The recycling of PVC waste in Europe (year 2004)

Final report

15th March 2006

Study realised by AJI-EUROPE on behalf of Vinyl 2010
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Post consumer PVC waste recycling

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A total of 77 ktonnes of post consumer PVC waste was recycled by the recyclers interviewed in the EU15 during the year 2004. Windows, other profiles and pipes represent 36% of this total.

The global level of confidence reaches +11% / -10%. This means that the total tonnage of post consumer PVC waste recycled is in the range [69 kt ; 85 kt]. The tonnages corresponding to Vinyl 2010 supported programmes have a better confidence level (+/- 4%) than the other tonnages (+13% / -12%).

Germany, the Netherlands and the UK represent altogether 67% of total post consumer PVC waste recycled in the EU15 by the recyclers interviewed.

66 ktonnes (86%) of post consumer PVC waste recycled in the EU15 by the recyclers interviewed belong to non regulated sectors (all sectors except packaging waste, WEEE and ELV).

The structure of post consumer PVC waste in the EU15 is rather concentrated. Among the 97 recyclers who provided data, the 10 largest have performed 51% of the total recycling. However, there are also a lot of SME's who treat post consumer waste occasionally.

In 2004, about 113 ktonnes of post consumer PVC waste generated in the EU15 were recycled either in the EU15 or in Asian countries (mainly China). This is a "best estimate."

Recycled products from post consumer PVC waste

Recycled pipes, profiles and miscellaneous mixed plastics products (traffic signs, road bands, cones) represent 79% of total outlets for recycled PVC products.

Poland

In Poland, total post consumer PVC waste recycled by the 11 recyclers interviewed reached 805 tonnes in 2004 (with a level of confidence of +/- 14.7%). The "best estimate" for total recycling in this country is about 1000 tonnes (including the very small recyclers which were not interviewed).

Post industrial PVC waste recycling

PVC converters in the EU15 have generated about 760 ktonnes of post industrial PVC waste in 2004. In this amount, 51% is due to pipes / fittings, windows and other profiles.

54% of total post industrial PVC waste generated by converters in the EU15 is directly recycled in-situ. 39% is recycled outside the processing plant and 8% is landfilled or energy recovered.

Forecast 2010

At the 2010 horizon, the recycling of post consumer PVC waste is expected to increase up to 145 ktonnes in the low hypothesis and up to 308 ktonnes in the high hypothesis.

1. Objectives, definitions and overall methodology

1. Objectives, definitions and overall methodology
1.1 Objectives

The study performed by AJI-EUROPE on behalf of Vinyl 2010 between September 2005 and January 2006 has three main objectives:

- Prepare a quantitative inventory of post-consumer PVC waste currently collected and recycled in the EU15 + Poland and identify the proportions of this waste originating from key applications (window profiles, other profiles, pipes, cables, flooring, coated fabrics)

- Assess the amounts of post industrial PVC waste which are currently recycled, either “in-situ” by the processors or processed by recyclers outside the processing plant where it has been generated

- Identify the main factors of evolution and carry-out a quantitative forecast of PVC waste recycling in 2010.

As requested by Vinyl 2010 in the Terms of Reference of this study: ”Vinyl 2010 may use the results in discussions with key stakeholders, including the EU Commission and Parliament. The results must therefore be robust enough to withstand scrutiny from such stakeholders, and to be submitted to verification by a recognised independent body. The consultant will be expected to self-assess and comment on the reliability and accuracy of the assembled and resulting information/data.”

Post consumer PVC waste is defined as follows by Vinyl 2010:

"A PVC product (including additives and any product bound into the matrix such as fibers, fabrics, ...) which has left its last production site, and which the holder discards, intends to discard or is required to discard. Processing waste from multi-layer products can be considered under certain conditions as post-consumer waste, if it cannot be reused in the corresponding production process."

The last sentence applies to the PVC processing waste produced during the manufacture of extrusion coated products (including artificial leather products) and PVC coated furniture.

Conversely, it does not apply to the PVC contained in used dash-boards because at least one technology exists that is able to separate the PVC from the other materials. Similarly, some floor-covering and roofing products are coated, but the separation of PVC from other materials in post industrial waste is technically feasible.

Mechanical and feedstock recycling

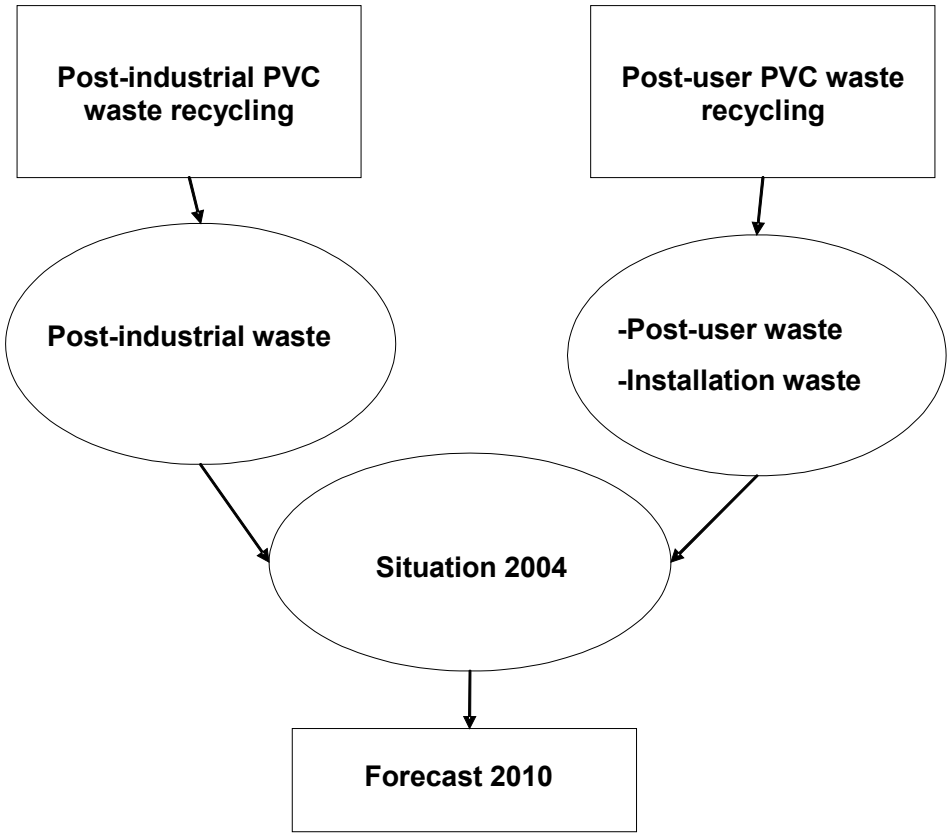
- The tonnages of post consumer PVC waste treated at the Vinyloop plant (Ferrara, Italy) are mechanical recycling.
- The tonnages treated by the plants of the companies SVZ (Germany) and Dow / BSL plant (Germany) are feedstock recycling.
- The process which uses plastic waste as a reducing agent in steel production in the Arcelor plants in Bremen and Eisenhüttenstadt (Germany) is feedstock recycling. However due to the characteristics of this process (plastics as reducing agent) it is not taken into account.

Vinyl 2010 supported programmes

- Although some PVC recyclers were not yet affiliated to Vinyl 2010 supported programs in 2004, the tonnages treated by these companies in 2004 are taken into account in the “total 2004” indicated in the Vinyl 2010 progress report. For this reason, we have also counted these tonnages as recycled in 2004 within Vinyl 2010 programs.
- The post consumer PVC waste collected and prepared by AgPR (to Stigsnaes) and Texyloop (to Vinyloop) in 2004 in the framework of the Vinyl 2010 program but not yet recycled has been taken into account.

