to the current uncertainty of the data, different variants of exported material flows have been calculated. Data uncertainty was considered at two levels:

- Total exported volumes: a minimum volume of 93,000 t, a maximum volume of 216,000 t and a weighted average volume of 155,000 t were included in the calculations.
- Exported appliance mix: the share of exported small appliances tends to be underestimated. Therefore, in addition to the appliance mix in accordance with customs registrations, an appliance mix with an increased share of small appliances was considered in the calculations.

Table 28 summarises the variants.

Table 28: Variants of material flow calculations

Variant	Sub-variant	Total exported volume	Appliance mix	
			CRT share	Share of small appliances and PCs
1	1	High	High	Low
	2		Slightly less	Increased
2	1	Low	High	Low
	2		Slightly less	Increased
3	1	Average	Average	Average

Based on these variants, this results in (see Figure 33) an export volume (weighted average) of 37,000 t for steel (range between 18,000 t and 61,000 t), 65,000 t for CRT glass (range between 35,000 t and 81,000 t) and 23,000 t for plastic (range between 13,000 t and 33,000 t).

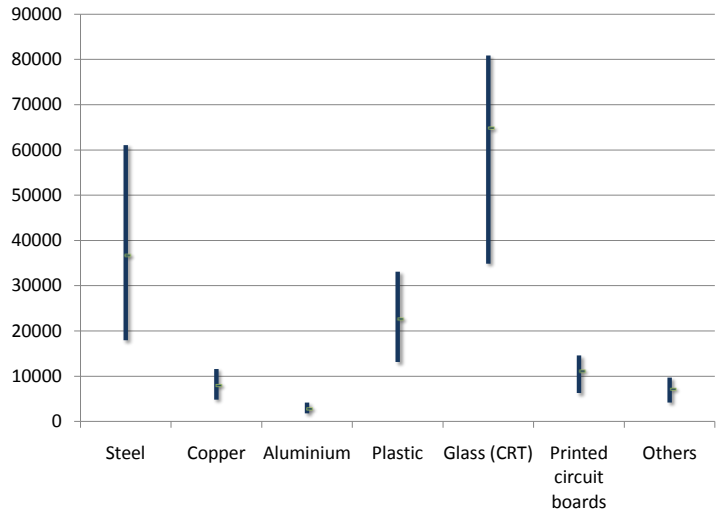

Figure 33: Range diagram of exported materials (figures in t for 2008)

Due to the limited availability of data on precious metal contents in the various appliance types, the representation of gold, silver and palladium is limited (see Figure 34). The exported precious metal volumes were calculated at ca. 1.6 t for silver (range between 0.5 t and 3.3 t), 300 kg for gold (range between 0.1 t and 0.6 t) and 120 kg for palladium (range between 0.05 t and 0.2 t).

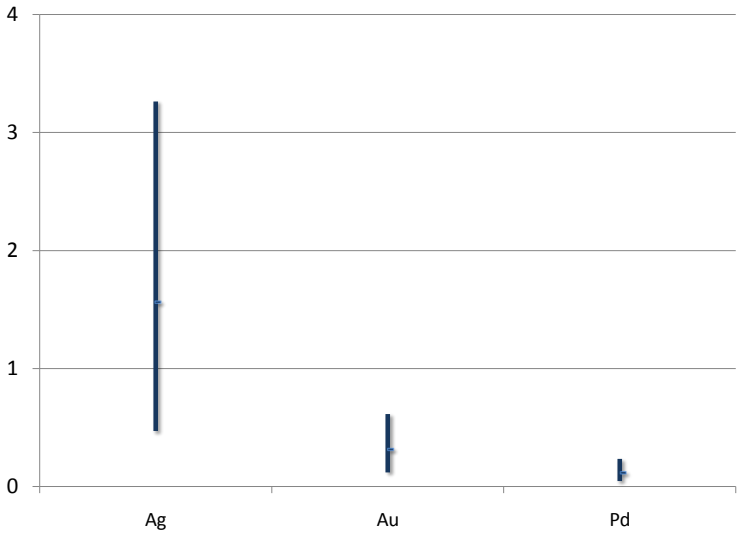

Figure 34: Range diagram of exported precious metals (figures in t for 2008)

Based on precious metal prices in the first quarter of 2008 the value of exported precious metal is ca. € 9 million (range between € 3 million and € 17 million).

For materials with particular environmental relevance (apart from the above-mentioned CRT glass), the volumes were 22 kg for batteries (range between 7 kg and 47 kg) and 90 kg for mercury (range between 20 kg and 190 kg) (data base [UNU 2007]).

8.2 Recovery of raw materials

Under ideal market conditions, i.e. with the effects of market forces in the areas in which the electrical/electronic equipment is handled in the countries of destination, it can be assumed that mass-relevant raw materials with relatively good purity can be reclaimed for recycling. This applies, for example, for steel and copper and, to a limited extent, aluminium (the recycling of the latter is dependent on whether it is identified and whether sufficient quantities are yielded in order to carry out separation).

For ca. three quarters of the exported quantities it can be assumed that the lacking waste management infrastructure leads to the final disposal of materials (often on unsuitable areas). The inadequate possibilities for final disposal, primarily with batteries and accumulators, mercury switches, capacitors and oils, lead to direct environmental effects.

