Initiative Recyclage®

Study for a waste electrical and electronic equipment recycling chain on the national territory

Final report, September 2004

Screlec
11-17 rue Hamelin – 75116 Paris
Telephone: 01 56 28 92 35
www.screlec.fr

This report was drafted from June 2004 to August 2004.
It is the fruit of the analysis of two years of experiments conducted from July 2002 to June 2004 in the Nantes Metropolitan Area (now called 'Nantes Métropole').

The purpose of this experiment was to put in place a full-scale selective collection system for waste electrical and electronic equipment on the scale of a large area, and dispatch the waste to suitable treatment chains, in accordance with the requirements of the European directive of 27 January 2003 on waste electrical and electronic equipment, which is due to come into force on 13 August 2005.

During these two years, special measures were taken to obtain technical, logistical, business and environmental information in connection with putting in place the WEEE chain on the national territory.

Three interim reports were drafted and published:

Interim report No. 1, published in February 2003
"Description of the introduction of a selective collection system in the Nantes Metropolitan Area and initial assessments"

Interim report No. 2, published in September 2003
"The first 12 months of the WEEE selective collection system and the formation of batches for treatment: initial assessment, definition of possible logistical schemes"

Interim report No. 3, published in February 2004
"The 4 kg per year per capita of collected WEEE mark has been reached, identification and assessment of WEEE treatment technologies, definition of the most appropriate logistical systems, calculation and monitoring of the cost chain".

The final report is part of an approach aiming to consolidate and analyse the information and tests carried out, as well as to outline the prospects for the field at national level.

Presentation of the project team

This report was written by:

Laetitia FLAHAUT **Bertrand REYGNER** **Vanessa MONTAGNE**

Eric LEGRAND **Sylvain RIFFE**

Under the supervision of:

Philippe OUDEYER, Director General of Screlec

The following assisted in the drafting of this report:

Freelog
Subject: Logistics & management of the future WEEE chain.

Terra
Subject: Costing primary collection

This report was proof-read by

Sarah Martin, Department of Prevention, Recycling and Organization of Chains
Agency for Environmental and Energy Management (ADEME)

Acknowledgements

Screlec would especially like to thank all those who took part in the working parties: over 80 work meetings were held over the 2-year period, involving the active participation of over 150 people:

Alcatel: **André Mérigoux** Babyliss: **Sacha Vettu** BSH Electroménager: **Michel Bourcier – Emilie Bout** Doro Matra Telecom: **Marc Vitali** Eberhardt: **David Schillo** Elco Brandt: **Marc Heude – Michel Montassier** Electrolux Home Products: **Armand Diouris** Electrolux LDA: **Wendy Browers** Epson: **Michel Hardy** Fagor: **Jean-Michel Ezkurra** Fujitsu Siemens: **Pierre Lestienne – Xavier Garrigue** Gillette Braun: **Fernando Moleiro** Groupe Seb: **Alain Rossi – Florent Renaudin** Grundig: **André Rielh** Hewlett Packard: **Alain Rioult - Catherine Jaillant – Catherine Martial** JVC: **Jean-Luc Jacqueline** Lexmark: **Bernard Daloz – Béatrice Marneffe – Dominique Tillay** Magimix: **Mr Lorthioir** Merloni: **Stéphane Cedelle** Miele: **Jean-Marie Zablocki** Motorola: **Jean-Michel Berthelot – Eric Malahieude** Nec Computers: **Laurent Farlotti** Nokia: **Bertrand Mathieu – Fabrice Camurat – Bernard Coignet** Panasonic: **Laure Lagon Caumartin – Erwan Medjedoub – J.Samady** Philips AD: **Jean-Marc Hubert** Philips Consumer Electronics: **Jean-Paul Ouin – Philippe Presutto** Pioneer: **Yves Brasart - François-Xavier Ducos-Fonfrede** Sagem: **Guy Viguier** Samsung: **Benoît Mahé - Emmanuel Herbreteau - Hideaki Munakata - Florence Monier** Sharp: **Daniel Rohard, Luc Barbier** Siemens: **Gérard Latrouite** Sony: **Arnaud Brunet** Thomson: **Gérard Bocquenet - Diene Ndiayed - Dominique Métayer** Whirlpool: **Christian Brabant** - **Pascal Ménard**

Ademe: **Alain Geldron - Marc Cheverry - Sarah Martin - Sylvain Pasquier - Marc Janin**

Nantes Metropolitan Authority's waste management department: **Joël Forestier - Sylvie Baliguet - François Lucas - Joëlle Berton - Marie-Christine Jonnet - Sylvie Fusellier – Anne Mariani – Didier Guillou - André Alberti - tous les gardiens de waste reception centres**

Nantes Metropolitan Authority: **Gérard Potiron - Camille Durand and all the Mayors in the Nantes Metropolitan Authority**

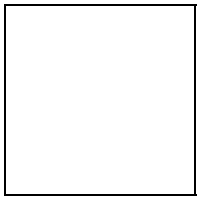
Operators**:**
Acoor Environnement: **David Dias** Aise: **Dominique Kaczmarek** Apparec: **Etienne De Wulf** Arceau Anjou: **René Séchet** Arc-en-Ciel: **Guillaume Ferré** Barbazanges: **Pierre-Yves Barbazanges** CFF: **Richard Debauve** Cité +: **Mickaël Prestavoine** Coved: **Gaëtan Maetz** Ecomicro: **Patrick Maranon** Electrorecycling: **Saber Maslah** Envie: **Philippe Fieux -Véronique Liné - Gaël Le Carnec** Galloo: **Olivier François** Géodis: **Sabine Zariatti - Damien Poiroux – Patrice Rambaud - Jean-Michel Boulmier** GDE: **Richard Guyon – François Varillon** Juratri: **Pierre Grosset** MBM: **Franck Desgranges** Noranda: **Stéphane Burban** Onyx Grandjouan: **Rémy Comte - Gérard Cassin - Hervé Moyon** Regain Ecoplast: **Daniel Roumier – Jean-Louis Ferry** Rethmann: **Vincent Rouméas** Séché: **Hugues Levasseur – Marie-Odile Bargain** Sita: **Anne Lamande - Geneviève Bedin** Tri 37: **Jean-Michel Jolly** Triade: **Jean-Pierre Parisi – Pascal Lermechin** Umicore: **Daniel Cheret** Valdelec: **Gilles Vincent**

Professional associations: **FIEEC: Bernard Heger – FICIME: Bertrand Eteve, Jean Bernard Riera, Laurence Fauque – GIFAM: Elizabeth Barthares – FCD: Géraldine Poivert – PERIFEM: Sophie Gillier- – FEDELEC: Philippe Caudron – INRS: Clara Rodriguez - FNADE –FEDEREC: Robert Lifchitz – CNEI: Brigitte Ogée – Alban Glairon Mondet - GAP UNETA: Bernard Rémy - GN PME: Guénola Urien**

Associations **CLCV – AMF – Amorce**

And all the following brand names:
Auchan: Yves Massart, Jacques Houdayer – Boulanger: Patrice Delaby, Cédric Leprince Ringuet, Emmanuel Place, Thierry Bialowas – Bouygues Telecom: Sylvie Lafont –But: Catherine Lécrivain, Laurent Luce – Camif: Philippe Guichet, Ludovic Leray – Carrefour: Véronique Discours Buhot, Nathalie Yserd, Nathalie Boutelet, Arnaud Alexandre, Paul Rowsome – Champion: Xavier Laviron – Conforama: Christian Lehot – Confort 3000: Marcel Gaborit – Connexion: Serge Rancière – Cora -

Cordon: Serge Cordon, Delphine Colas – Darty: Hervé Somon, Guy-Alexandre Gallon, Philippe Blaise – Disposelec – E. Leclerc: Pierre Chartier, Philippe Laury, Didier Bernard , Gaëtan Chadeleau - Expert: Eric Rigaud, Hervé Robert – Fnac: Denis Vicherat, Eric Le Grand, Jean-Benoit Cazenave, Christophe Waterkeyn – France Telecom: Paul Carriot, Christian Dieguez – Galeries Lafayette: Pierre Thiriet – Géant: Paul Louis Chailleux – Gitem: Ludovic Boquet, Mr Garnier – Ikea: Fabienne Della Vedova – Inter & Bricomarché: Daniel Crocq, Gwaënaelle Lacroix, Gaël Baudrier – Metro: Frédéric Lentz – Micromanie: **Dominique Houdmond - Monoprix: Jeanne Heusch, Patrick Querrec – Pro & Cie – Pulsat – Revimex: Jean François Aumon, Jean Paul Léon – Sogep: Eric Lenormand, Patrice Martin– Sytème U: Jean Leroyer, Christophe Godineau, Franck Egonneau, Hervé Bidaud, Roland Menenteau, Patrick Cerbelle.**



The financial partners of Initiative Recyclage®

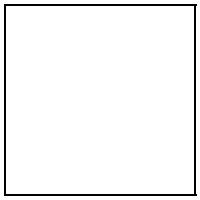
Screlec would like to thank the partners who funded this project, thereby enabling this study to be completed:

Public-sector bodies:

Agency for Environmental and Energy Management (ADEME)

41 companies manufacturing electrical and electronic goods, representing 74 brand names:

ALCATEL – ASTORIA – BABYLISS – BSH Electroménager – DE LONGHI – DOMENA – DORO MATRA TELECOM – EBERHARDT – ELCO BRANDT – ELECTROLUX HOME PRODUCTS – ELECTROLUX LDA – EPSON – FAGOR – FUJITSU SIEMENS – GILLETTE BRAUN – GORENJE - GROUPE ROSIERES – GROUPE SEB – GRUNDIG – HEWLETT PACKARD – JVC – LEMA – LEXMARK – MAGIMIX – MERLONI – MIELE – MOTOROLA – NEC COMPUTERS – NOKIA – PANASONIC – PHILIPS AD – PHILIPS Consumer Electronics – PIONEER – ROBLIN – SAGEM – SAMSUNG – SHARP - SIEMENS – SONY – THOMSON – WHIRLPOOL



Glossary of initials, abbreviations and acronyms used in this report[1]

- CFC : Chloro Fluoro Carbon
- DIY stores: Do-it-yourself stores
- IT: Information Technology (Computers, Computing)
- LHA: Large Household Appliances
    - Refrigerating LHA (hereafter abbreviated to RLHA): Large household appliances used for refrigeration purposes: Refrigerator, freezer
    - Non-refrigerating LHA (hereafter abbreviated to NRLHA): Other equipment classified under large household appliances
- m.o.: mail order (business)
- NMA: Nantes Metropolitan Authority (CUN – *Communauté Urbaine de Nantes*– in French)
- OIW: Ordinary Industrial Waste
- S&H: (self-service) Supermarkets & Hypermarkets (also known as Superstores)
    - Hypermarkets: self-service food stores over 2,500 m² in sales area
    - Supermarkets: self-service food stores from 400 to 2,500 m² in sales area
- SHA: Small Household Appliances
- SMA: Small Miscellaneous Appliances (IT, SHA, Consumer electronics excluding TV, IT excluding screens, telephony, tools, gardening, other)
- SSS: Small Specialty Shops
- S-sSS: Self-service Specialty Stores (home electronics, culture/leisure, toys, DIY, gardening)
- Tel.: Telephony
- TOOL: Tools
- TV: Television
- ULAC: Under Local Authority Control
- WEEE: Waste Electrical and Electronic Equipment
- whsle: wholesaler

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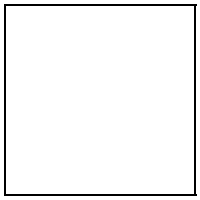


1. Assessment of the Initiative Recyclage experiment

Initiative recyclage® is the practical study of collecting and recycling waste electrical and electronic equipment produced by households. The groups of products covered in this study are:

- Consumer Electronics, comprising two subgroups: Consumer Electronics excl. TVs and TVs
- Information Technology equipment (IT), comprising two subgroups: IT excl. monitors and monitors
- Small Household Appliances (SHA)
- Telephony
- Large Lousehould Appliances (LHA), comprising 2 subgroups: RLHA (refrigerating LHA) and NRLHA (Non-Refrigerating LHA).
- Miscellaneous, including toys, DIY equipment, gardening equipment etc.