The study is structured in three modules:

- **Post consumer PVC waste recycling**, including preparation (questionnaire,…), inventory of the recyclers, detailed survey, assessment of the level of confidence, final extrapolation (“best estimate”) ;
- **Post industrial PVC waste recycling**, including preparation (questionnaire,…), sampling, survey and checking of coherence ;
- **Quantitative forecast for the year 2010**.



2. Post consumer PVC waste recycling (EU15)

Main steps of the analysis

1- Preparation of the questionnaires in English, French, Spanish, German, Italian and Polish languages.

2- Inventory of recyclers, based on the analysis of available publications / bibliographic sources, directories of professional associations, specialised and general databases (Kompass, Dun and Bradstreet, Europages, Sinoe....), files built by AJI-EUROPE during previous assignments, interviews of enterprises specialised in construction works and electrical assembling, interviews of large plastic waste collectors and international traders, contacts with regional Chambers of Commerce, regional agencies supporting the economic development, local agencies providing the environmental agreements for handling, storing or transporting waste, and finally national administrations.

3- Survey. Priority was given to phone contacts (the experience shows that mailings are neither efficient nor reliable because of the low rate of reply and of the difficulty to check the quality of data received). When necessary, meetings have been organised with associations or recyclers. Moreover, a mission has been performed in Poland to meet some recyclers and professional associations.

4- Synthesis, checking of coherence and level of confidence of data

We have assessed the level of confidence corresponding to each data got from recyclers. Then, a global level of confidence has been derived for total figures by country and by PVC application (the detailed procedure for the assessment of the levels of confidence is described in appendix A.1).

5- Final extrapolation (“best estimate”) of tonnages of post consumer PVC waste recycled.

Chapter 2 is presented in the following order:

• Results of the survey among recyclers:

- Tonnages of post user PVC waste actually recycled in the EU15 in 2004 by the recyclers interviewed

- Descriptive sheet by application (one sheet by application)

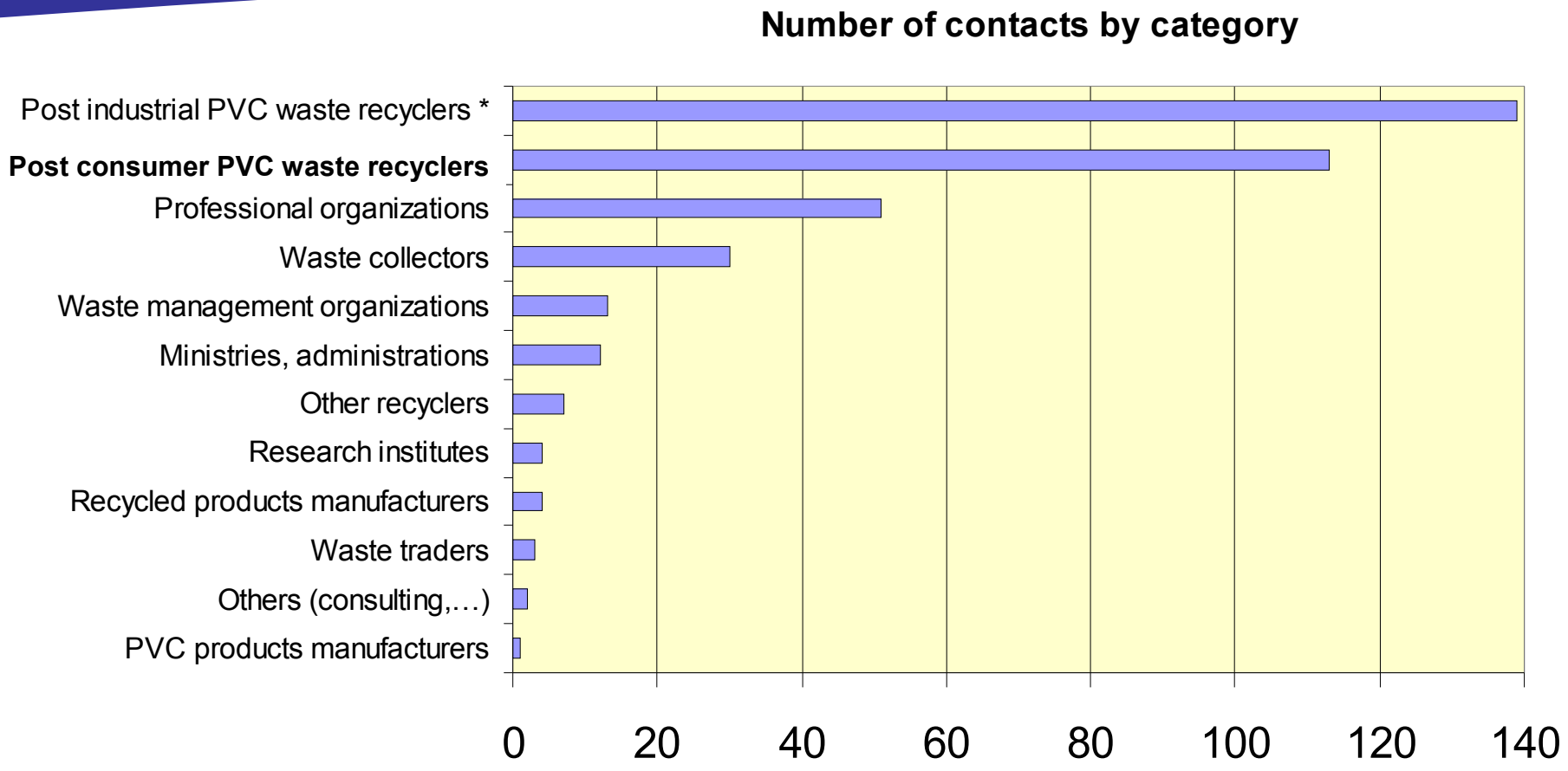
- Descriptive sheet by country (including the list of recyclers interviewed and the list of contacts).

• Overall "best estimate" (final extrapolation) of the total tonnage of post consumer PVC waste generated in the EU15 in 2004 and recycled in the EU15 or outside.

• Comparison between the situation of post consumer PVC waste recycling in 2000 and 2004.

• Outlets for recycled PVC products.

Note: the focus on the situation of PVC waste recycling in Poland is described in chapter 3.



Detailed lists of contacts by country are described in chapter 2.6.

** After checking, it appeared that these recyclers do not recycle post consumer PVC waste.*

Professional associations

- The lists available through associations (recyclers, cable manufacturers, various actors of the PVC sector) for a given country have been systematically used, as well as the EuPC directory of plastic recyclers. However, the industrial structure of PVC recycling in the EU15 evolves very quickly and we have noted that, in general, the lists of recyclers published before 2003 are obsolete (new enterprises have been created, others have stopped their activity or have evolved from post industrial to post consumer PVC waste,…).

- Due to the rules of the free market, it was sometimes not possible to get detailed figures for each recycling partner of Vinyl 2010 supported programs (e.g. Rewindo scheme).

Ministries, administrations

- In Germany, each Land has its own procedure for managing the waste collection, storing and recycling authorisations. Lists are available in some Länders. However these lists have not allowed to identify new post consumer PVC waste recyclers.

- In France, any waste processing activity (collection, storage, processing…) requires to get an agreement from the "préfecture de département " where the company is located. The agreement specifies the type of waste (plastic waste for example) but PVC is not specifically mentioned. There is no "official" list of authorised companies in each of the 95 "départements" and the administration files are not publicly available. The SINOE database managed by the ADEME provides more details.

- In Spain, the agreements are delivered to recycling companies by each "Communidad Autonoma".