No analysis is available regarding the reclamation rates for precious metals and rare earths in the countries of destination. Based on analysis in Bangalore and treatment processes applied in Asia it can be assumed according to [Hagelüken 2009] that reclamation rates for gold of 25 % are achieved when printed circuit boards are treated in simple processes. Palladium, rare metals, lead and nickel will be lost. According to this basis it can be estimated that ca. 240 kg gold (ranges from 90 kg to 458 kg) and 120 kg palladium (ranges from 50 kg to 230 kg) are lost in the countries of destination. If similar reclamation rates are applied for silver as done for gold it can be estimated that 1.2 t of silver would be lost (ranges from 353 kg to 2,445 kg).

It has to be noted that this calculation model assumes that the equipment is actually collected in the countries of destination and that market forces in the regions ensure that (limited) reclamation possibilities are applied. To what extent this is actually the case is not known exactly and would require investigations in those countries.

9 Measures/options

In discussions with the parties involved, measures were developed which can contribute towards optimising the control and inspection of transboundary shipment of electrical equipment. The measures are influenced or determined among other things by there being no treatment facilities available in the countries of destination considered with a protection level which the European member states consider to be minimum standards for themselves. The analysis of the situation in the countries of destination reveals the necessity to effectively ensure in practice that only appliance qualities which are according to the definition of the Waste Framework Directive[107] (article 3) re-usable without further preparation and meet the requirements of the Correspondents' Guidelines for products are exported under the product regime (appliance categories A to D1 in accordance with chapter 4.9).

The measures are described in chapters 9.1 to 9.4 and summarised in Table 29[108].

9.1 Statistics and data

The evaluation of statistics and databases has shown that meaningful information on the export of used electrical and electronic equipment of the characteristic profiles D2 to G (see chapter 4.9) can only be prepared with a lot of time and effort, if at all.

In order to improve information from the further monitoring of the development of exports of such appliances, **evaluation routines for the export databases should be developed and implemented in order to simplify/enable the monitoring (Measure 1a**)[109]. **The waste monitoring authorities (where applicable also those of other federal states other than Hamburg) should have easier access to export data in order to allow volume developments to be monitored** (**Measure 1b**). In this context it should be **ensured on a permanent basis that the police has access to the export databases** (**Measure 1c**).

The Federal Ministry of Finance (BMF) should initiate appropriate data retention requirements and evaluation routines.

The time horizon for the initiation of the measure should be in the short term.

In relation to this, a differentiation in the statistics between new and used appliances is important. This differentiation is currently achieved using criteria of limited reliability (exporter's state-

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[107] Directive 2008/98/EC of the European Parliament and Council of the 19.11.2008 on waste and repealing certain directives, Official Journal L 312 of the 22.11.2008, p. 3.

[108] The numbers of the measures stated in the text are in accordance with Table 30.

[109] The exports should without exception be classified in the specified value categories (see also chapter 2) in order to include the indicator "value of exported goods" in the monitoring.
A full account of the volumes in the DESTATIS data including below certain value limits would provide important information on the exporting of goods in the grey area between waste and product.

ment on price per registration[110]). **European statistics should differentiate for relevant exported appliance types such as monitors, televisions, refrigerators between new and used appliances by introducing appropriate codes in the combined nomenclature** (**Measure 1d**). The agreement of all countries participating in the Harmonised System (HS) (see chapter 3) would take a lot of time (if an agreement could be achieved at all), as there is also a goal to reduce the total number of goods codes. Differentiation at the level of the combined nomenclature of the EU appears to be enough to address the problem of exports from Europe. **Worldwide harmonisation is recommended as a longer-term prospect**.

The possibility of seizing the initiative to implement this measure is considered most likely with the UBA or BMU in cooperation with the BMF. Implementation of this measure should be started in the short term. It has to be assumed though that it will take several years until it is really applied.

9.2 Sources of exported equipment

Overall, it was seen that the exported appliances of the profiles D2 to G (see chapter 4.9) come from a large number of sources. There is not one major source which, if regulated, would result in most of the exported appliances of the profiles D2 to G being covered.

It appears that theft from **bulky waste** and the collection of electrical and electronic equipment by **scrap collectors** can only be controlled to a limited extent by local inspections by regulatory authorities. Such inspections are also associated with relatively high cost. It therefore appears to make sense **to as far as possible change the collection of appliances from the roadside and in a manner which provides protection against theft (collection, hand-over by last owner) (Measure 2a).** In relation to the collection of bulky waste but also with regard to the collection of appliances by scrap collectors, **the public should be given more information (also by media) on the risks relating to inappropriate treatment and to their own role in relation to the export of waste electrical and electronic equipment and the negative consequences of this (Measure 2b).**

Here the UBA should seek to cooperate with the municipalities or the VKS in the VKU and initiate public campaigns and changes in collection. The UBA can also initiate public relations activities with institutions which perform public relations within the scope of implementing the Electrical and Electronic Equipment Law (ElektroG).

The measures can be initiated in the short term.

It also appears with regard to appliances which are traded via **print media** and at **flea markets** that the most likely way to reduce the number of appliances with the profiles D2 to G being sold to export-relevant routes is by providing the public with targeted information. However, it will be very important here to provide the last users with a specific alternative in the public relations message. Awareness that the appliances can still have a use plays an important role in particular with sales at flea markets. The communication of contacts at qualified re-use organisations

[110] There are a couple of uncertainties involved when evaluating the database based on prices. First of all the stating of prices of exported goods has repercussions under customs law, and secondly the prices refer to individual registrations. It is not possible to clearly deduce the unit prices of the appliances exported from this.

may make sense here. A list of such re-use organisations should be developed by the offices responsible for public relations.