The study was conducted over a 24-month period from 1st July 2002 to 30th June 2004.

The area of the Nantes Metropolitan Authority, now called Nantes Métropole – the initial name*"Communauté Urbaine de Nantes' (CUN) is used in this final report for reasons of convenience* - was selected at the project's inception for a variety of reasons:

- the size of the territory & its population of about 550,000 inhabitants, both dense and scattered
- the presence of all the country's major retail and brand names
- the excellent coverage of the waste reception centres: 100% of the population is served
- the existence of WEEE collection and recycling initiatives, such as the collection of LHA organized by Envie 44
- the dynamism of a recently formed metropolitan authority

Of all the aims set for this study, which is unique in its field, the main one was to provide a vision of the future WEEE collection and recycling chain in France, both in terms of volumes and in terms of logistical and treatment means to implement in the short term, with a concern for economic and environmental performance.

This study has brought together all the players in the field: producers, distributors, local authorities, recycling and logistics professionals, consumer associations and the authorities. The following assessment of the experiment reviews the following topics:

1.1. WEEE collection in the Nantes Metropolitan Authority area

1.1.1. The key figures

	Total amount of WEEE collected in t	Number of appliances	Number of collection points
Initiative recyclage July 02 - June 04	4,042	168,770	133

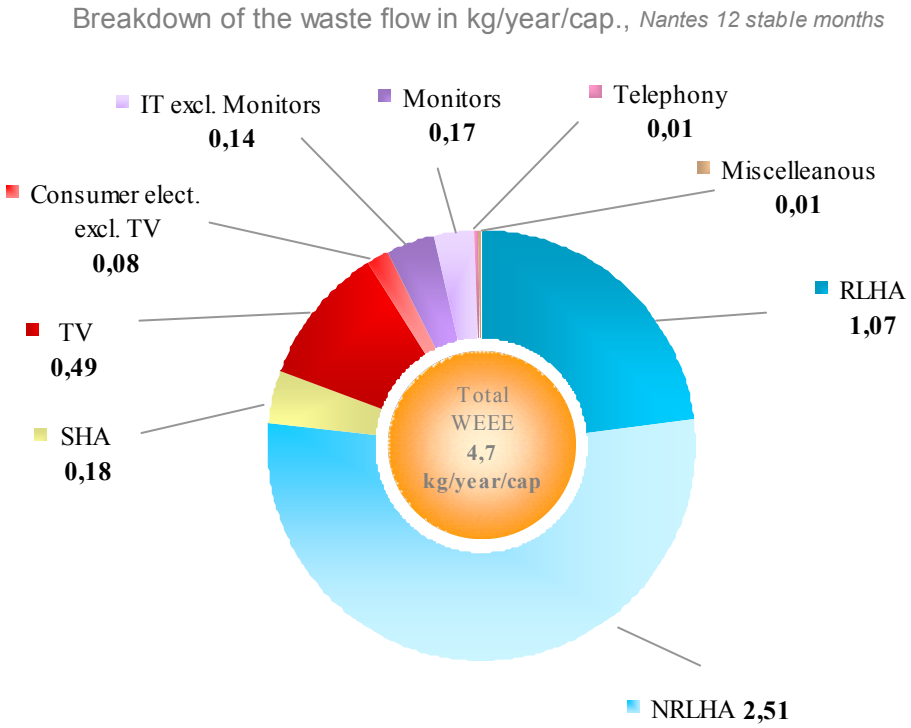
The ratio of 4 kg per year per capita, the collection target set by the WEEE directive, has now been exceeded in the Nantes Metropolitan Area, standing at 4.7 kg per year per capita for the last 12 months of the experiment, this by covering all the potential WEEE collection points (the distribution trade, waste reception centres and other collection points such as associations).

1.1.2. Breakdown of the flow of waste and variations over the experimental period

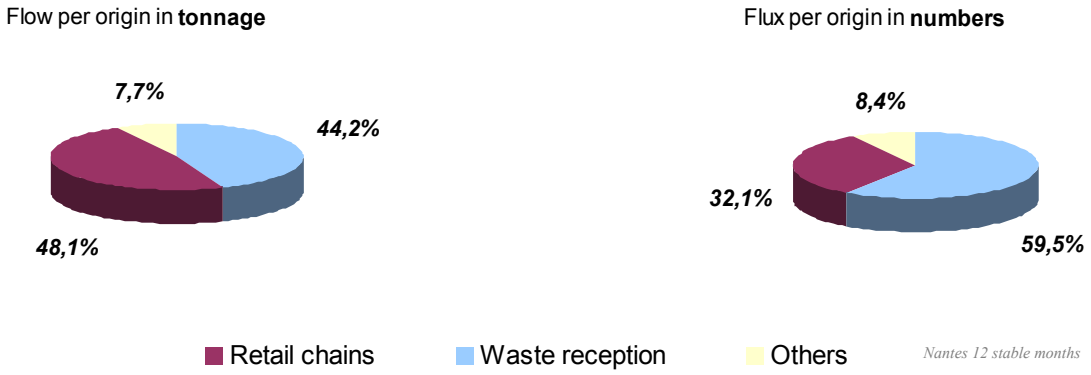
	The so-called "build-up" period		The so-called "stable" period	
	July 02 – June 03		*July 03 - June 04*	
TV	8,1%	119,4	10,5%	271,0
Cons. El excl. TV	0,96%	14,0	1,74%	44,8
Total Consumer Electronics	**9,1%**	**133,4**	**12,3%**	**315,8**
Monitors	1,2%	18,3	3,6%	93,3
IT excl. monit.	1,6%	23,9	3,1%	79,5
Total IT	**2,87%**	**42,2**	**6,72%**	**172,8**
SHA	**2,0%**	**29,8**	**3,8%**	**98,9**
Telephony	**0,2%**	**2,5**	**0,3%**	**6,8**
RLHA	23,39%	343,6	22,95%	590,4
NRLHA	62,17%	913,6	53,65%	1380,2
Total LHA	**85,6%**	**1257,2**	**76,6%**	**1970,6**
Misc.	**0,3%**	**4,3**	**0,3%**	**7,7**
Total WEEE	***100%***	***1 469 354***	***100%***	***2 572 476***

The 2 periods under study are firstly the build-up period during which collection points were progressively opened and secondly the stable period (133 collection points served).
Between these two periods, we note that the group mix evolved, in particular with the growth in collection rates for Consumer Electronics, IT equipment and SHA in tonnage terms (different types of collection points were opened and the group mix changed within each type of centre). However, the proportion of LHA remained predominant, standing at over 75%.

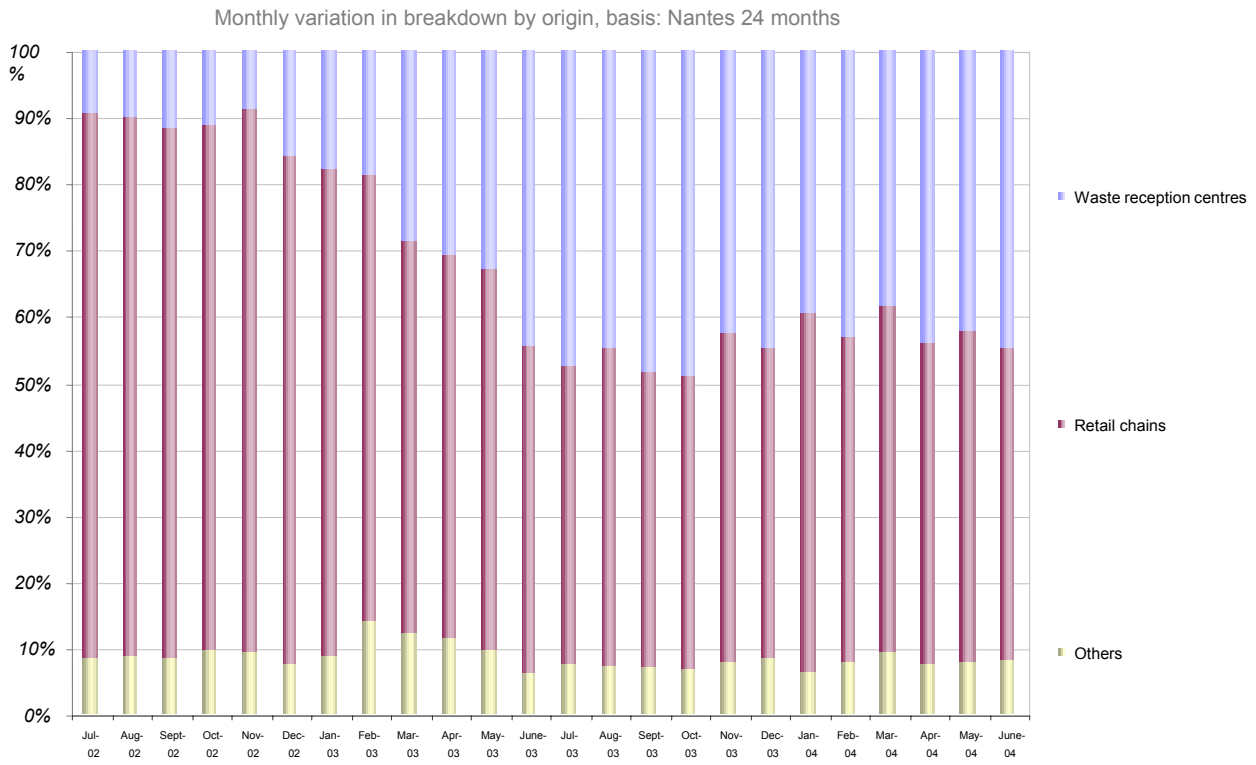
- Breakdown of waste flows in **equivalent kg per year per capita**



1.1.3. *The origins of collected WEEE and variations over the course of the experiment*



Half of the collected tonnages of WEEE came from distributors, followed closely by the flow from waste reception centres; it should be noted that the average weight of appliances collected from distributors is higher than that collected in waste reception centres.
The flow from other sources (associations, Emmaüs, etc.) is significant, making up nearly 8% of flows collected in the Nantes Metropolitan Authority.



Over the 24 months of the recycling initiative programme, the balancing out of the origins of waste flows is a striking feature, mainly originating from Distributors during the initial months, by the end of the experiment, the tonnages of collected WEEE between waste reception centres and distributors were practically equivalent.