- In Austria the agreements are delivered by each Land

- In Belgium, each region has its own procedure, respectively managed by : OVAM, IBGE and Office Wallon des Déchets.

- In Italy, a national permit is required for waste collection and transportation, while each region delivers authorisations for recycling activities.

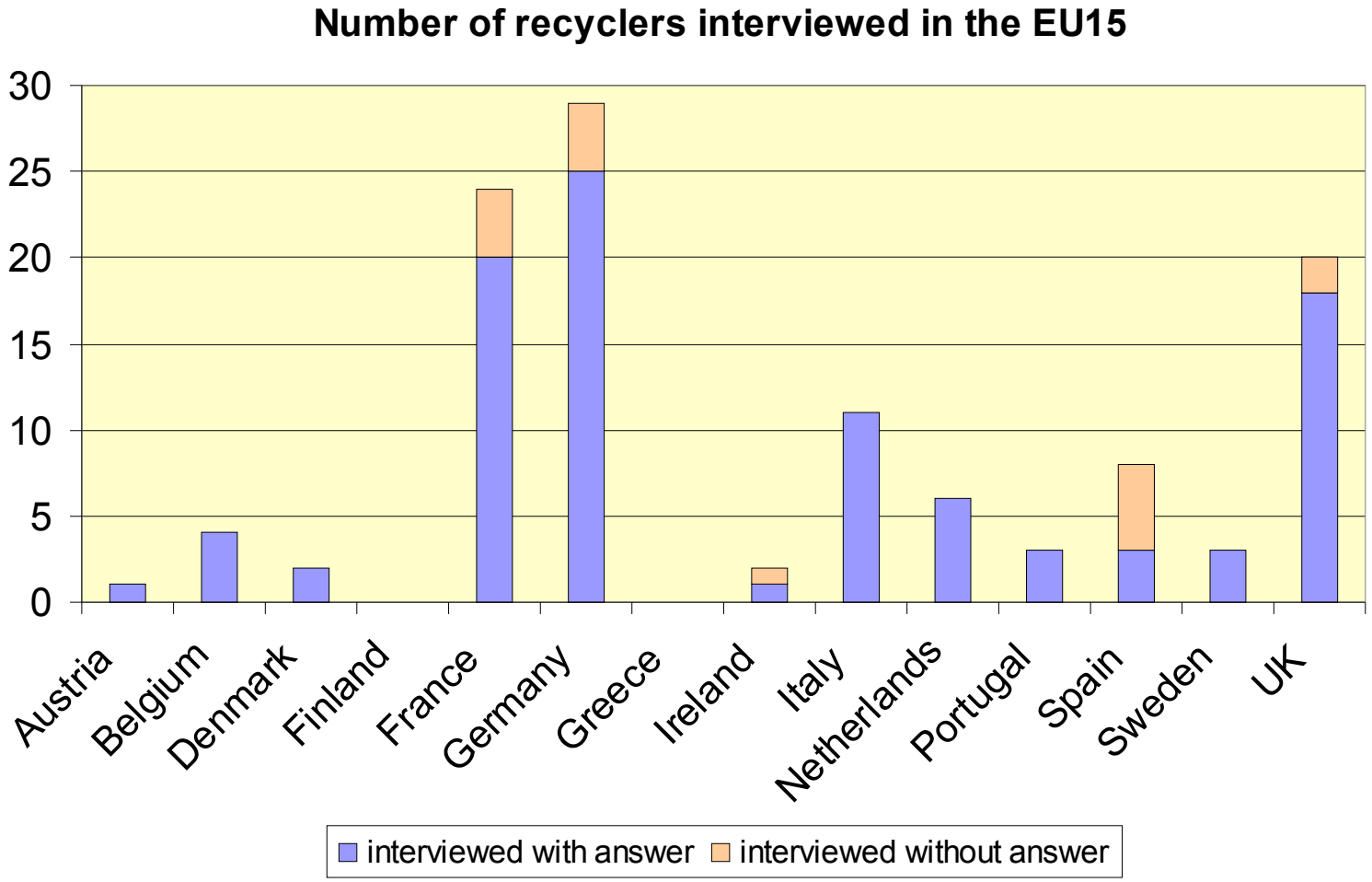
- In Ireland, collection and recycling agreements are managed by each County Council but no lists are available.

- In Greece, company data available at the Ministry of Environment are split between those who recycle metals and those who recycle non metal items (including plastic materials but without specifying PVC).

Data collection in Spain

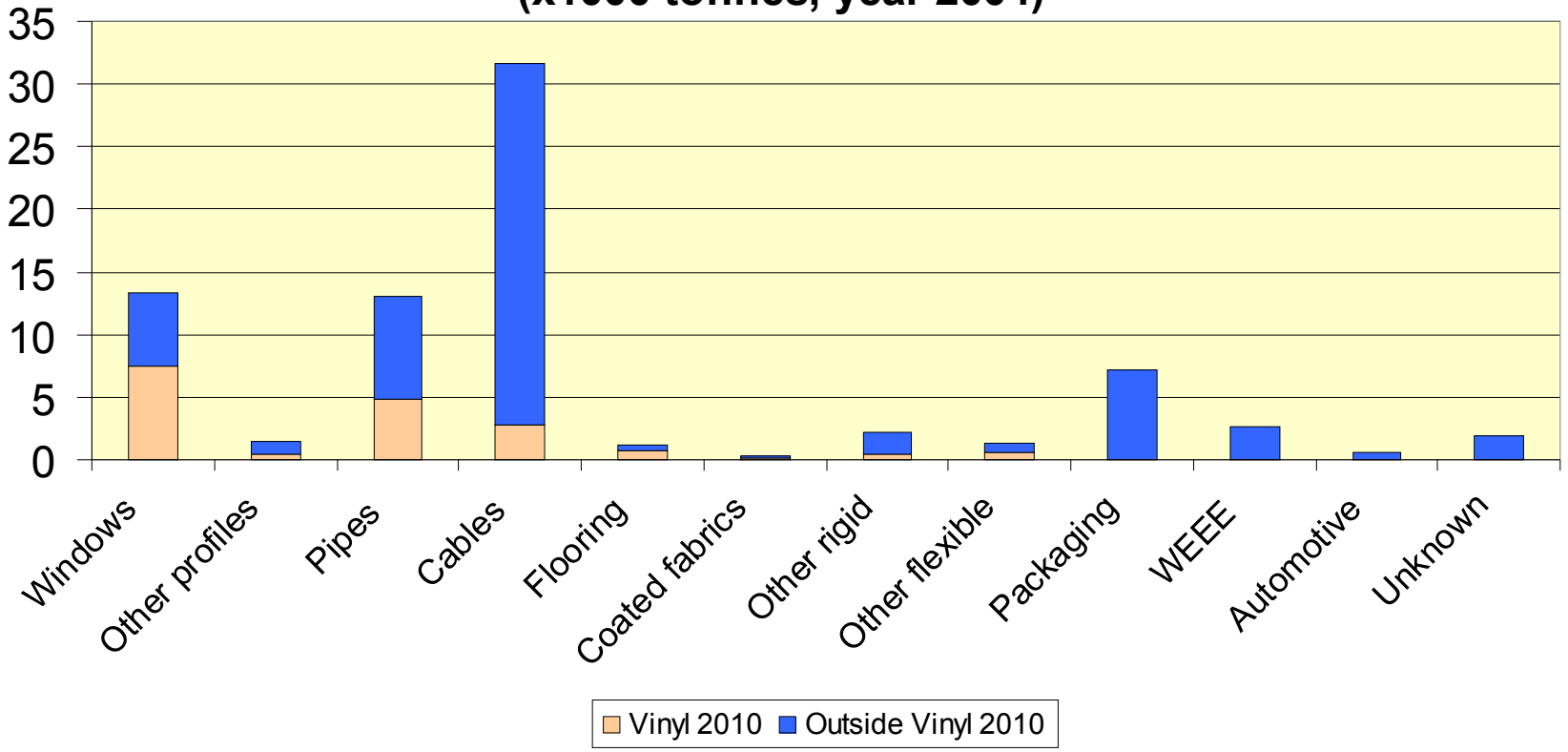
- A specific data collection approach has been implemented in the case of Spain. Indeed, our tentatives to get data directly from Spanish recyclers or through the associations have given poor results. In this context, we have used the tonnages mentioned in the Cicloplast report entitled “Estadisticas sobre consumo, generacion and gestion de residuos plasticos en Espana, ano 2003.” The data obtained recently from Cicloplast cannot be used.