Providing the public with information and the link to the situation in the countries of destination is also considered an important measure with regard to **online trading**. Particularly with the major trading platforms such as eBay, this should be done in cooperation with the operators.

The UBA should also initiate public relations activities here with institutions which perform public relations within the scope of implementing the Electrical and Electronic Equipment Law (ElektroG).

Many **producers** of electrical and electronic equipment have not developed and established their own specific corporate philosophy/policy in relation to the exporting of new and used appliances. At many companies the specific responsibilities or scope for action have not been specifically implemented. **Producers should therefore develop and implement specific corporate policies in relation to the exporting of waste electrical and electronic equipment (Measure 2c).** Particularly so far as re-marketing companies are concerned, the development opportunities appear to exist (e.g. the choice of **re-marketing companies which have established a qualified specific corporate policy in relation to the exporting of non-working appliances (see Measure 2d below)**). However, the monitoring of the contracted treatment companies for WEEE can also be developed in those cases where the producers do not monitor real mass flow rates in practice.

It should be worked out with producers and producer organisations (where applicable at European level) how such a corporate policy and its compliance could be realised.

While the initiation of the process by for example the BMU is conceivable, the overall process should though be organised by the producers themselves.

For **re-marketing companies** the export of appliances is an important part of their corporate strategy. Their selection function is also based with regard to exported appliances on their own interpretations of legislation. **Therefore quality labels and a voluntary commitment for re-marketing companies should be developed and implemented (goal: non-export of non-working appliances to non-EU countries) (Measure 2d**). Here the instrument of self-commitment and transparent proof of compliance with this appears to make sense in order to ensure a common understanding.

The BMU can initiate a discussion on such a self-commitment. A workshop could be held on this issue, to which the most important re-marketing companies would be invited.

The number of appliances of the profiles D2 to G actually exported by **re-use organisations** (e.g. job-creation and training companies) appears to be rather low[111]. It is therefore considered to be sensible that specific corporate policies for exports are developed for such companies and where applicable ensured by a quality label. On the way, these organisations can also set quality standards for other institutions which re-market appliances.

Particularly in the context of the work of re-use organisations, **the development of a quality label should be integrated into the "Second Life" project promoted by the UBA (Measure**

[111] Pers. com. Bröhl-Kerner Werkstatt Frankfurt 2009

2d). In the process, as for re-marketing companies, specific requirements on the export of non-working appliances should be considered.

A self-commitment of producers and exporters relating to the non-export of non-working old appliances should be introduced at the CeBIT trade fair in 2011 (Measure 2e).

The consideration of export-related corporate policies when companies are evaluated by ranking organisations appears to make sense (Measure 2f). The UBA should inform specific appropriate companies about this.

The discussions with **waste management companies** (and producers) have shown that producers monitor the management of waste appliances which they are responsible for to varying levels of detail. Some producers make precise specifications to the waste management companies relating to treatment routes and also monitor these. Other producers merely require that the contracted waste management company must meet the minimum legal requirements for treatment, but monitor the mass balances themselves. A third group of producers hand the waste over to the contracted waste management companies without making any specifications beyond the minimum legal requirements and without doing any monitoring themselves. Waste management companies which have built their own treatment and recycling plants stressed their interest in fully utilising these plants and that it is normally more economical to dispose of the waste in their own plant than to export the appliances. In particular major waste treatment companies emphasised that a positive image and customer loyalty (in this case of producers) are essential for the longer-term success of the business and that it was therefore in their own interests to prevent exports to grey zones, which was ensured by internal monitoring.

It would need to be clarified whether a negative **"black list"** of companies is legally tenable. The publication of a positive list of certified companies does though appear to be possible. Past cases though show that certification as a waste management company does not seem to provide sufficient certainty. Instead improved control mechanisms appear to be necessary to cover the export problem.

Measures which are applied at the level of producers (as well as re-marketing companies and waste treatment companies) as **voluntary and self-committed measures** also appear to make sense because there are limits to a purely legal strategy due to the international constellation.

Specific **product responsibility concepts**, where the producer or retailer remains the owner of the product during its utilisation phase (e.g. leasing) are currently being used for some types of appliances and user constellations (in particular among industrial, high-price users). Such concepts, which could be extended to other appliance types and user groups, do not provide a sufficient instrument per se to improve controls for the exporting of appliances. It has been revealed that re-marketing organisations, which take back used appliances from leasing activities when producers deliver new appliances, export appliances of the profiles D2 to G. In cases where the producers do not recondition or resell the appliances themselves, specific product responsibility concepts would only make sense in conjunction with a self-commitment as described above.

9.3 Legal regulations and controls

Important legal regulatory areas which concern the exporting of appliances of the profiles C to G are the differentiation between waste and non-waste and the regulations concerning the export restriction of appliances which do not meet certain minimum requirements.

The discussions with the parties controlling exports have shown that a simple legal basis for distinguishing between appliances which may be exported in the product regime and those which should be exported in the better-monitored waste regime, is considered to be essentially important.

Appendix I to the draft of the amendment of the WEEE directive was considered by these parties to be an important step and a suitable instrument which can solve a range of difficulties in preventing unwanted exports.