This phenomenon originates both from the progressive opening of waste reception centres for selective collection of WEEE during the experiment as shown below, and from the growth in collected volumes per collection centre.

Monthly variation in the collection of WEEE and the order in which new waste reception centres opened

Aug-02	Sept-02	Oct-02	Nov-02	Dec-02	Jan-03	Feb-03	Mar-03	Apr-03	May 03	June 03	July 03
10,3%	18,7%	36%	-23,8%	**102,6%**	**47,9%**	-17,2%	67,3%	10%	3,3%	**85,4%**	**26,6%**

→ 4 Eco Points

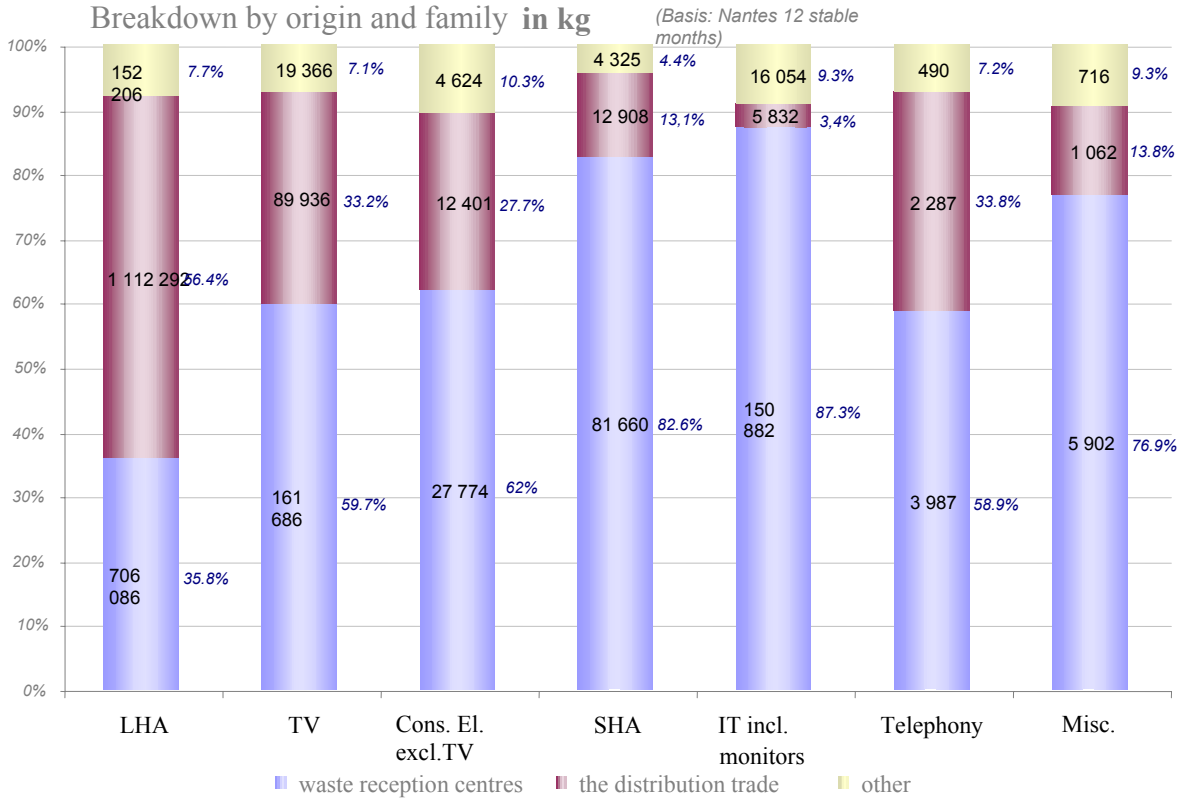
→ Nantes Sorting Centre

→ 1 waste reception centre

→ 9 waste reception centres

NB: the Nantes waste reception centre opened for selective collection of WEEE (LHA) as early as 2001.

1.1.4. *Breakdown of flows per group and origin*



A comparison of the origins between all the various groups reveals large differences: 70 to 85% of flows of SHA, IT equipment and Miscellaneous come from waste reception centres, as against 35% for LHA.

1.1.5. *Comparison of the average weight per group and origin*

(Basis: Nantes 12 stable months)

	RLHA	NRLHA	SHA	TV	Cons. Elect. Excl. TV	Monitors	IT excl. Monitors	Telephony	Misc.
Waste reception centres	43,5	43,7	4,9	21,2	3,9	12,2	5,9	1,6	3,3
Retail Chains	51,1	54,2	3,6	26	2,1	12,5	4	0,8	2,2
Others	48,1	51,8	2,3	22,4	3,5	12,7	5,2	0,9	2,2

the greatest weight

Average weight varies greatly according to product origin. It is worth noting that the average weight of television sets and large household appliances originating from distribution flows (mainly part-exchanges for sales of new appliances) is 15 to 20% greater than that of appliances coming from waste reception centres; the opposite is true for other group products, in particular SMAs, for which the difference in average weight varies from 30 to 100%.

1.2. The introduction of selective WEEE collection in the Nantes Metropolitan Area

1.2.1. Canvassing collection points

The canvassing of potential WEEE collection points in the Nantes Metropolitan Area consisted in:

- For the retail chain, meeting with all the electrical and electronic equipment retail outlets affected by the directive, persuading them to take part in the experiment according to procedures set out in a draft agreement. The aim for the point of sale is to be free of managing the end-of-life cycle of appliances and to hand them over to recycling chains.
- For waste reception centres, working out in conjunction with the Nantes Metropolitan Authority's waste management department a WEEE selective collection zone for all the waste reception centres. Waste reception centres are either managed directly by the Nantes Metropolitan Authority (under local authority control) or run on its behalf by private-sector companies; in the latter case it was also a question of entering into a contractual relationship with the private operator.
- For other collection points, obtaining the agreement of associations Envie, Emmaüs and Actif Ouest on the collection of WEEE brought to them by the general public.

- The distribution trade

Retail Chains	Total identified in the NMA	Initiative Recyclage participants	Active*
Self-service Specialty Stores (S-sSS)	22	20	13
Food Superstores (S&H)	44	26	12
Small Specialty Shops (SSS)	63	40	21
After-Sales service	36	23	22
Mail Order (m.o.)	4	4	3
Total	**169**	**113**	**71**

NB: certain distributors group together the WEEE they collect at a single collection point, which is why the 71 distributive collection points identified here then become 62.

- Waste reception centres

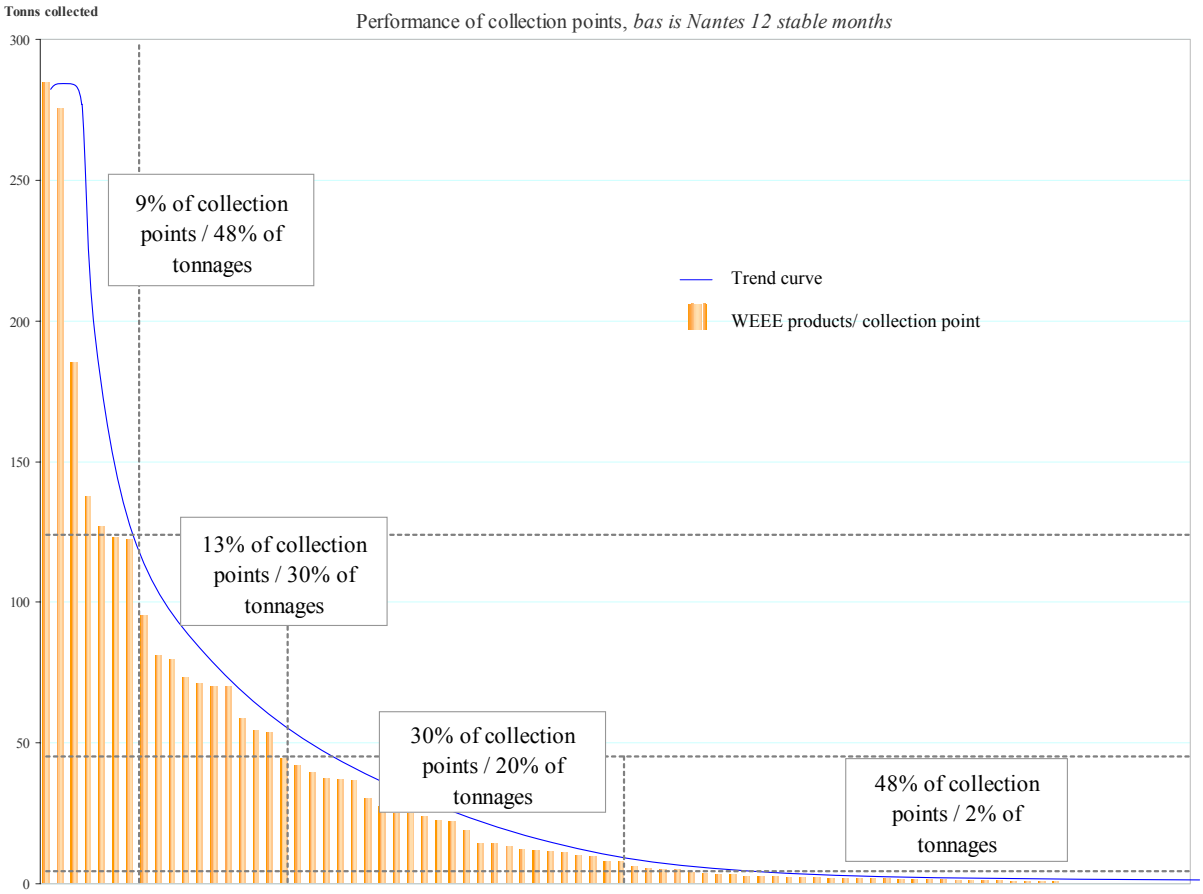
NMA	Total identified in the NMA	Initiative Recyclage participants	Active*
Waste Reception Centres	16	15	15
Sorting centres	1	1	1
Total	**17**	**16**	**16**

- Others

Others	Total identified in the NMA	Initiative Recyclage participants	Active*
Associations	**ND**	**4**	**4**

**Active: includes all collection points having provided WEEE at least once during the course of the last 12 months of the experiment*

1.2.2. *Collection points "performance" and segmentation*



Over a full year of stable activity, 91 out of the 133 collection points participating in Initiative Recyclage ® provided WEEE collected through their activity at least once.
The ratio of inactive collection points stood at 32%, all among the distributors, more particularly SSSs and S&H, as the above tables show. This can be accounted for by the fact that these stores sell very little electric and electronic equipment – they mainly sell SHAs-.