2. Post consumer PVC waste recycling (EU15)
2.3 Number of recyclers identified



113 post consumer PVC waste recyclers have been identified and interviewed, of which 97 have accepted to provide detailed data about their activity.

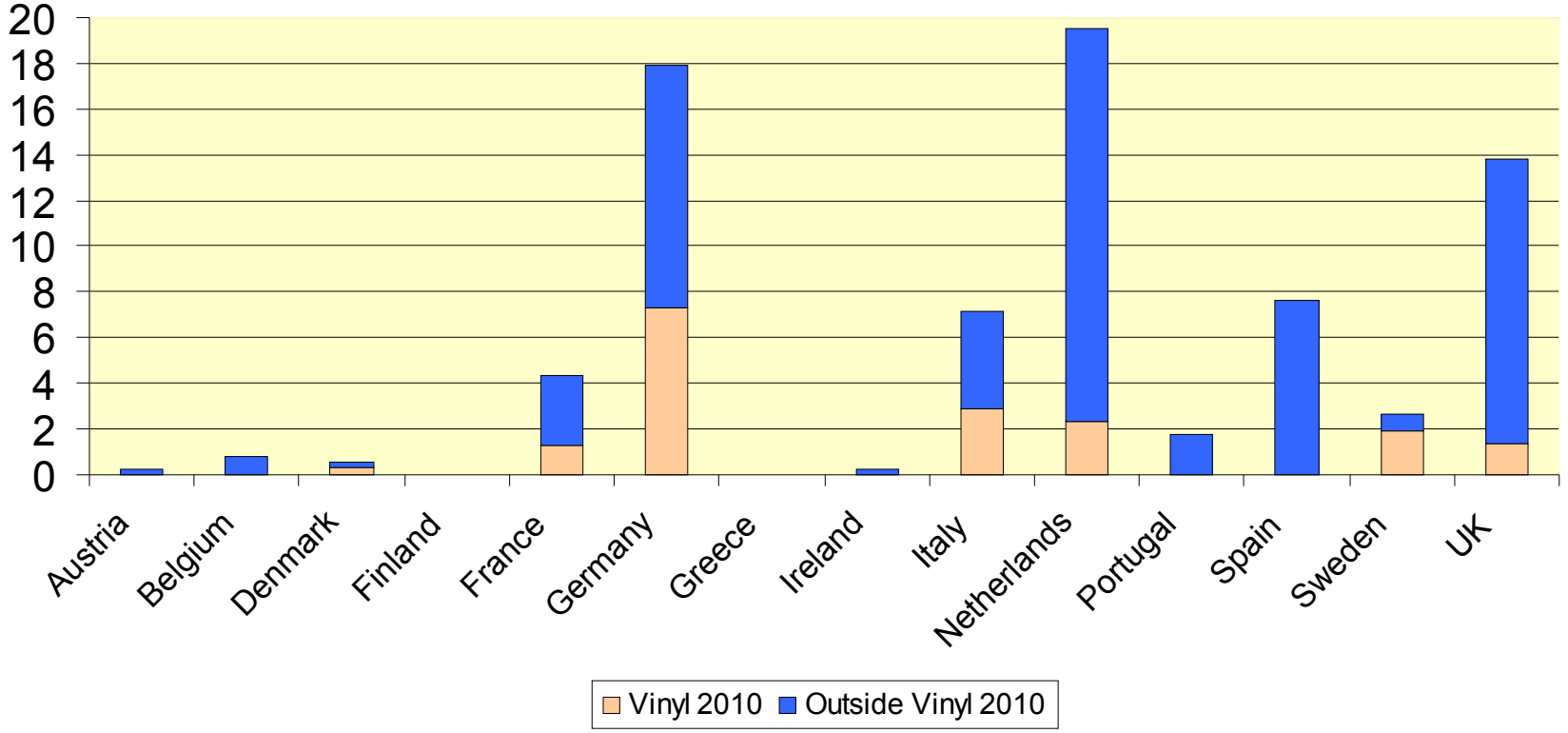
Post consumer PVC waste recycled in the EU15 by the recyclers interviewed, by application (x1000 tonnes, year 2004)



A total of 77 ktonnes of post consumer PVC waste was recycled by the recyclers interviewed in the EU15 during the year 2004 (of which 1.5 ktonnes of feedstock recycling).

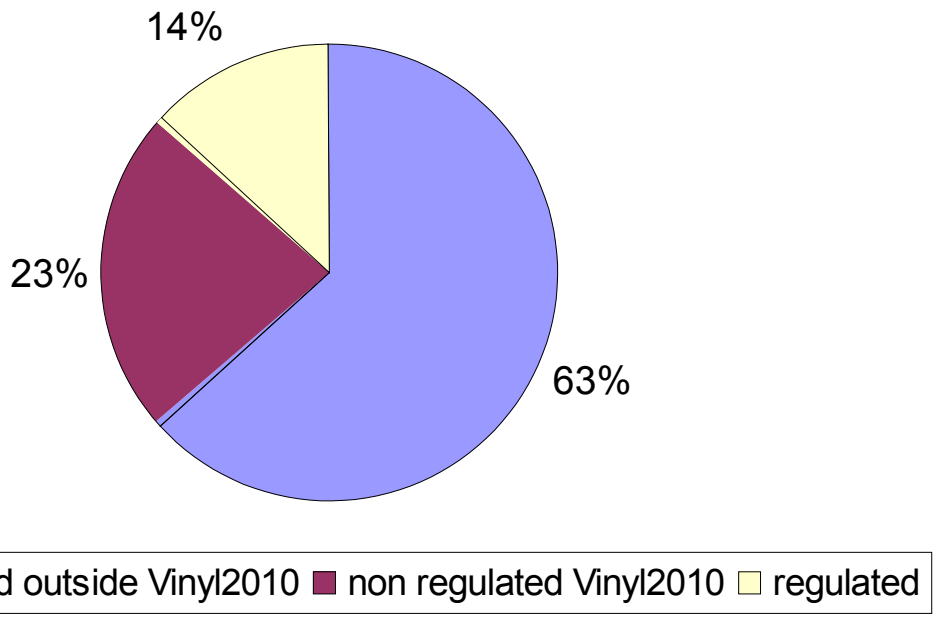
Windows, other profiles and pipes represent 36% of this total.

Post consumer PVC waste recycled in the EU15 by the recyclers interviewed, by country (x1000 tonnes, year 2004)



Germany, The Netherlands and the UK represent altogether 67% of total post consumer PVC waste recycled in the EU15 by the recyclers interviewed.