The analyses and discussions have shown that this instrument achieves the best effect when it is kept simple. With simple requirements it can happen though that some exports are prevented which would not result in unwanted consequences in the countries of destination or in loss of resources. In view of the scale of the problem in countries of destination such as Nigeria and Ghana, it does appear to be justifiable, however, to accept unwanted side-effects to a limited degree in order to considerably ease the overall problem. Here a social responsibility to improve the situation in the countries of destination is also seen, which have to be placed possibly before those of individual interests. Where necessary it should be reviewed at regular intervals whether the application of the detailed monitoring regime of waste legislation results in unreasonable difficulties for exports.

It is therefore recommended that the distinction between waste and non-waste for UEEE/WEEE should be made via the amendment to the WEEE. The existing approach in this draft amendment should be further developed in detail for this purpose (Measure 3a). In any case a specification in the text of Appendix I to the effect that only exports outside of the EU are to be affected by the regulation appears to make sense. It should also be reviewed whether it has been included in Appendix I of the amendment of the WEEE directive in accordance with the requirement of 8b (last clause) of the Correspondents' Guidelines[112] that non-working appliances which are under guarantee and sent for repair by the producer are not subject to the waste regime.

It appears to make sense, based among other things on further discussions with various re-use organisations, re-marketing companies and parties controlling exports, to relate the requirements which Appendix I makes on permissible exports to fundamental functions of the appliance. Appendix I para. 1 a) therefore specifies a copy of the invoice and the contract (…) which confirms that the appliance is suitable for direct re-use and in full working order." Appendix I paragraph 2 a) defines the test requirements in more specific terms: "For most used electrical and electrical equipment a test of the key functions is sufficient" [proposal for a directive of the European Parliament and Council concerning waste electrical and electronic equipment (new version) Brussels, 2008]). For the cases of doubt which have become known within the scope of

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[112] Electrical and electronic equipment is normally not considered to be waste if
b) the criteria specified in paragraph 7 letters c and d are complied with and the appliances are returned as a faulty collective consignment for maintenance to the producer or to maintenance centres (e.g. as part of the guarantee) with the intention of re-use. For clarification it is recommended that the text is specified more precisely to the effect that this applies to appliances sent for "maintenance to the producer or to its maintenance centres".

this study a test of these key functions would have been sufficient to prevent export under the product regime. It is necessary to define the tests for the key functions mentioned in more specific terms. This can be done though in subordinate regulations. It appears in any case to be necessary to link breaches of the requirements of Appendix I with fines or penalties.

The proposals can be made by the BMU in the discussion on the amendment of the WEEE directive in a European context.

By way of support, a simple **matrix** should be developed for the information of exporters, as well as for use with export controls and by the authorities responsible for exports in the federal states which adopt the differentiation between appliances in categories A to G (see chapter 4.9) proposed in this study. The matrix presented in a project workshop by the Hamburg Environment Office can be used here as a starting point.

The timetable for the revision of the WEEE directive suggests that it may take another 3 to 5 years before it is implemented in national law and actually comes into force. For some types of equipment, this period is too long as for example CRT monitors and televisions are now being exported in great volumes as they are being replaced by flat screens. With other used appliances the requirements of for example the RoHS directive (on the restriction of the use of certain hazardous substances in electrical and electronic equipment) will not show any real effects with used appliances for a couple of years, whereby the need for action is greater now. It is not possible to make an appropriate change to the Electrical and Electronic Equipment Law (ElektroG) while the WEEE directive is being revised (block on changes). The legal obligation to ensure the requirements of the Correspondents' Guidelines at national level in the short term also carries the risk that exports will be redirected to ports in other member states.

The analysis on the origin of exported appliances (see chapter 5) showed that a range of sources is relevant and therefore also that a range of intervention points should be processed. Based on experience and the fact that the personnel resources for enforcement are instead being reduced, monitoring of these points appears to be difficult. As a result, export controls at the points where the appliances are stowed into sea containers or where the containers are shipped become particularly important.

While the city of Hamburg has managed to employ two additional people in the area of waste shipment, in view of the large number of containers this cannot though sufficiently replace personnel resources in other federal states. The analysis of the areas of origin has shown that the monitoring of export hubs will remain of great importance for improving export processes and that relevant volumes of appliances are not export via the Port of Hamburg, but via ports in other member states (e.g. Antwerp).

The knowledge and awareness of collection points for electrical and electronic equipment for export (see section 5.1) is still very limited in the federal states. **It is recommended that first of all a systematic survey on the number, facilities, approval type and status and turnover of the collection points in the federal states takes place. Criteria for the identification and control of collection points should be developed for this purpose (Measure 3b)**. As the goods collected and traded here often fall in the grey area between waste and non-waste, the situation at the collection points can for example be assessed against the background of the requirements of the Electrical and Electronic Equipment Law (ElektroG) and Appendix I of the amendment of the WEEE directive.

Appropriate initiatives could be proposed by the BMU to the LAGA.

In some federal states and in Europe collection points are already being monitored in relation to exports of electrical and electronic equipment. It was emphasised that it is not possible to monitor every container which is packed for export. The goal is rather to control by way of example and to talk with exporters and gather their information on the requirements concerning the export electrical and electronic equipment under the product regime. An extension of such controls and discussions to more collection points should be initiated by the responsible monitoring authorities in cooperation with the responsible police forces. Where applicable this is also possible in the form of more concerted actions in which the experiences of the various federal states can be included.