Collection points can therefore be segmented into the 4 following main categories:

Collection points profile	Collection points annual production of WEEE	Number of collection points	Equivalent in number of active collection points	Equivalent weight collected	Equivalent skip turnover
1	Over 120 t	7	9%	48%	over 4 skips a month
2	45 t to 120 t	11	13%	30%	2 skips a month
3	6 t to 45 t	25	30%	20%	1 skip a month
4	Under 6 t	39	48%	2%	less than 1 skip a month

1.3. The logistical organization of WEEE in the Nantes Metropolitan Area

The organization and implementation of WEEE collection from "canvassed" collection points took into account the background of WEEE in the area and also study-related constraints. That is why the system put in place in this area is not necessarily as optimized in logistical terms as it could have been if designed without any constraints.
The system as put in place by the Nantes Metropolitan Authority and a proposed realistic optimal system are described in this section.
It should be noted that WEEE is segmented into four 4 categories:
- Screens (television sets, computer monitors)
- RLHA (refrigerating large household appliances)
- NRLHA (non-refrigerating large household appliances)
- SMA (small miscellaneous appliances: all appliances other than LHA and screens)

1.3.1. The logistics put in place

1.3.1.1. Constraints

We took into account 2 types of constraints when setting up the organization:

- constraints relating to the players present in the field and to the background
- constraints relating to the study to be conducted

Below, some of the **field constraints**:
NMA requirements:

- Collection operators at the waste reception centres
    - operators collect from their own waste reception centres
    - Envie 44 collects from waste reception centres under local authority control
- Daily collection from waste reception centres

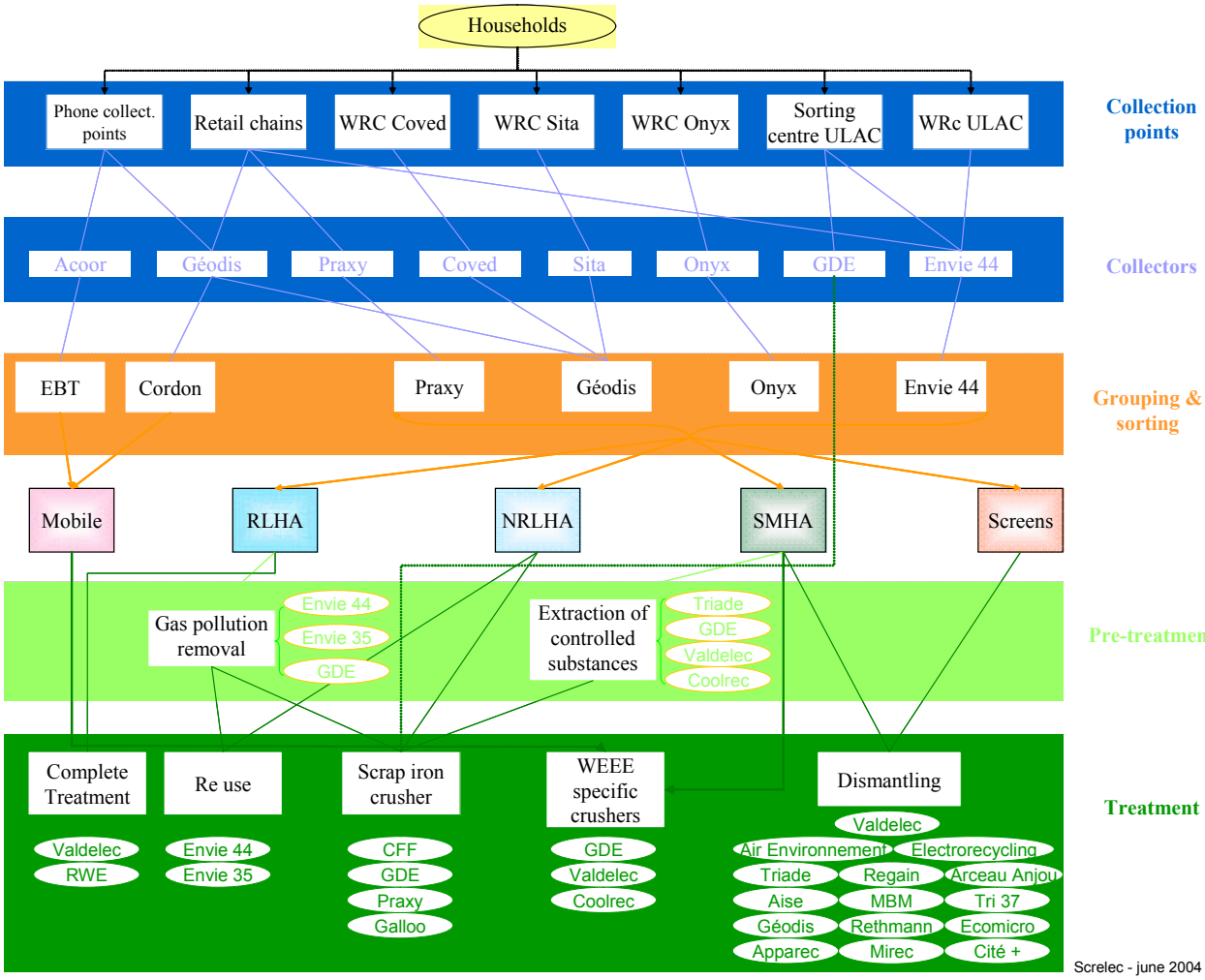
Field background:

- Contractual relationship between NMA and waste reception centre operators
- LHA collection operations carried out by Envie 44
- The retail chain's preference for a limited storage time

Below, some of the **study-related constraints**, which prevented us from optimizing the volumes collected and treated:

- Tests of various types of logistics:
    - packing (plastic crates, wire mesh crates, skips),
    - removal on demand / on rounds,
    - specialization of collection contractors (white goods, recoverable waste, logistician)
    - vehicles (utility vehicles, trucks with tailgates, tipper trucks)
- Tests of various types of treatment:
    - observation phase for "natural" services,
    - more or less automated treatment solutions tested
- Classification of flows of collected waste by origin and group
- A study limited in time and space that cannot optimize the resources (packaging, vehicles etc.)

1.3.1.2. The logistics put in place by the various players

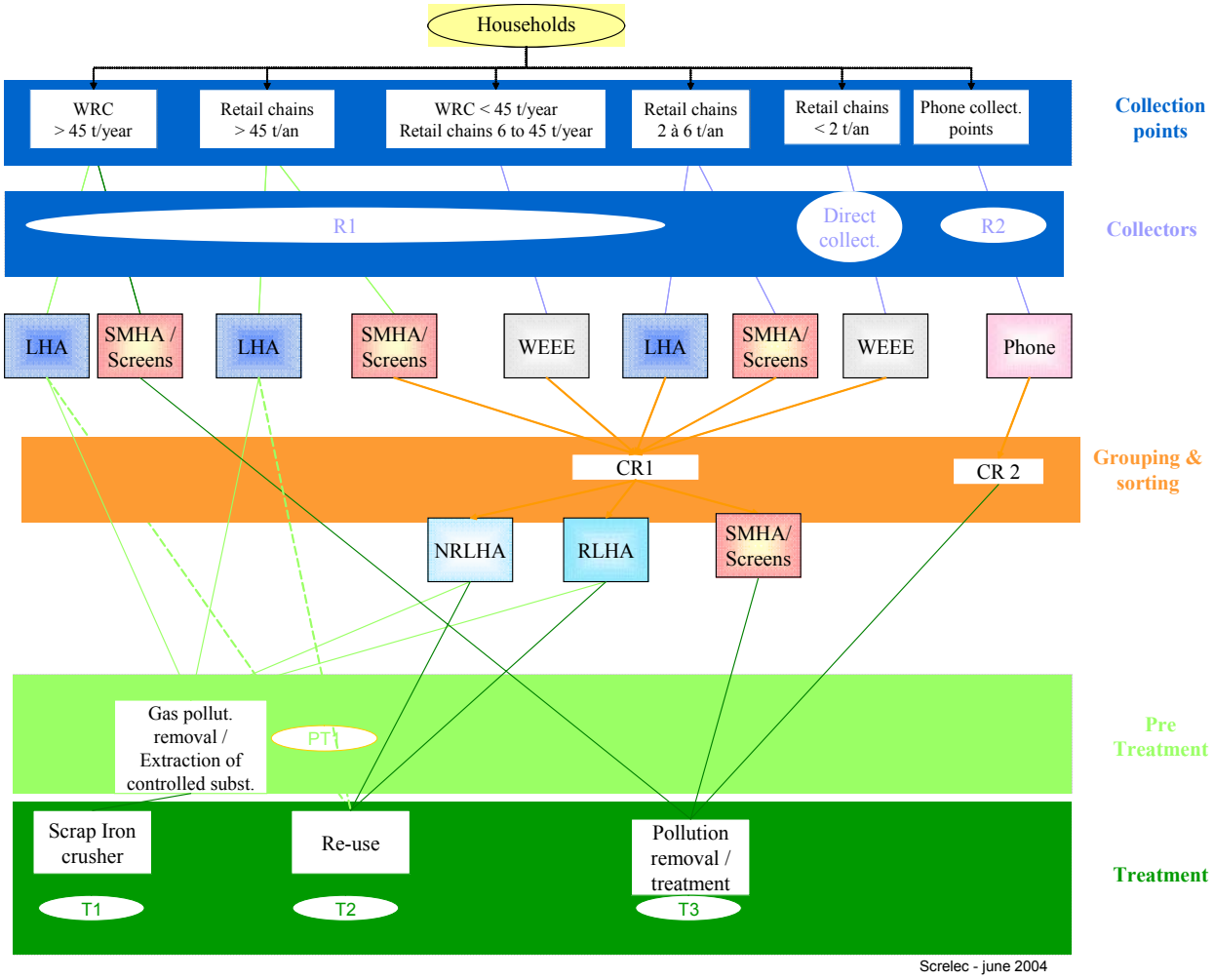


We are therefore now in a position to **assess** this logistics system now in place.
This system has enabled us to phase in the system rapidly in terms of volumes collected, dispatch many batches for treatment and work with as many different types of operator as possible.
It is nonetheless important to list the limitations of the system:

- Insufficient quantities collected
  - Ill-assorted types of packaging and insufficient loading capacity at times
  - Low-capacity vehicles
  - Empty runs, vehicle capacities not optimized
- Storage times at assembling centres too long
  - Too many assembling centres, thereby slowing down the preparation of consignments
  - Too much time spent selecting treatment operators
- Insufficient quantities per consignment
- Management complexity
  - Too many logistics and treatment operators
- Packaging/packing down time too long
- Systematic grouping/sorting

1.3.1.3. A realistic optimal logistics system

The following logistics system could have been implemented in the Nantes Metropolitan Area, in the absence of historical or study-related constraints:



Points to note:

- Logistics excluding phone collection points: a minimum number of operators (1 R1 collector, 1 CR1 assembling centre)
- High-capacity collection centres: flows of LHAs on the one hand and of SMAs/Screens on the other dispatched directly
- Average capacity collection centres: grouping and sorting, batches dispatched for treatment
- Low-capacity collection centres (< 2 t. a year): collection centre takes equipment directly to the assembling centre to cut storage time, or possibly one-off removal from an amount equivalent to 1 m^3 of WEEE.
- Flows in phone collection points (telephony): special channel to a specialized technical centre (R2, CR2)
- SMAs/Screens treated by a single T1 operator, pollution control in phase 1 for RLHAs and extraction of controlled substances before LHAs are crushed by a single operator (PT1), possible re-use of LHA and follow-up (T2)

This scheme does not affect the conditions in which WEEE is provided by the collection points (the frequency and means of collection could be those of the system already in place).