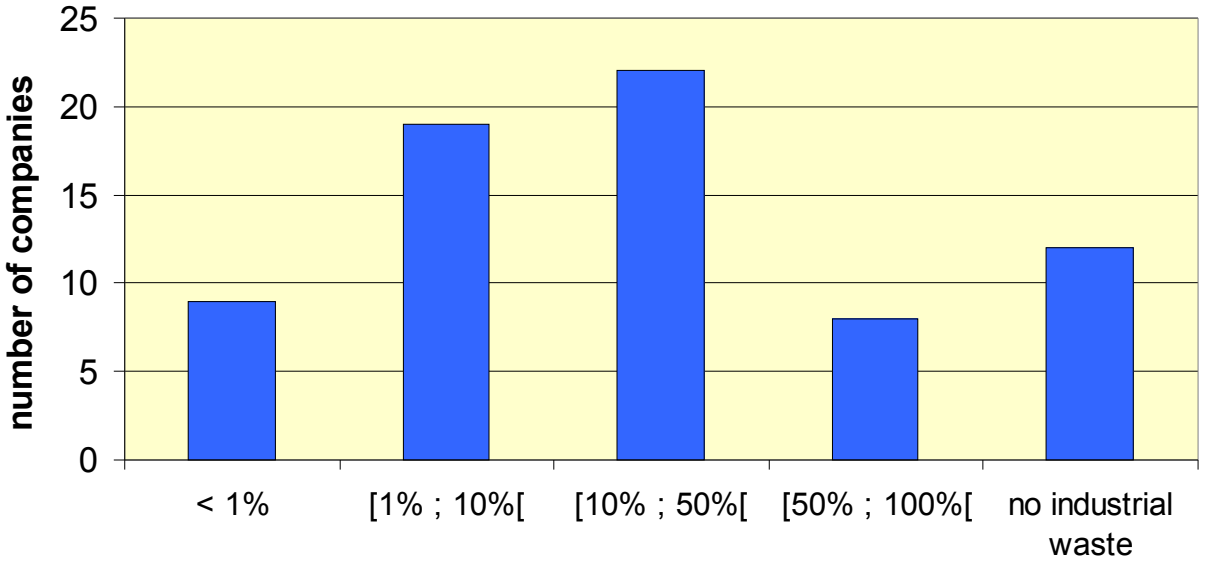
Breakdown between regulated and non regulated sectors in post consumer PVC waste recycling (based on recyclers interviewed, year 2004)



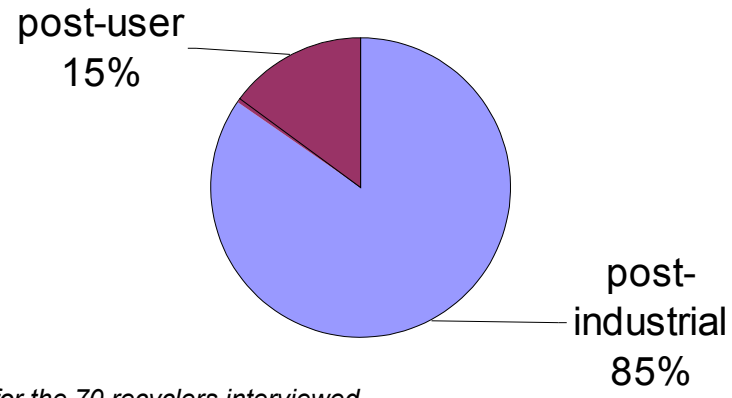
66 ktonnes (86%) of post consumer PVC waste recycled in the EU15 by the recyclers interviewed belong to non regulated sectors (all sectors except packaging waste, WEEE and ELV).

70 post consumer PVC recyclers have given data about both their post consumer and post industrial PVC recycling activity.

Number of recyclers interviewed, according to the share of post consumer PVC waste in the total PVC recycling activity



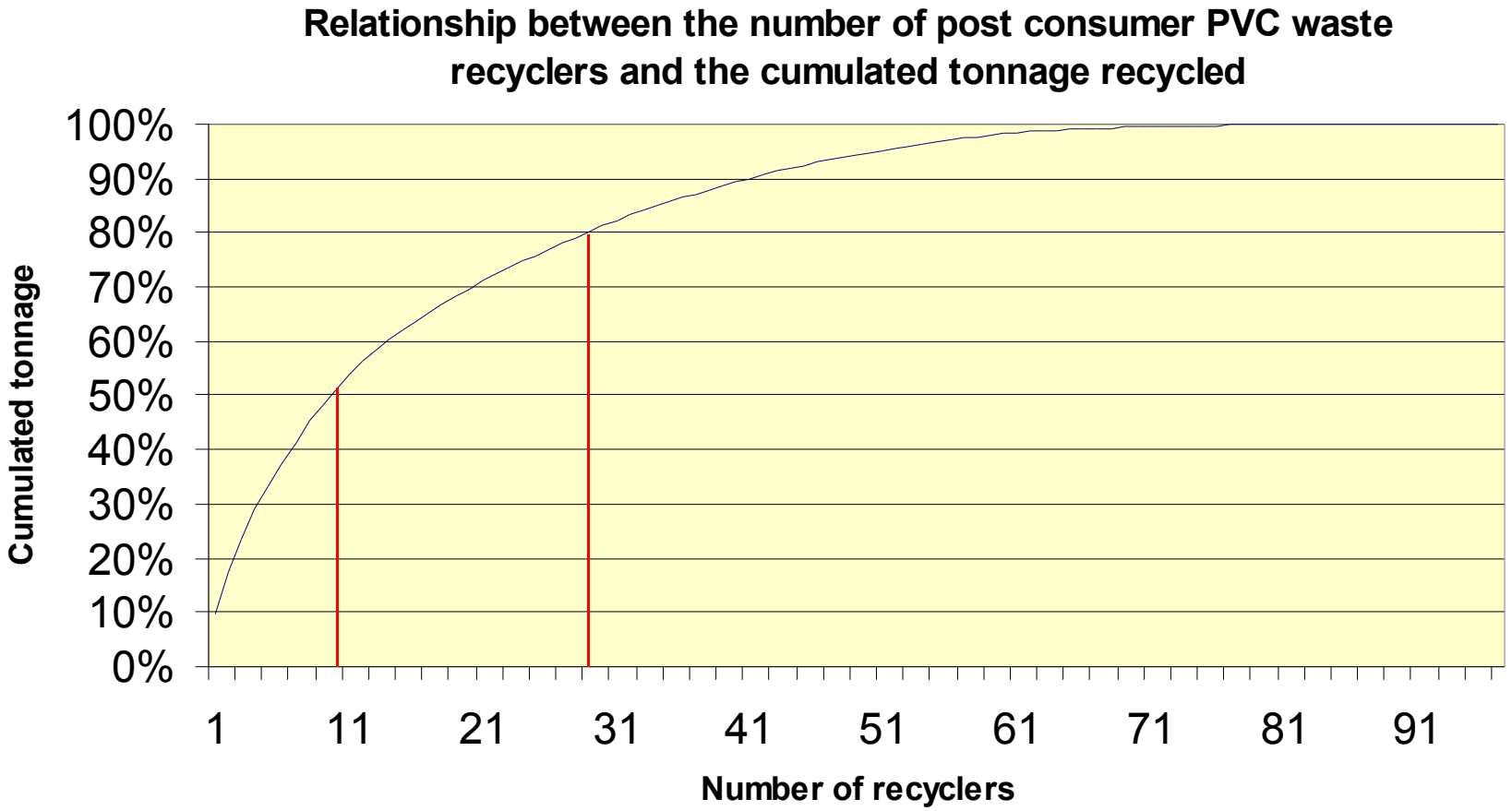
Share between post consumer and post industrial PVC recycling activity*