It became clear that the effective cooperation between the police, customs and the responsible waste authorities is an essential requirement for successful waste export controls and a harmonised and high standard of control. The legal responsibility of the police for the area of waste transport controls is at least considered to be sensible in the inland and sea port cities. An important element for effective controls is also that the police obtain access to databases for export registrations. This access, which has been established in Hamburg but is not ensured for future database systems, is considered an important requirement for identifying suspected cases using the police and being able to carry out targeted inspections. **For this purpose the risk profiles of such exports should be further developed and there should be more intensive exchange between the responsible authorities (Measure 3c).**

Based on the IT information on export registrations, container check routines can be applied which also differentiate between the environmental risk potential of the appliances.

- With refrigerators, the statistical comparisons suggest that a significant share of the appliances contain CFCs. Here a high frequency of controls and monitoring of the appliance-specific information, as recommended by the Correspondents' Guidelines, makes sense.
- CRT monitors are currently the most significant type of appliance in terms of volume being exported to the countries of destination investigated. The environmental risk potential and the currently very strong drivers for non-working appliances to also be exported (domestic treatment costs, lack of recycling opportunities for the highest-volume fractions) also make a high inspection frequency appear sensible.

This practice, which already takes place in some federal states, should be harmonised in its application.

In addition, the on-the-ground work of the environment offices with container inspections should be foreseen.

The exchange between the federal states and between German, Dutch and Belgian sea ports on the investigative profiles of exports where the risk of exporting waste as products is particularly high should be intensified.

According to the police they could gather more detailed information on the areas of origin if, for example, after a transport is stopped the responsible authority issued such a request to the police. The gaps in information on the origin of exported appliances (see chapter 6 and in particular sections 6.6 and 6.8) show the importance of such a procedure. **Investigations using the police in certain potential areas of origin for exported UEEE/WEEE (appliances which were already in the waste regime and are exported as used appliances) should be initiated (Measure 3d).**

The exchange of information between the federal states is considered a sensible way of collating and using experience in all states. This can be done by developing a network of regional authorities and by exchanging employees. In the process, the experiences from the IMPEL-TFS projects concerning exchanging experience can be built upon. This could be initiated in the short term by Germany's coordinating centre for the Basel Convention.

9.4 Waste treatment structures in the countries of destination

The above recommended measures have shown that a mixture of measures at different levels and with different time horizons is necessary in order to optimise the management and control of cross-border material flows of waste electrical and electronic equipment.

First, it will be a matter of significantly reducing unwanted exports with source-related measures and improved export controls. Measures for this can be initiated in the short and medium term.

In addition, further-reaching measures are considered sensible, with their implementation period considered to be in the medium to long term.

The waste treatment structures in the countries of destination are below (sometimes by far) the protection level which the Europeans have set themselves. As the export of appliances (in working order) will continue in future, and this certainly also makes social and environmental sense, and new appliances will be marketed which will at some point be ready for treatment, the support of the countries of destination in the further development of their waste treatment structures and the tying of the industrial countries to waste treatment structures makes sense.

With regard to environmental and health risks and also with regard to the relevant volumes of raw materials which are exported and not recovered, it should be expressly emphasised at this point that such medium and long-term measures can be no replacement for the export restriction measures in Germany.

The countries of destination should also establish import restrictions which prohibit the import of non-working appliances and control imports more effectively.

It should also be verified whether, for the waste caused by the appliances exported from Europe, equivalent waste volumes from the countries of destination should be disposed of in industrial countries in accordance with the requirements of the WEEE directive if no adequate waste treatment structures have been created there.

The question of how these waste shipments from the country of destination to the industrial country could be financed is still to be answered[113]. It appears that a duty on all appliances which are exported from Germany or the EU would be difficult to achieve due to legal reasons. In discussions with experts concerning such a method of financing it was emphasised though that such a duty and the increased export costs might make the exporting of poor quality appliances less profitable.

The findings concerning the waste treatment situation in the investigated countries of destination make the following dividing lines for the current situation between domestic treatment and export appear sensible:

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[113] They could be partly financed by the choice of material (e.g. material containing precious metals).

- domestic manual or basic mechanical dismantling,
- export of fractions which contain a high degree of materials with an environmental risk potential and fractions which have to be treated in technically complex thermal or chemical processes.

It also appears possible based on current knowledge (and certainly also productive) that the parties in the countries of destination share in the value created from the waste treatment.

In order to be able to export the fractions, domestic collection structures would also have to be established though. This can be problematic particularly in countries with a low degree of organisation in the informal sector (e.g. Nigeria and Ghana). It was also pointed out by some experts that the procurement of the necessary papers for the export of hazardous waste in compliance with the Basel requirements problematic and very costly in some countries.

Concerns were also expressed in discussions with experts to the effect that the re-export of waste could be used as a justification for the export of poor quality appliances to such countries and even produce an unwanted pull effect. A sensible adjustment of the economic conditions of the re-export would certainly be necessary so that this does not hinder or prevent the development of domestic waste treatment structures.

Therefore, further in-depth investigations are recommended into how fractions from the manual and mechanical dismantling of WEEE can be re-exported from the countries of destination to industrial countries (Measure 4a).

The re-export of waste must not be restricted in this proposal to waste relating to the treatment of waste electrical equipment. In particular where valuable raw materials are contained in other waste (e.g. in catalytic converters from cars[114]) and a high recovery rate cannot be ensured in the respective country, the pooling of waste provides an opportunity to increase the efficiency of transport and simplify the financing.