1.4. Performance in treating WEEE produced during Initiative Recyclage

In total, 24 treatment operators with varying treatment technologies and corporate structures, were involved in the two years of the programme.

1.4.1. Aims of the directive

- Recycling and recovery rates

Results further to the invitation to tender for treatment contracts	RLHA	NRLHA	Screens	SMHA	
				SHA	Consumer Electronics-Telephony, IT
Reference weight	51.6 tonnes	24.2 tonnes	422.6 tonnes	179.2 tonnes	
The directive's recycling rate targets	75%	75%	65%	50%	65%
Material recycling rate level 1 and 2*	91.5%	63%	82.6%	82.9%	
Material recycling rate level 3**	88.6%	63%	74.9%	73.2%	
The directive's recovery rate target	80%	80%	75%	70%	75%
Recovery rate level 1 and 2*	96.3%	63%	82.6%	83.9%	
Recovery rate level 3**	94.8%	63%	78.2%	76.1%	

(*)Level 1 and 2: without the downstream chains

(**)Level 3: with the downstream chains

Points to note:

- Recovery results for RLHAs match the results for full treatment in Germany.

- The level is that when the results for materials were drawn up
  - the recycling rate is ratio of output to total weight of materials sent to recovery treatment centres
  - the recovery rate is the difference between the total weight of the batch and weight of the output extracted for landfill or incineration purposes in relation to the total weight
  - level 1: weight results are drawn up after manual dismantling
  - level 2: after the crushing stage
  - level 3: includes the performance of downstream chains with regard to the output resulting from deconstruction (dismantling and/or crushing)

- These rates are not the consolidated figures for all flows of equipment treated in the Nantes area, they were measured using certain batches of consolidated WEEE.

- The results are considered to be broadly representative:
  - screens and SMAs: the sizes of the samples are adequate, this is a consolidation of a set of treatment results with varying features (output, dismantling, crushing and other chains)

- RLHAs: the results match those recorded in Germany and other countries having comprehensive treatment solutions for this type of appliance,
- NRLHAs: the results match situations in which only the metals are recovered; if plastics and concrete were also recovered the recycling – and therefore recovery - rate would rise to nearly 80%

- Re-use rate for complete appliances

Re-use rates for all products collected (all collection contractors)

January 03- June 04 (all collections)

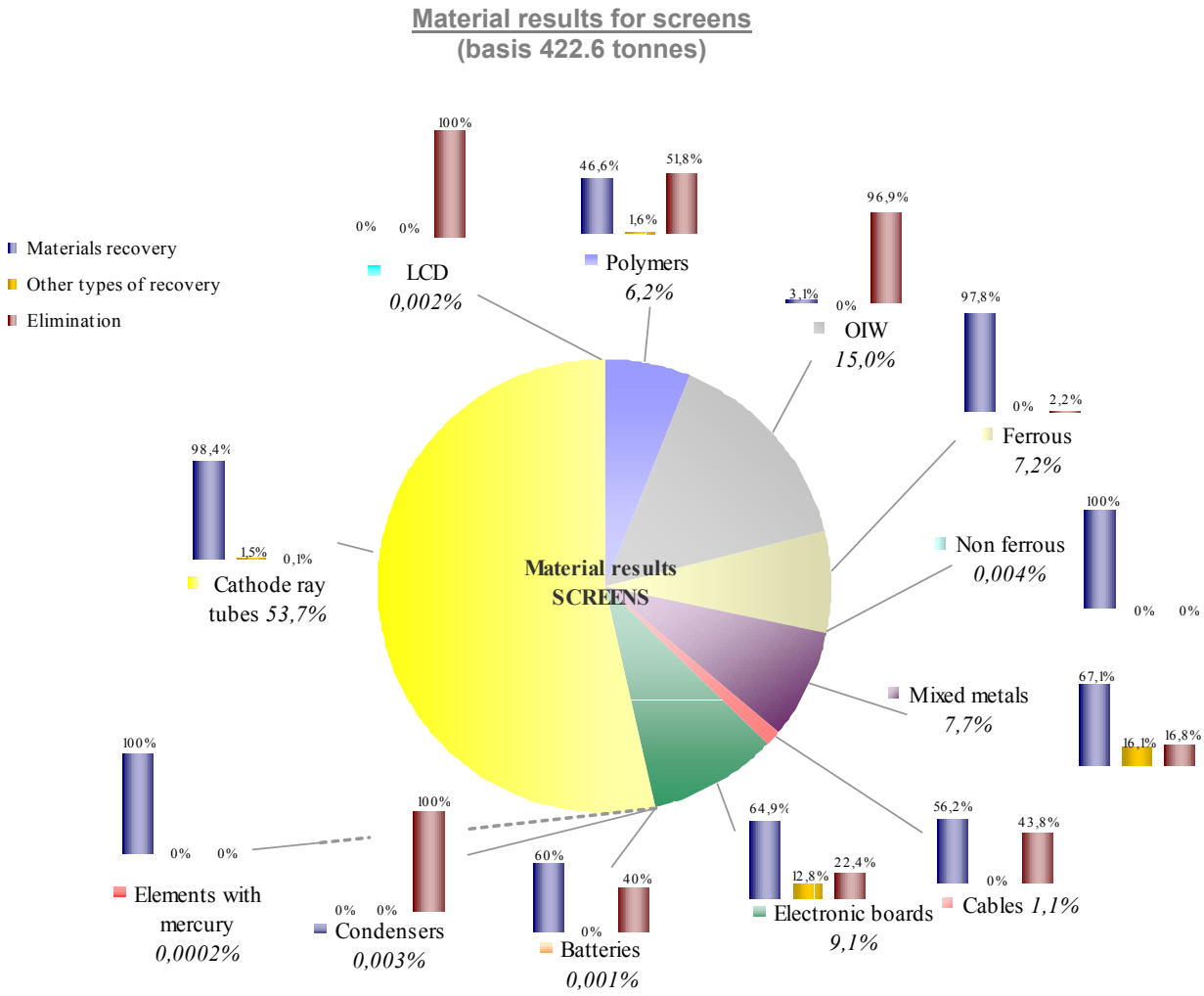
Consolidated rate	**NRLHA**	**RLHA**
reference rate (in kg)	1,914,239	787,921
Rate by weight	7.4%	9.7%
Rate by numbers of appliances	6.8%	9.1%

Re-use according to the origin of flows for products collected by Envie 44

January 03- June 04 (basis: Envie 44)

Rate in number of appliances per origin	**LHA HF**	**LHA F**
Reference: number of appliances	27 013	11 552
Appliances from the retail chain	9.7%	14.9%
Appliances from NMA	2.3%	3.7%
Appliances from Emmaüs and Envie 44	19.1%	21.2%

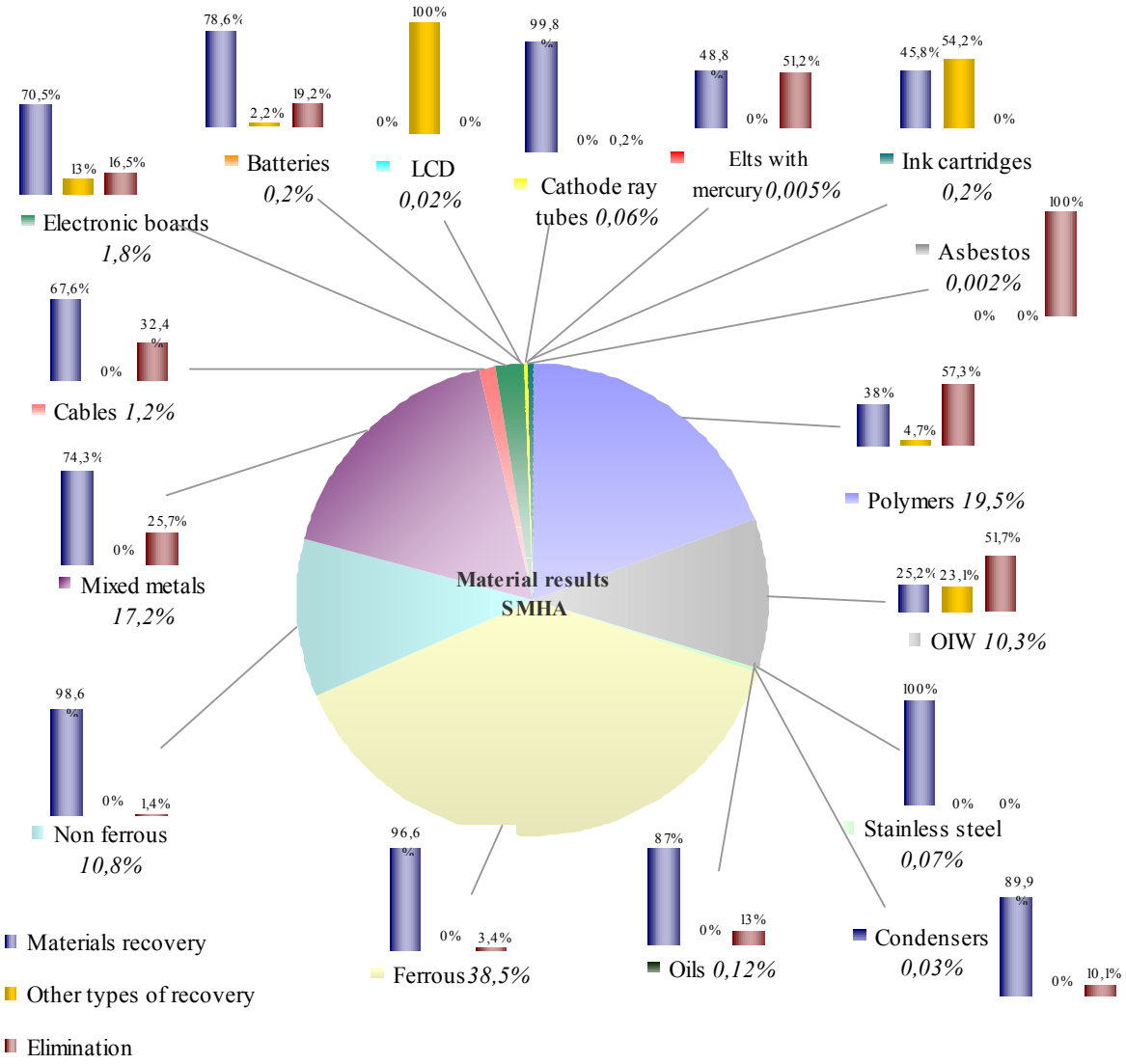
1.4.2. *Results for materials*



- To achieve recycling (or recovery rates) for screens (television sets and computer monitors), the cathode ray tubes (over 53% of the weight of screens) must be recycled. It is therefore crucial to know how the glass resulting from the treatment of the cathode ray tube is used.

- Half of 47% of the weight of appliances is metal (often in combination with other materials), the other half being polymers and wood (identified as such or present in OIW). If we include the yields of the downstream chains when measuring recovery rates, it is practically mandatory to recycle or recover the polymers and wood in order to achieve the target recycling rates.