** for the 70 recyclers interviewed*

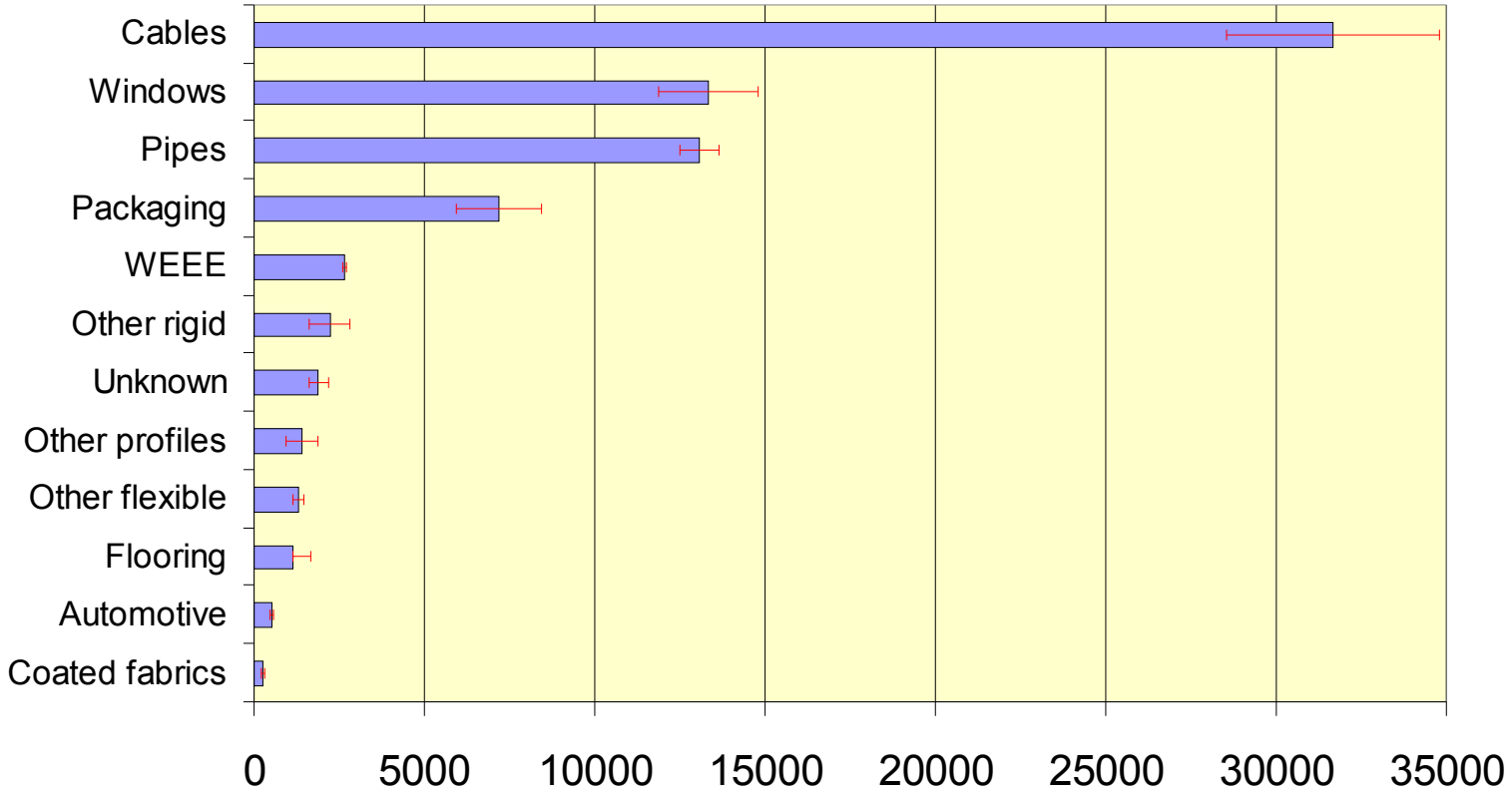
The graphic above should be read as follows:

For example, for 19 companies (over 70) the post consumer PVC recycling activity is in the range 1% to 10% of their total PVC recycling activity.



Among the 97 recyclers who provided figures, the 10 largest have performed 51% of the total recycling.

Post consumer PVC waste recycled by the recyclers interviewed (EU15, tonnes, year 2004) Confidence level by application *



The global level of confidence reaches +11% / -10%. This means that the total tonnage of post consumer PVC waste recycled is in the range [69 kt ; 85 kt]. The tonnages corresponding to Vinyl 2010 supported programmes have a better confidence level (+/- 4%) than the other tonnages (+13% / -12%).

** The method for evaluating confidence levels is described in appendix A.1.*

Non-regulated sector

Number of recyclers identified (post consumer PVC waste): 39

Total tonnage of post consumer PVC waste recycled: 14 740

of which Vinyl 2010 supported programs: 7 923

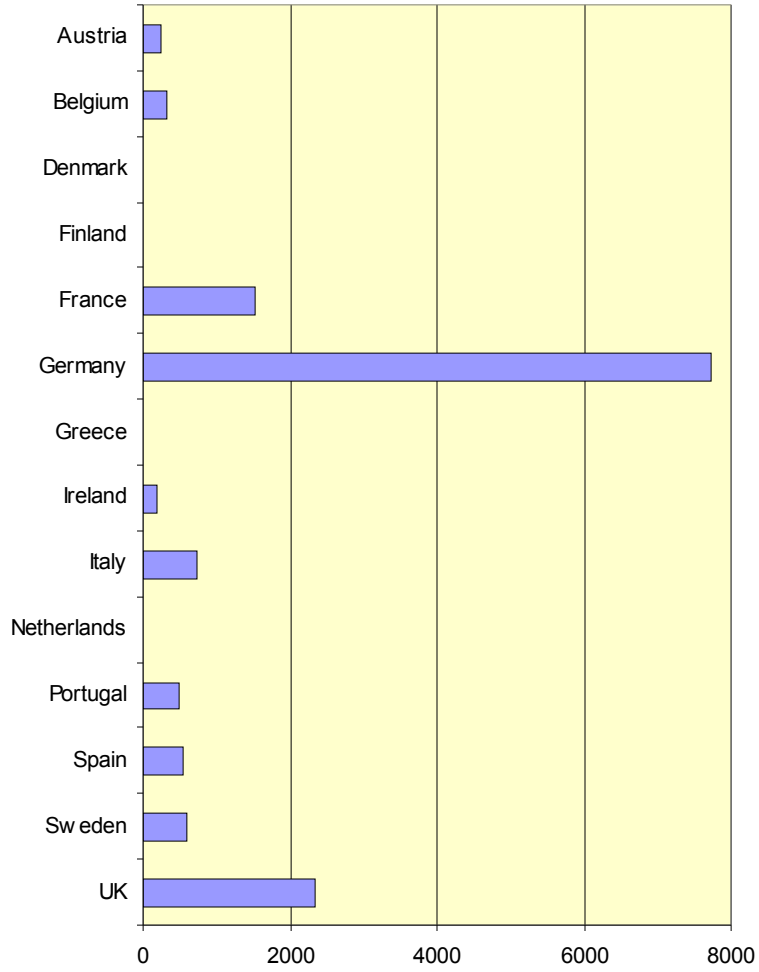
Key findings

In many countries the low quantities available of used PVC windows and shutters prevent the development of recycling. One reason is that the PVC windows market has developed only recently on a large scale (end of the 80's in countries as Spain or Poland), so only small quantities are arriving now at their end-of-life.

Significant quantities of PVC from used windows and shutters are recycled outside the Vinyl 2010 schemes.

Some used PVC windows were exported to Eastern Europe in the past, for re-use. However, these exports have stopped with the development of PVC windows production in Poland.