In parallel to this European countries and producers should provide support in the development of suitable waste treatment facilities and infrastructure in countries of destination (Measure 4b).

Producers in the countries of destination which implement broad product responsibility in this context might also implement the measures. Where applicable cooperation with companies in the recycling industry may take place[115].

9.5 Summary of the proposed measures

Table 29 below summarised the measures recommended in chapter 9.1 to 9.4.

[114] Specific cases of this were reported in Nigeria.

[115] As is the case with Hewlett Packard's involvement in measures to improve the waste management situation in Asia and South Africa. In this context discussion with forwarding agents was also proposed.

Table 29: Overview of the proposed measures

Measure		Addressee	Implementation level
Statistics			
1a	Evaluation routines for the export databases should be developed and implemented in order to simplify or enable monitoring.	BMF (German Federal Ministry of Finance) supporting work by enforcement authorities	Short-term
1b	A simple access to the export data should be provided for the waste surveillance authorities (if necessary also of those German Federal States other than Hamburg), in order to enable a monitoring of the development of quantities.	BMF	Short-term
1c	It should be permanently ensured that the police forces have access to the exports databases.	BMF	Short-term
1d	European statistics for important exported types of equipment such as, for example, monitors, television sets, refrigerators should be differentiated between new/used equipment in that appropriate codes are introduced into the combined nomenclature (a worldwide harmonisation is recommended as long-term perspective).	BMF	Medium-term
Sources of exported equipment			
2a	The collection of bulky waste should take place in such a form that protection against pilferage of waste electrical and electronic equipment is provided.	Federal states / municipalities	Short-term
2b	The public should be more intensely informed about its own role in relationship to the export of waste electrical and electronic equipment and its negative effects.	UBA (German Federal Environment Agency)/ VKS/VKU (German Association of Municipal Waste Management and City Cleaning in VKU), all protagonists	Short-term
2c	Manufacturers should elaborate and implement explicit corporate policies for the export of used electrical/electronic equipment and waste electrical/electronic equipment.	Manufacturers / BMU (German Ministry for the Environment, Nature Conservation and Nuclear Safety)	Short-term
2d	Quality label and voluntary self-binding agreement for resellers should be elaborated and implemented (Objective: non-export of non-functional equipment in non-EU States). The integration of the label development in the UBA promoted project “Second Life” is recommended.	BMU / UBA	Short-term
2e	A voluntary self-binding agreement of manufacturers and exporters for the non-export of non-functional used equipment should be presented at the CeBIT Trade Fair in 2011.	BMU / UBA	Short-term
2f	Corporate policies for the export of non-functional equipment should be taken up by company ranking.	Ranking organisations	Medium-term

Table 29: Overview of proposed measures (continued)

Measure		Addressee	Implementation level
Legal regulations and controls			
3a	The distinction between waste and non-waste for EEE/WEEE should take place via the amendment of the WEEE Directive. The existing draft should be refined in detail on this point.	BMU/UBA	Short- to medium-term
3b	A systematic survey of the collection points for equipment for export in the German Federal States should take place and criteria for the identification and checking of such points should be elaborated.	Federal states, municipalities	Short-term
3c	Risk profiles for the export of WEEE and UEEE should be developed further and exchange between the responsible authorities should be intensified.	BMF/UBA, Environmental authorities in NL and BE; focal points for the Basel Convention	Short-term
3d	Investigations using police means in certain potential areas of origin for exported WEEE/UEEE should be initiated (equipment which has already been in the waste regime and is to be exported as used equipment).	Environmental authorities, department of public prosecution	Short-term
Cooperation with countries of destination			
4a	Investigations should take place into how a re-export of fractions from the manual and mechanical disassembly of WEEE from the countries of destination into industrial states can take place.	EU, BMZ (German Ministry for Economic Cooperation and Development)	Short-term
4b	European countries and manufacturers should provide support with the build up of suitable waste treatment facilities and infrastructure in countries of destination.	Manufacturers, EU, BMZ	Medium-term

The analysis and the discussions with experts clearly showed that the improvement of the situation cannot be achieved via a singular measure. The proposed measures combine mid- and long-term activities and target numerous protagonists/players. An intensive monitoring of potential sources of equipment destined for export everywhere will not be possible due to restricted human resources and a desired high controlling efficiency. Control measures should therefore be focused on those spots which concentrate equipment destined for export (collection and loading points, ports).

Due to the transnational character of this problem with exports pure legislative approaches cannot solve the accompanying difficulties completely. Therefore voluntary measures on the level of manufacturers (but also of the re-marketing and waste treatment companies) have been developed.

It can be expected that the combination of these measures will mitigate the problem for Germany. In order to improve the situation in the countries of destination structurally, further activities on an international level are necessary.

The inclusion of further export rules into the recast of the WEEE-Directive is being welcomed in particular by the controlling authorities. Nevertheless with regard to the current export wave of CRT-monitors the implementation of the Directive within the Member States will come too late.

With regard to the current large scale exports of old CRT-Monitors and -TV short term solutions should be found.

Overall, it can be expected that the combination of these measures can ease the problem for Germany. For a fundamental improvement of the situation in the countries of destination, however, further measures at an international level are necessary.