Material results for SMAs
(basis: 179.2 tonnes)

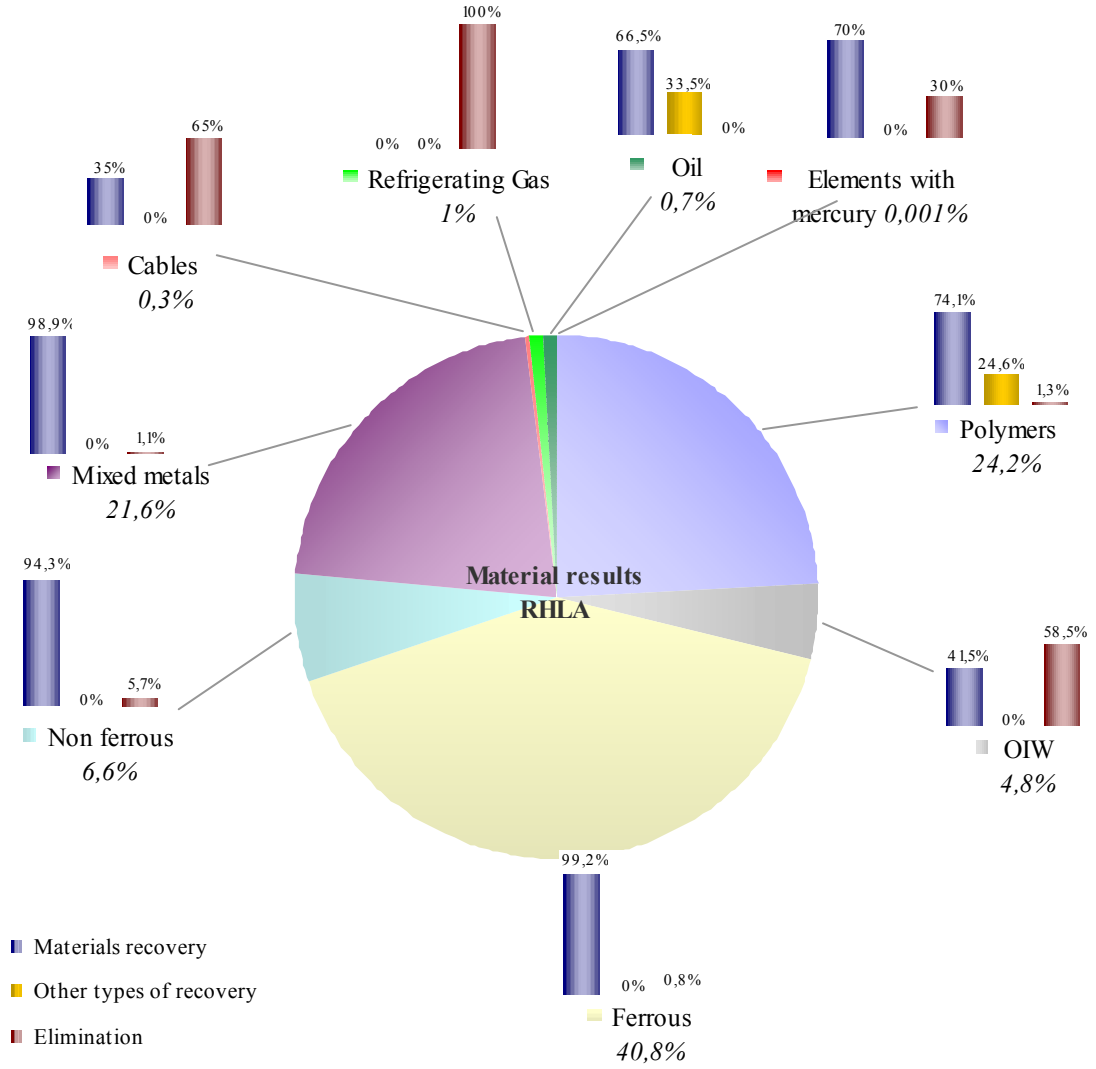


- The recovery of metal parts (making up over 68% of the weight of SMAs) enables the recycling rate to be achieved for all groups making up the SMA category.

- Part of the polymers must be recovered (identified as such or present in OIW) in order to achieve recovery rates. If we include the yield of downstream chains when measuring recovery rates, other elements have to be recycled, in particular all the polymers.

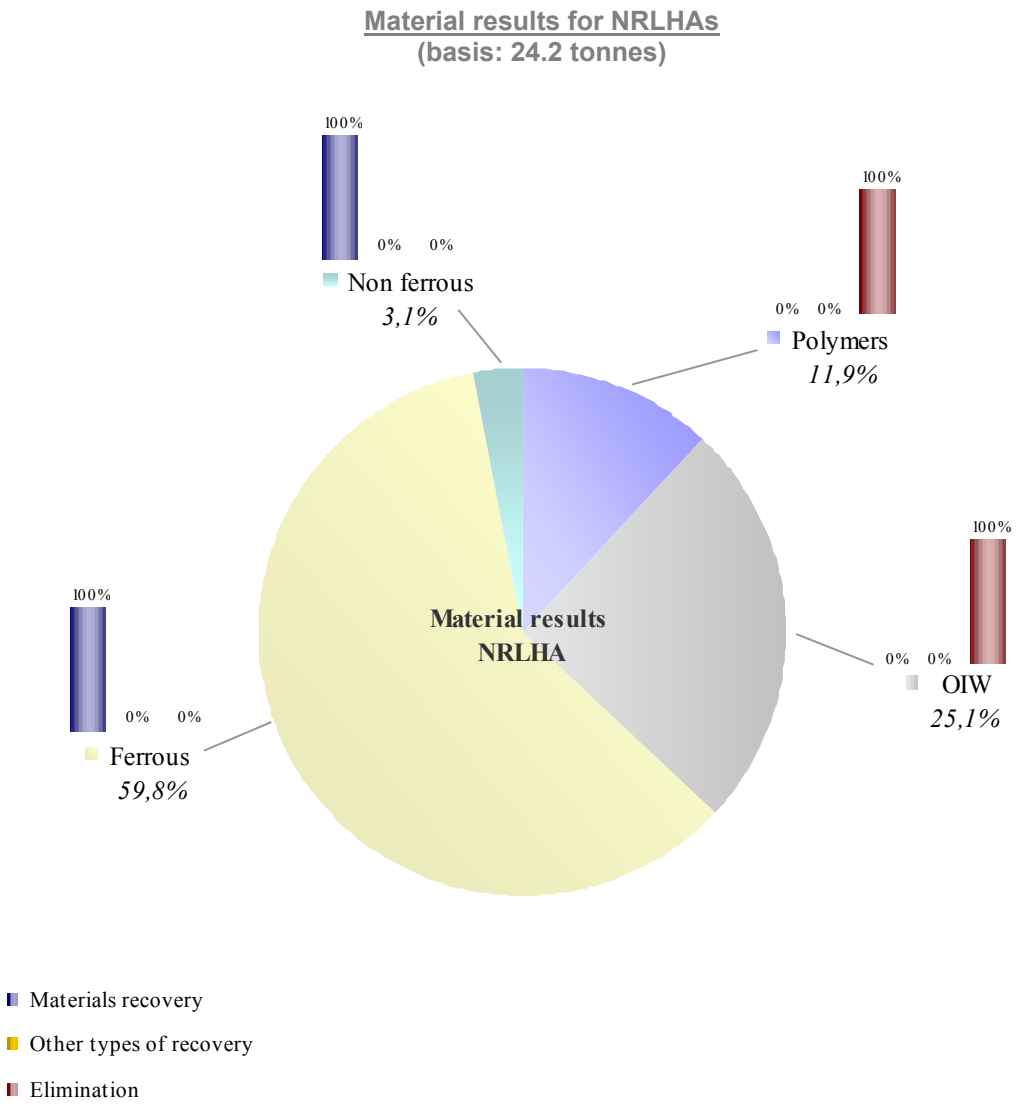
- The weight of controlled substances (annexe II of the directive) is very low and it is impossible to judge whether extraction rates are sufficient, because methods vary according to operator and the composition of SMA flows has a high impact on the presence of such substances.

Material results for RLHAs
(basis: 51.6 tonnes)



- Solutions for treating complete household refrigeration appliances enable recycling and recovery target rates to be achieved through the recovery of metals and polymers.

- Insofar as pentane household refrigeration appliances can be treated without recovering gases, the shells can be processed using NRLHA solutions after the oils have been extracted, and the results of this type of processing are close to those of NRLHAs. In particular polystyrenes and polyurethane foams must therefore be recovered in order to be recycled.



- It is absolutely vital to recover non-metal components. There are two possible courses of action: recovery of polymers and glass- and concrete-type mineral components (due to the large amount of concrete in washing machines, which figure prominently in the flows of collected NRLHAs)

- The extraction of controlled substances was not achieved through crushing solutions, but it can be achieved through cursory manual dismantling consisting solely in extracting such substances.

1.5. Financial assessment

The total cost of Initiative Recyclage® was 2,380,000 euros, including:

- Expenditure on operational collections, grouping, sorting and treating 4,082 tonnes of WEEE, as well as follow-up and traceability operations
- Design costs, this item comprising the cost of the Screlec team assigned to the study and to services outsourced to specialized firms
- Communication-related expenses: producing the communication tools provided to collection points in the Nantes area, press campaigns covering the experiment, surveys, etc.

The cost items break down as follows:

Cost items	Share
operations	**52%**
Study	**40.5%**
including internal costs	30.5%
including the services of third-party consultants	10%
Communication	**7.5%**

Cost of Initiative Recyclage® (in €)	**2,380,000**

2. The chain at national level: the lessons to be drawn from the experiment and recommendations

The following recommendations are a response to two types of expectations:

- The government's expectations in terms of regulations
- The expectations of the Producers, while at the same time including the constraints of the distributors and local authorities

In practical terms, regulatory expectations encompass 3 major aims:

- Collection rate
- Recovery rate
- Traceability and reporting of services

To sum up, the expectations of the Producers are oriented towards meeting regulatory requirements at the best cost and within deadlines.

The chain we recommend is therefore structured around 5 major vectors:

1. covering high-potential collection points and setting up alternative solutions for low-volume collection points
2. defining and implementing economical and realistic logistics
3. developing the network of treatment centres in terms of capacity and coverage of the national territory
4. using existing treatment technologies and taking into account the opportunities afforded by new processes
5. implementing the management of the chain: steering

We give details of the 5 major vectors in the pages that follow.

2.1. Covering high-potential collection points and setting up alternative solutions for low-volume collection points

Lessons to be drawn:

- **a high concentration of WEEE in a few collection points** :
    - 20% of collection points handle 80% of the volume

These collection points include waste reception centres and sorting centres, S&Hs (Food Superstores > 5,000m²), S-sSSs (Self-service Specialty Stores), distribution platforms and certain After-Sales services, as well as associations like Envie and Emmaüs.

- 32% of collection points are idle

- **the cost per tonne as a function of the volume of WEEE produced by the collection centre**

The more WEEE the collection point produces, the greater the degree of potential logistical optimization, and the lower the cost per tonne.
Certain collection points will produce less than 2 tonnes of WEEE per year, this figure of 2 tonnes being the minimum economic threshold for collection we have set.

Recommendations

- **Participation of collection points**: this depends on future negotiations between producers, local authorities and the distribution trade on the procedures by which WEEE can be made available at the collection point.