Recycling of used PVC windows and profiles, by country (tonnes, year 2004)



Non-regulated sector

Number of recyclers identified (post consumer PVC waste): 37

Total tonnage of post consumer PVC waste recycled: 13 050

of which Vinyl 2010 supported programs: 4 800

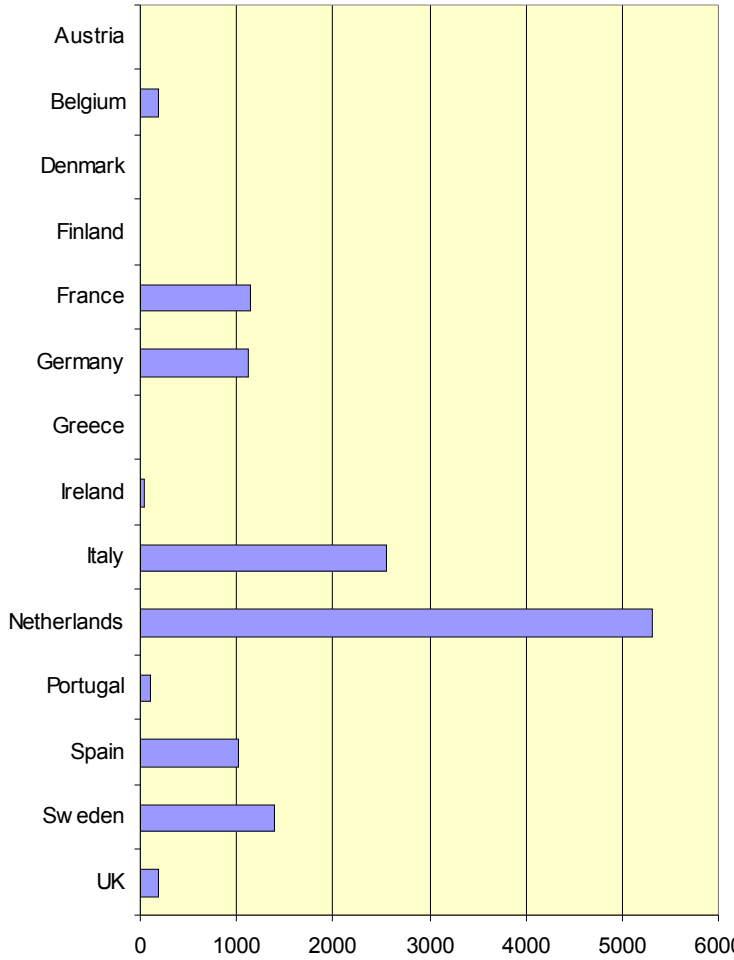
Key findings

Used PVC pipes recycling is concentrated in 5 countries: the Netherlands, Sweden (WUPPI system based on used pipes coming from Denmark in majority), France, Italy, Germany and Spain.

In some countries (as Finland for example) experiences in pipe collection scheme have not been successful. Transporting and gate fees to other European PVC recyclers would have meant too high costs.

Recycled granules from used PVC pipes are generally used as internal layers for new pipes.

Recycling of used PVC pipes, by country (tonnes, year 2004)



Non-regulated sector

Number of recyclers identified (post consumer PVC waste): 20

Total tonnage of post consumer PVC waste recycled: 31 685

of which Vinyl 2010 supported programs: 2 815

Key findings

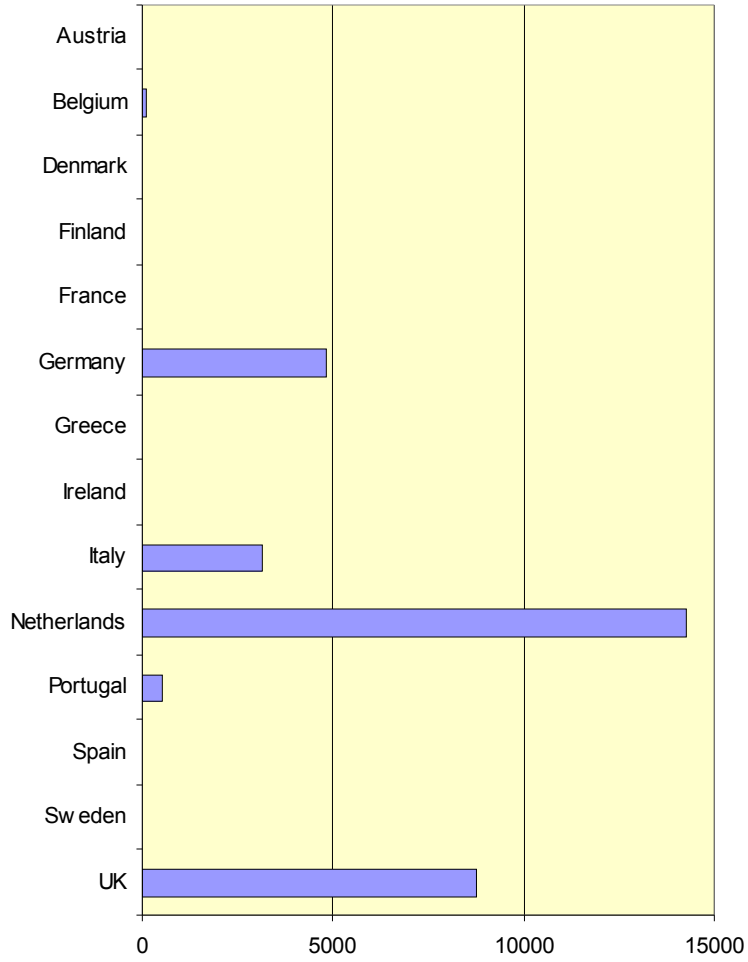
The recycling of copper and aluminium from used electric and communication cables has strongly decreased in Western Europe during the last five years.

60-70 % of the collected electric and communication cables are exported to China after sorting, frequently without any preparation.