The inclusion of provisions for the waste export problem in the amendment of the WEEE directive is considered sensible and very helpful by the inspection authorities. With regard to the current wave of exported CRT monitors, the effects of the directive would not unfold until after the directive has been implemented in the member states, i.e. too late. In view of the large scale of old CRT monitors and televisions being exported, a solution which would have a short-term impact should be found.

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11 Appendix

11.1 ZAPP/ATLAS criteria

Table 30: Goods codes used in an evaluation of the database

Goods code	Text
84181020	Combined refrigerator-freezers, capacity > 340 l
84181080	Combined refrigerator-freezers, capacity <= 340 l
84182110	Household refrigerators, compression-type, capacity > 340 l
84182151	Household refrigerators, table model <340l St
84182159	Household refrigerators, built-in <340l St
84182191	Household refrigerators with compressor < 250 l
84182199	Household refrigerators with compressor 250-340 l
84182900	Other household refrigerators
84183020	Chest freezers, capacity <=400l
84183080	Chest freezers, capacity >400l-800l
84184020	Chest freezers, capacity <=250l
84184080	Chest freezers, capacity >250l-900l
84185011	Refrigerated show-cases and counters for frozen food
84185019	Other refrigerated show-cases and counters
84185091	Furniture for deep-freezing, storage and display
84185099	Other refrigerating furniture
84501900	Washing machines, dry linen to 10kg
84502000	Washing machines, dry linen greater than 10kg
85165000	Household microwave ovens
85166010	Electric cookers for domestic use
85166051	Electric cooking plates for domestic use
85166059	Electric cooking plates for domestic use
85166070	Electric grillers and roasters, for domestic use
85166080	Electric ovens for building in, for domestic use
85166090	Electric ovens for domestic use
85081100	Vacuum cleaners with electric motor, <20 litres
85081900	Other vacuum cleaners with electric motor
85086000	Other vacuum cleaners
85167200	Electric toasters for domestic use
85167920	Electric deep fat fryers for domestic use
85167970	Electro-thermic appliances, for domestic use, not mentioned elsewhere.
85101000	Electric shavers with self-contained electric motor
85102000	Hair clippers with self-contained electric motor
85103000	Hair-removing appliances with self-contained electric motor
85163110	Electric drying hoods
85163190	Electric hairdryers
85163200	Electro-thermic hairdressing appliances
85163300	Electric hand dryers
85164010	Electric steam irons
85164090	Electric irons
85167100	Electric coffee and tea makers, for domestic use
85094000	Electromechanical food grinders and mixers (kitchen equipment) and fruit and vegetable juice extractors, for domestic use
85098000	Electromechanical domestic appliances, with self-contained electric motor (excl. vacuum cleaners of position 8508, food grinders and mixers (kitchen equipment) and fruit and vegetable juice extractors)
84433210	Printers
84433230	Facsimile machines
84433291	Machines for copying and printing
84433293	Machines with copy function with optical system

Goods code	Text
84433299	Other machines for connection to EDP machines
84433910	Machines for copying and printing
84433931	Machines with copy function with optical system
84433939	Other copying machines
84433990	Other machines for copying and printing
84729070	Other office machines
85437010	Electrical machines with translation or dictionary functions, without a calculator
84713000	Portable computers (central unit with display and keyboard)
84714100	Digital automatic data-processing machines
84714900	Digital automatic data-processing machines, provided as a system
84715000	Digital processing units
84716060	Keyboards for input or output units
84717020	Central storage units for automatic data-processing machines
84717030	Disk storage units for automatic data-processing machines
84717050	Hard disk storage drives for automatic data-processing machines
84717070	Disk storage units for automatic data-processing machines, not mentioned elsewhere
84717080	Magnetic tape storage units for automatic data-processing machines
84717098	Storage units for automatic data-processing machines, not mentioned elsewhere
84718000	Peripheral units for data-processing machines
84719000	Magnetic or optical readers, machines
84733080	Parts and accessories, data-processing machines
84690010	Word-processing machines
85195000	Telephone answering machines
85198151	Dictating machines with external source of power
85198915	Dictating machines
85198115	Pocket-size cassette players
85198121	Cassette players with analogue or digital system
85198125	Other cassette players
85198155	Cassette recorders for recording or reproducing sound
85198161	Cassette recorders for recording or reproducing sound
85198165	Cassette recorders for recording or reproducing sound
85198175	Cassette recorders for recording or reproducing sound
85198181	Magnetic tape recorders for recording sound
85198185	Magnetic tape recorders for recording sound
85198195	Magnetic tape recorders for recording sound
85198911	Record players
85198919	Other sound reproducing apparatus without sound recording device
85198990	Other sound reproducing apparatus
85211020	Magnetic tape recorders for recording video and sound
85211095	Magnetic tape recorders for recording video and sound, not mentioned elsewhere
85221000	Pick-up cartridges
85271210	Pocket-size radiocassette players
85271290	Pocket-size radiocassette players
85271310	Radio-broadcast receivers
85271391	Radio-broadcast receivers/cassette players
85271399	Radio-broadcast receivers with laser reading system
85271900	Other radio broadcast receivers
85272120	Radio-broadcast receivers used in motor vehicles
85272152	Radio-broadcast receivers/cassette players for motor vehicles
85272159	Radio-broadcast receivers for motor vehicles
85272170	Radio-broadcast receivers for motor vehicles
85272192	Radio-broadcast receivers/cassette players for motor vehicles
85272198	Radio-broadcast receivers for motor vehicles
85272900	Radio-broadcast receivers used in motor vehicles
85279111	Radio-broadcast receivers with cassette player
85279119	Radio-broadcast receivers with speakers
85279135	Radio-broadcast receivers with laser reading system
85279191	Radio-broadcast receivers/cassette players
85279199	Other radio broadcast receivers
85279210	Alarm clock radios
85279290	Radio-broadcast receivers with clock
85279900	Other radio broadcast receivers
85192091	Sound reproducing apparatus with laser reading system operated by coins, banknotes, bank cards, tokens or