- **Implement plans for canvassing high-potential collection points**:
    - Entering into contractual relations with local authorities and their waste reception centre operating companies
    - Entering into contractual relations with the distributors
    - Drawing up formal agreements with the associations

- **Put in place alternative solutions for that part of the distributors producing less than 2 tonnes**: authorizing access to the nearest assembling centres and/or waste reception centres.

2.2. Defining and implementing economical and realistic logistical systems

The lessons to be drawn:

- **A direct link between the size of the volumes produced by collection points and the potential to optimize logistics**
- **Savings can be made** by:
  - using appropriate containers
  - using suitable vehicles
  - reducing break-bulk points
  - minimizing stock levels
- **The importance of the procedures by which collection points make WEEE "available"**

To illustrate this last point, we suggest comparing 2 situations in which WEEE are made available at waste reception centres (national projection). These 2 situations are simply an illustration of the point and in theory are 2 "extreme" cases, one of which uses skips exclusively and the other does not. The reality is probably somewhere between these two extreme cases.

Potential savings relating to making WEEE available at waste reception centres:

	Volumes of WEEE per year*	Organisation 1 Without skips (€/t) **	Organisation 2 With skips (€/t)	Potential saving
Waste reception centres > 120 t	27,125	210	102	
45t < waste reception centres < 120t	44,485	214	130	
2t < waste reception centres < 45t	36,890	342	193	
WEEE of waste reception centres (t)	108,500			
Total cost for waste reception centres		€27.8 million	€15.7 million	€12.1 million

** Basis: national extrapolation 2004*

*** these costs include the cost of making WEEE available at the collection centre (areas, equipment, manpower) +the logistics up to the treatment centre, including the skip rental, assembly and sorting, as the case may be*

Organization 1, without skip **- LHA in the set-down zone SMA and screens in bins, removals at 3-weekly intervals on average**

*There are 3,500 waste reception centres in France, making a total of 10,500 removals per week in France, or **546,000 removals per year in all.***
The 3,500 waste reception centres produce about 108 500 tonnes per year.

*Average weight per removal: 108,500/546 000 = **200 kg/removal**, the equivalent of about 3 LHAs + 2 screens + under 10 SMAs*

*This collection organization for all types of WEEE presupposes **systematic pooling** before dispatch to treatment centres.*

Organization 2, with skips - **Skips deposited at waste reception centres in the following proportions** (*the system presupposes sufficient room for the skips):*

- over 120 tonnes of WEEE a year: 4 skips (RLHA, NRLHA, Screens, SMA)
- from 45 t to 120 t of WEEE a year: 2 skips (LHA, Screens-SMA)
- under 45 t of WEEE a year: 2 skips (LHA, Screens-SMA)

It should be noted that certain waste reception centres will not have enough space to receive 2 skips. This is as we said a theoretical example.

Removal criteria are full skips (80% of the theoretical capacity)

+ 120 t of WEEE a year — *6,750 removals a year*

from 45 t to 120 t of WEEE a year
- from 45 t of WEEE a year } *19,600 removals a year*

*Making a total of **26,350 removals a year***

*Average weight per removal: 108,500/26 350 = **4,120 kg per removal***

*The use of skips enables **direct dispatch** to the treatment centre, i.e. without transiting via an assembly stage.*

Recommendations

The systems adopted and presented below aim to consolidate removals, cut the mileage covered and overall manpower hours.

These systems depend on a principle of segmenting collection points according to their output of WEEE and their storage capacity (storage at the collection point) and adapting operating methods to this segmentation.

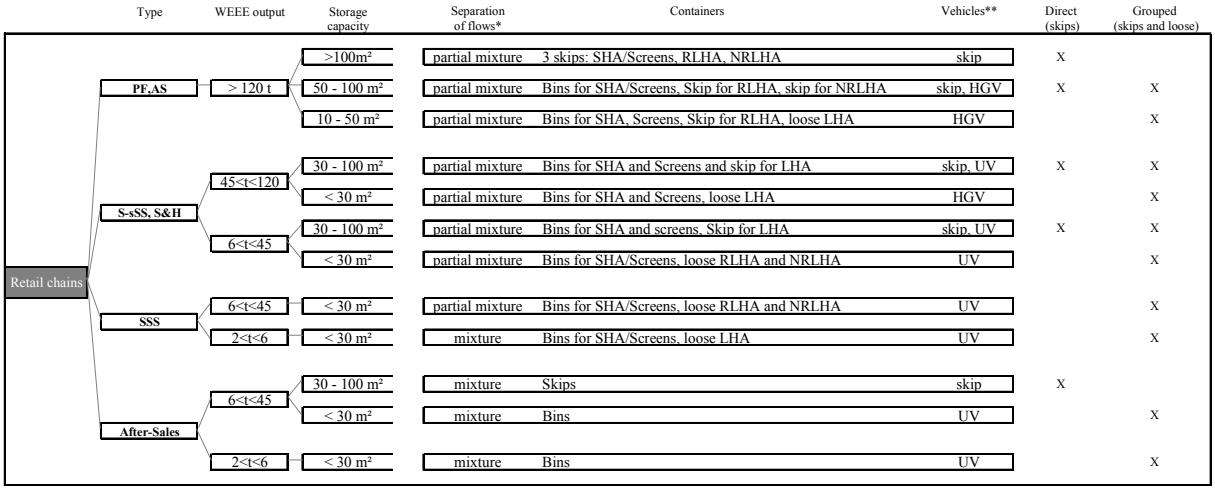
Broadly speaking, our logistical systems take into account 2 types of constraints:

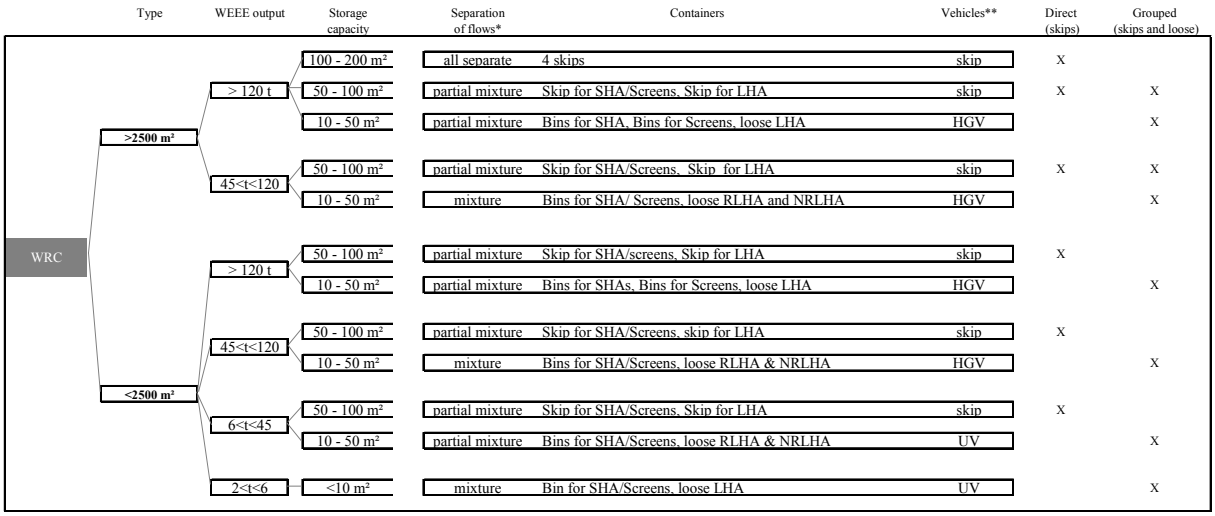
- The profile of collection points: using appropriate logistics
  - Separate or mixed removal
  - Container
  - Vehicle

- Product-related specifics

These specifics include logistical characteristics (overall spatial requirements, dimensions, etc.) and treatment technologies for the 4 groups of WEEE.

Organizational recommendations for flow by type of collection point, WEEE output and storage capacity at the collection point





*Separation of flows: this involves removing flows as follows:

Mixed: All WEEE

Partial mix: Screens-SMA, RLHA, NRLHA — or — Screens-SMA, LHA

All separate: Screens, SMA, RLHA, NRLHA

**Vehicles: tipper trucks, HGVs (heavy goods vehicles) or UVs (Utility vehicles)

2.3. Developing the treatment centre network in terms of capacity and national coverage

Lessons to be drawn

There are 4 treatment groups:

- RLHAs
- NRLHAs
- SMAs: small miscellaneous appliances
- Screens with cathode ray tubes

The 252,000 tonnes of WEEE *(national extrapolation 2004)* could not be totally absorbed by current treatment capacities on the national territory. But this assessment varies according to group:

- **RLHA**: **no installations in France**.

57,000 tonnes will need to be treated by 2007 and these flows of equipment will not be absorbed by the European installations treating their national flows.

- **NRLHA: capacity is sufficient for crushing**

135,000 tonnes, but there is a problem with regard to the selective treatment of controlled substances.

- **SCREENS**: **sufficient capacity for dismantling** 37,000 tonnes.

To date, there are many operators of small and medium capacities able to dismantle screens, but they are scattered randomly at national level. Various glass treatment chains are available in France, offering adequate conditions for treating the tubes.

- **SMAs**: **the capacity is insufficient for treating** 23,000 tonnes

The quantities of SMA cannot be absorbed by current dismantling operators. As for NRLHAs, the use of crushers will be possible and sufficient when the problem of selectively treating control substances is resolved. Currently there are no SMA-specific crushers in France.

Recommendations

- **RLHA: Set up 6 treatment centres and/or use mobile units**

The export of refrigerating appliances can only be a palliative measure when the chain is fully phased in. European capacities will be used by the flows from countries where the installations are established.

- **NRLHA and SMA: implement technologies or processes for extracting controlled substances prior to or during treatment**
    - Use of traditional crushers with technological developments (extracting condensers implementing a floatation technique)
    - Prior manual extraction, then traditional or specialized crusher
    - Develop a WEEE-specific crusher that can extract controlled substances
- **Groups of mixed collected WEEE dispatched directly to treatment centres:** There is a need for multi-purpose treatment centres for RLHA-NRLHA and multi-purpose treatment centres for Screens and SMAs.

To sum up, there are two types of treatment in the WEEE chain that need to be understood according to 2 different logics:

- a logic of valorization of the local and social economy
- a purely economic and industrial logic

These 2 types of treatment are:

- Highly manual and unskilled treatment, which is hardly impacted at all by scaling up
- Treatments requiring state-of-the-art technologies (currently under development), substantial levels of investment, generating high levels of fixed costs, according to an industrial logic (scaling up flows, continuous operation)

E.g.: crushing shells of RLHA and NRLHA, SMAs and waste glass processors for the glass in cathode ray tubes.

The key factors for success are a combination of:

- Optimal use of existing resources (local and regional companies) for a national coverage
- Rationalizing existing resources: developing multi-purpose or multi-product centres
- Integrating dismantling with crushing centres

The strategy for setting up treatment centres can be summarized as follows:

Treatment centre	**Conditions**	**Distance of collection points in Km ***
RLHA	Set up 6 centres and/or use mobile units	160
NRLHA	Use existing crushers with prior extraction of controlled substances	80
LHA	Deliver NRLHA to RLHA treatment centres and treating NRLHA in the same zone	160
SMA	Use local/regional dismantling centres + use specially adapted national crushers	160
SCREENS	Use ten or so local/regional dismantling centres	200
SCREENS & SMA	Use screen local/regional screen dismantling centres (diversification SMA)	200

**Average distances calculated for optimal coverage of the country*

2.4. Using existing treatment technologies and taking into account the opportunities afforded by new processes

Lessons to be drawn:

- Achieving recycling and recovery rates for all groups by using existing technologies in Europe, provided all metals and other products (plastics, cathode ray tubes etc.) are recovered

For each of the groups, the proportion of metals contained in WEEE does not suffice to meet recycling and recovery targets.

Recommendations:

- **NRLHA**: crushing and treatment of crushing residue for recovering plastics and/or concrete (washing machine ballast)
- **RLHA**:
  - for appliances containing CFC and HFC: use existing complete treatment solutions or ones to be set up
  - for appliances containing pentane: use NRLHA-specific processes after draining off the refrigeration circuits
- **Screens**: dismantling and recovering the tubes (52% of the average weight of appliances) and some of the wood and plastic of screen housings
- **SMA:** some of the plastics and minerals must be recovered (glass, silicon etc.) in order to achieve targets.

The increase in the volume of WEEE resulting from the application of the Directive will have positive knock-on effects on WEEE industrial treatment processes and consequently on costs:

- gains in productivity and optimized dismantling organizations
- better rate of return on industrial investments
- development of new technological processes

2.5. Implementing management of the chain: steering

The aim of steering is to phase in and manage operations consistently and ensure they comply with regulations and the expectations of the various actors involved: a chain at the best cost that complies with regulations.

The risks of not putting in place a steering mechanism for the chain could result in the following consequences:

Risks at the collection point:

- Probable choice of a flexible organization for the collection point, and costly for the industry
- Increase in administrative costs
- Failure to optimize removal frequencies

Risks at grouping/sorting level:

- Systematic grouping and sorting
- Sorting ill-adapted to treatment solutions and synergies
- Failure to form economical batches for transport and treatment purposes

Risks for the downstream transportation chain:

- Failure to synchronize dispatch from the grouping centre with reception by the treatment centre

Risks for the treatment part:

- Choosing random treatment solutions

And more generally:

Management-related risks:

- Higher administrative costs

Traceability-related risks:

- The complexity of tracking batches both physically and in accounting terms
- Losing batches, failing to control parallel circuits, uncontrolled pollution
- Difficulty in meeting producer reporting obligations, government requirements...

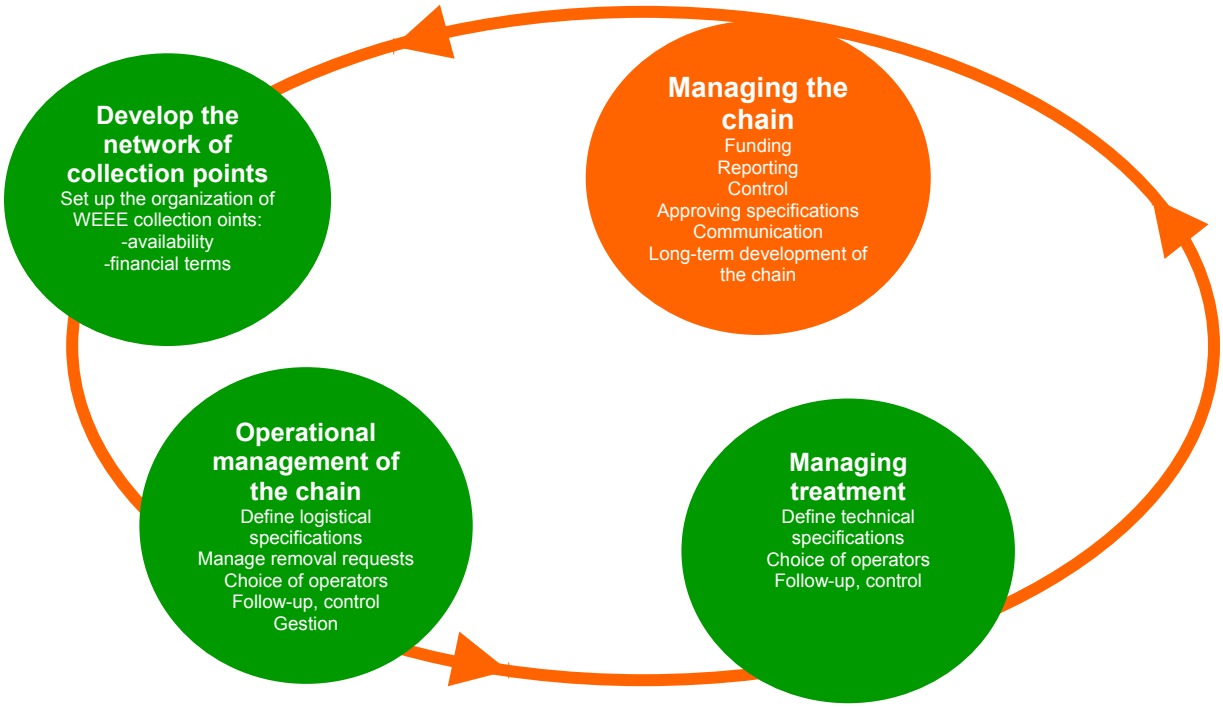
Environmental risks:

- Less efficient environmental assessment of the chain

That is why we recommend a steering mechanism aimed at implementing the four vectors we have discussed earlier in as consistent and efficient a manner as possible, namely:

- Develop the network of collection points
- Financing companies (Producers) should manage flows operationally
- Implement treatment operations in terms of capacity and national coverage
- Coordinate and develop the chain over the long term

To sum up, the overall organization of the chain is illustrated in the following diagram:

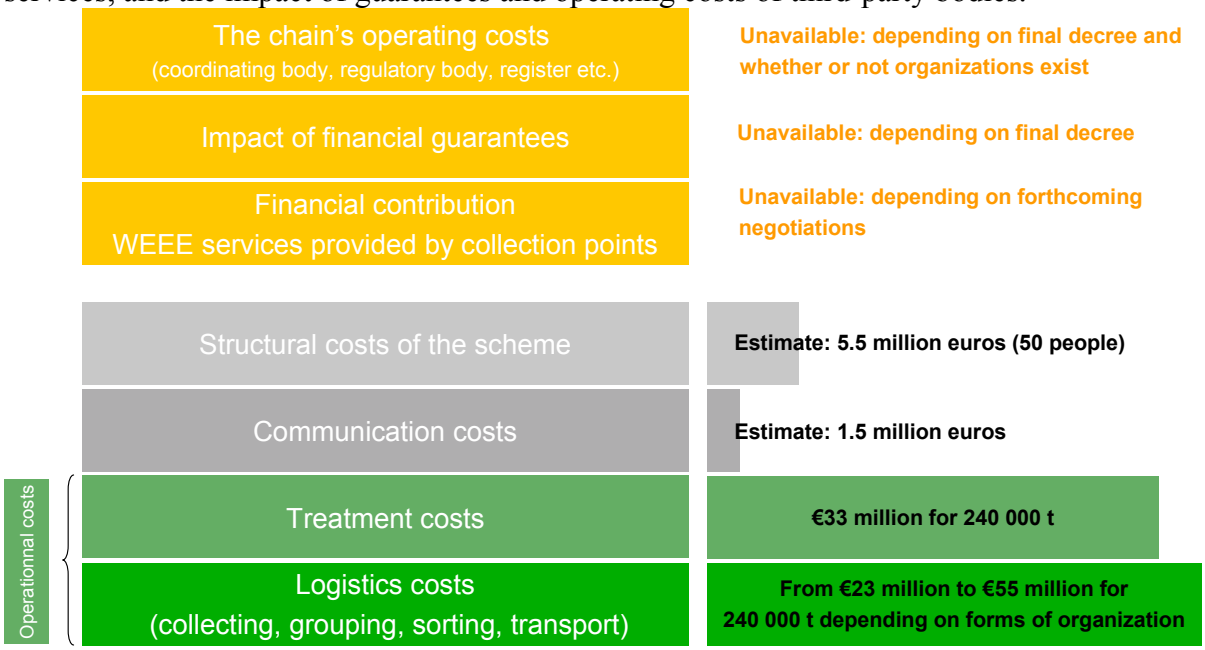


2.6. Costs

2.6.1. Cost structure

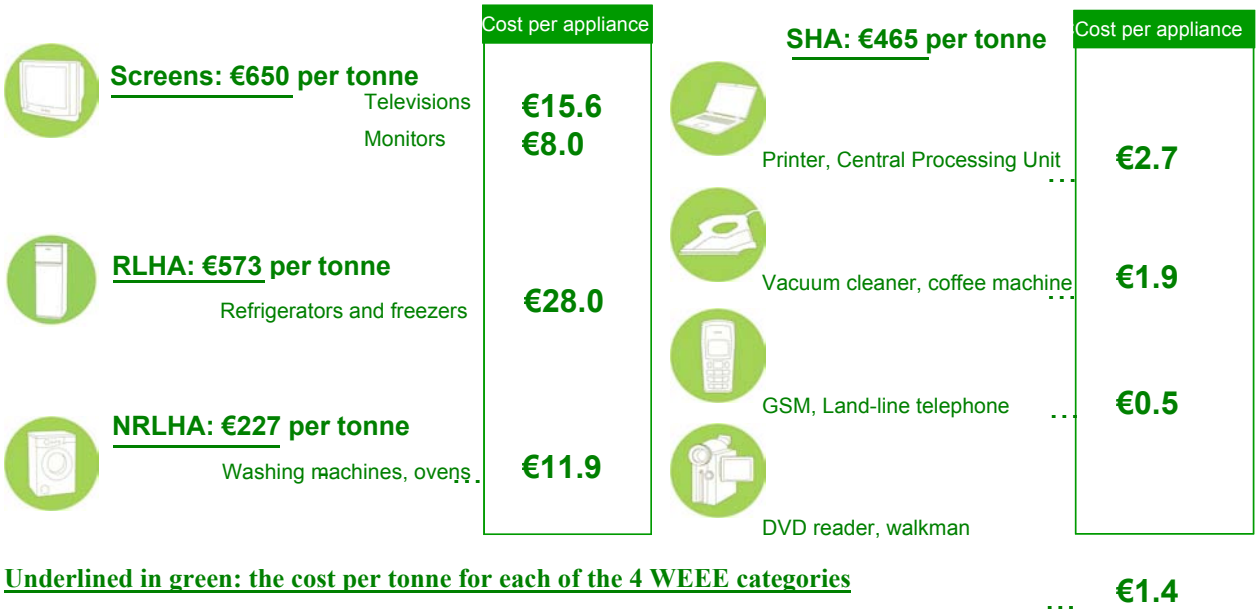
The chain's cost structure includes the costs of the scheme, the operationnal costs -treatment + logistics -, communication and structural costs of the scheme (staff, premises, fixed costs).

To these costs should be added the financial contribution paid to collection points for WEEE services, and the impact of guarantees and operating costs of third-party bodies.



2.6.2. *Costs per treated appliance*

Excluding the financial contribution made to collection points for WEEE services
Excluding the impact of guarantees
Excluding the chain's operating costs



Underlined in green: the cost per tonne for each of the 4 WEEE categories