Goods code	Text
	by other means of payment
85192099	Sound reproducing apparatus without sound recording device operated by coins, banknotes, bank cards, tokens or by other means of payment (excl. those under codes 85192010 and 85192091)
85193000	Turntables, sound reproducing apparatus
85198131	Sound reproducing apparatus with laser reading system
85198135	Sound reproducing apparatus with laser reading system
85198145	Other sound reproducing apparatus without sound recording device
85192010	Coin-operated or disc-operated record-players
85258091	Video camera recorders
85258099	Video camera recorders
85219000	Video recording or reproducing apparatus
85258030	Digital cameras
85287220	Reception apparatus for television with built-in video recording or reproducing apparatus
85287190	Reception apparatus for television, colour
85287231	Reception apparatus for television, colour
85287233	Reception apparatus for television, colour
85287235	Reception apparatus for television, colour
85287239	Reception apparatus for television, colour
85287251	Reception apparatus for television, colour
85287259	Reception apparatus for television, colour
85287275	Reception apparatus for television, colour
85287291	Reception apparatus for television, colour
85287299	Reception apparatus for television, colour
85287300	Reception apparatus for television, black and white or other monochrome
85287210	Television projection equipment, colour
85286910	Video projectors, operating by means of flat panel display
85286991	Video projectors, black and white or other monochrome
85286999	Video projectors, colour
85286100	Projectors for data-processing machines
85285990	Video monitors, colour
85284935	Video monitors, colour
85284991	Video monitors, colour
85284999	Video monitors, colour
85284100	Monitors for data-processing machines
85284910	Monitors, black and white or colour
85285100	Monitors for data-processing machines
85285910	Monitors, black and white or colour
85171100	Line telephone sets with cordless handsets
85171200	Telephones for cellular networks mobile telephones or for other wireless networks
85183020	Line telephone handsets
85171800	Telephone sets (excl. line telephone sets with cordless handsets and telephones for cellular networks or for other wireless networks)
85176100	Base stations of apparatus for the transmission or reception of voice, images or other data incl. apparatus for communication in a wired or wireless network [such as a local or wide area network]
87032190	Motor vehicles with spark-ignition engine, to 1000cm3, used
87032290	Motor vehicles with spark-ignition engine, 1000-1500cm3, used
87032490	Motor vehicles, campers, with spark-ignition engine, over 3000cm3, used
87032390	Motor vehicles, campers, with spark-ignition engine, 1500cm3-3000cm3, used
87033190	Motor vehicles with diesel engine, to 1500cm3, used
87033390	Motor vehicles, campers, with diesel engine, >2500cm3, used
87033290	Motor vehicles, campers, with diesel engine,1500-2500cm3, used

11.2 Selected countries of destination

Egypt
Algeria
Angola
Ethiopia
Belgium
Benin
Burkina Faso
Ivory Coast
Democratic Republic of Congo
Democratic People's Republic of Laos
France
Gabon
Gambia
Ghana
Guinea
India
Indonesia
Yemen
Jordan
Cambodia
Cameroon
Kenya
Lebanon
Liberia
Malawi
Malaysia
Morocco
Mauritania
Mozambique
Myanmar
Nepal
Netherlands
Niger
Nigeria
Pakistan
Philippines
Republic of Congo
Republic of Korea
Saudi-Arabia
Senegal
Zimbabwe
Spain
Sri Lanka
South Africa
Thailand
Togo
Tunisia
Turkmenistan
United Arab Emirates
United Republic of Tanzania
Vietnam
People's Republic of China

11.3 Elements of the variant calculations

Table 31: Variants of the exported appliance mix

Type of appliance	Variants of the volume distribution		
	High CRT share	High share of small appliances and PCs	Average shares
Refrigerators and freezers	10%	10%	10%
Monitors	35%	30%	33%
Televisions	43%	33%	38%
Brown goods	5%	5%	5%
Small appliances	3%	10%	7%
Computers	4%	12%	8%
Total	**100%**	**100%**	**100%**

Table 32: Material flows from the export of electrical and electronic equipment and WEEE

Fraction	Max.	Min.
t		
Steel	61,064.26	17,952.48
Copper	11,585.64	4,818.85
Aluminium	4,170.97	1,790.87
Plastic	33,094.63	13,143.65
Wood	514.07	124.82
Glass	329.49	127.93
Glass (CRT)	80,873.96	34,858.26
LCD screens	1.72	0.24
Batteries	47.37	6.65
Capacitors	44.76	9.91
Circuit boards	14,589.87	6,288.52
Oil	190.23	68.98
PCB	0.17	0.07
Mercury	0.19	0.02
kg		
Ag	3.26	0.47
Au	0.61	0.12
Pd	0.23	0.05
Sn	34.70	6.86
Zn	32.46	5.78