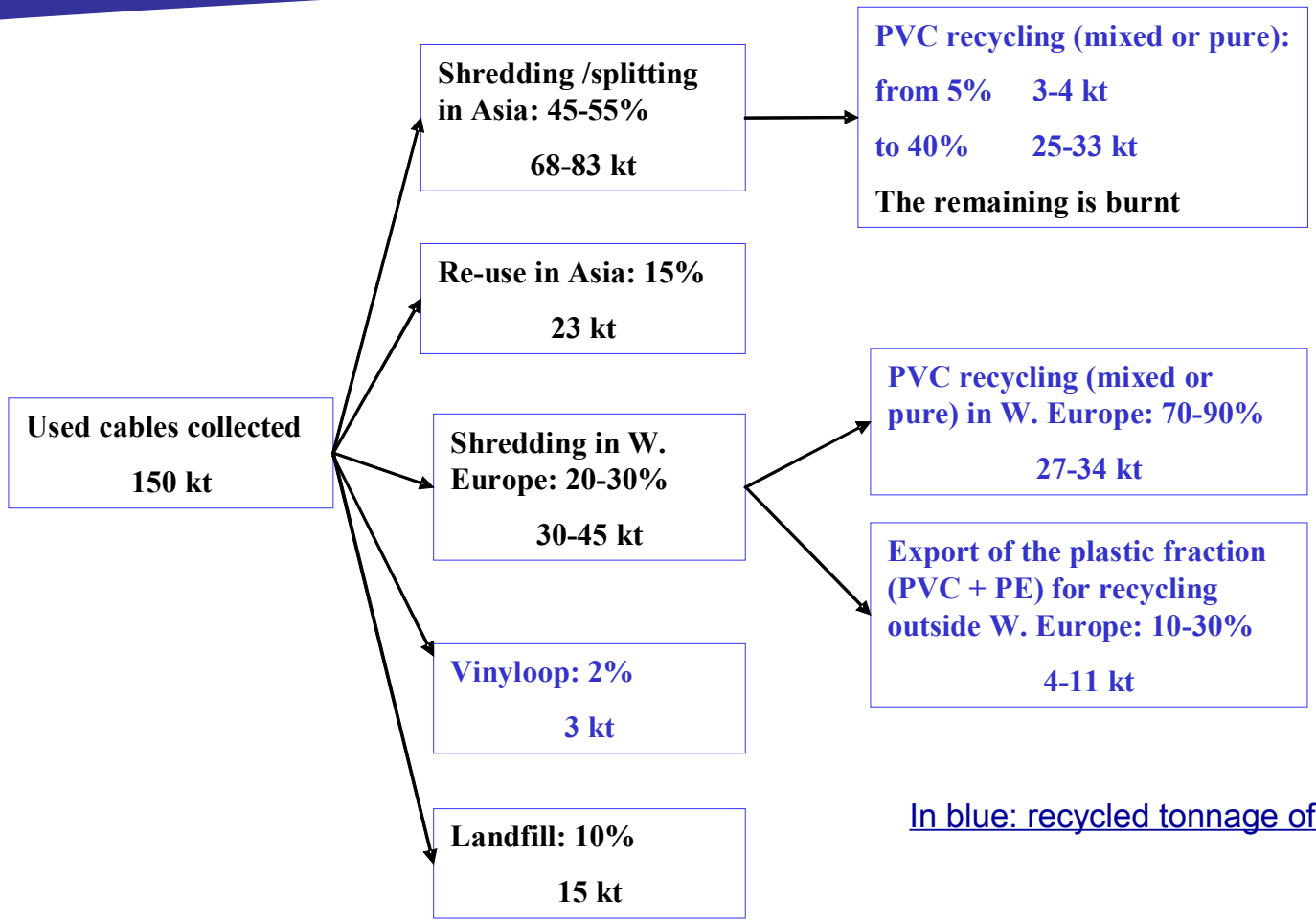
Due to their low labour costs, Chinese cable recyclers are in a position to perform a manual separation of plastics from used cables. Officially, most plastics contained in the used cables exported to China are recycled. However, there is a great uncertainty about what really happens in this country.

The mechanical recycling at Vinyloop (Ferrara) represents 89% of the 3.15 ktonnes of PVC recycled from used cables in Italy.

Recycling of PVC contained in used cables, by country (tonnes, year 2004)



2. Post consumer PVC waste recycling (EU15)
2.5 Results of the survey by application: Electric cables



In blue: recycled tonnage of PVC

30 to 37 ktonnes of PVC contained in used electric and communication cables were mechanically recycled in Western Europe in 2004.
For Asia, the uncertainty on the tonnage of plastics recycled is very large and leads to an estimated tonnage in the range 7 to 44 ktonnes (see the detailed analysis in the following pages).

Cables collection and recycling in the EU15

The PVC content in the used electric and communication cables collected from the C&D sector in the EU15 in 2004 represents about 150 ktonnes (source TN Sofres).

Large telecom operators and electricity suppliers have contracts with waste collectors for the collection of their used electric and communication cables. Some of them have set-up collection schemes at country level (for example France Télécom in the case of PE-HD waste) but most of them have multiple contracts with local collectors.

As a consequence of the high prices paid by Asian countries (particularly China), the recycling of copper and aluminium from used electric cables has slowed-down in Western Europe during the last five years. Only 20-30% of the used electric cables collected (mainly clean off-cuts and clean used cables) is recycled in Western Europe.

The plastic fraction obtained after shredding of used cables is either recycled in mixed polymers granules (PE-HD + PVC + rubber) by specialised companies or energy recovered, or sent to landfill or exported to Asia. However, the price of copper being high, there is no real need to get money from the plastic fraction and consequently, there is a decrease in the plastic recycling activity.

Cables collection and recycling in the EU15

Italy is a good illustration of the recent evolution of PVC mechanical recycling from used electric and communication cables. Large quantities of PVC from used electric cables were recycled at the end of the 90's by Italian recyclers. The largest one was Tecnometal, with 15 000 tonnes/year capacity (PVC).

However, these recyclers faced increasing constraints:

- higher and higher proportion of fillers in the PVC
- partial substitution of PVC by other materials, in particular reticulated polyethylene
- increasing proportion of fillers as calcium carbonate (up to 80% in some types of cables)
- start-up of the Vinyloop plant in Ferrara
- competition from Asian recyclers which purchase used electric cables at high prices.

Finally most recyclers have stopped their PVC recycling activity from used cables. It is the case of Tecnometal, Sarrme, EVC Compound and FITT which do not recycle post consumer PVC from electric cables anymore. Only two SME's are still active in this field (Plastic Planet and Gio Plastic).

Exports of used cables to Asia: methodology

Given the large tonnages of PVC waste which are sent from the EU15 to Asia, and particularly to China, we have carried-out a desk research and additional contacts have been taken with:

- European collectors and traders
- Chinese recyclers (cables and plastics)
- Chinese governmental institutions and Chinese research centres
- Responsibles at European environmental organisations as the OVAM, Basel Action Network (BAN), the European Commission (DG Environment)….
- European companies in charge of technical assistance projects in China aiming at the development of cable recycling.

Most of the time, the information obtained through these contacts was rather global. Due to the opacity of industrial practices in China, only fragmented and rather contradictory viewpoints have been obtained about the behaviour of cable scrap recyclers (as far as plastics contained in these cables are concerned). Some relevant quotations highlighting the situation are presented in the following pages.

The analysis of all interviews leads to the following conclusion: The best and the worst practices may be found for cable recycling in China. Some plastic recyclers are operating according to the State-of-the-Art but cables imported by China are sometimes burnt prior to metal recovery. When mechanical recycling occurs, the stripping is frequently managed by very small companies or even by individual people.

Proportion of cable scraps being sent to Asian countries

Between 60% to 70% of the used electric and communication cables generated in the EU15 is exported to China after sorting, frequently without preparation, cables being just cut at 0.5 m length. Earth cables containing bitumen are put apart. These points have been confirmed by all collectors, plastic recyclers and traders that we have interviewed in Germany, France, Netherlands, Belgium and Italy.

In addition to the PVC contained in cables exported to Asia, part of the mixed plastics fraction resulting from cable shredding in Europe is also exported to Asia at high prices.

Main sources of information about the situation of plastics recycling in China

Ortwin Meeus (OVAM)
Richard Gutierrez (Basel Action Network)
Mr. Van der Herten (DG Environment)
Michael Vetter (AgPU)
Thomas Ormond (DG Environment) in charge of waste shipments
Albert Vermussen (COBEREC – Belgium)
Mr. Evers (De Paaw – The Netherlands)
Johan Zwart (EU Business Development, Sims Mirec)
Holger Böes (DKR)
Martin Eugster (EMPA)
Trading databases

Electric cable scraps recycling in China: the EU15 viewpoint

According to the Basel Convention, most used cables are on the green list of non-hazardous waste. Cable scraps require a notification and financial guarantees in order to be exported from the EU, since it remains unlisted in the current Regulation. However, the competent national authorities frequently refuse to provide authorisations for cable scrap export (the Flemish authorities for example).

The common opinion of responsibles at European environmental organisations is that cables in China are either burnt in open-air or manually stripped. The Basel Action Network has also reported that cable scraps are sent to various Asian countries where they are burnt. Conversely, EMPA has the feeling that a majority of plastics in cable scraps are stripped as the copper price of stripped cable waste is higher than from burnt ones.

Conversely, the European traders have a quite different opinion. They believe that most plastics contained in cable scraps are either recycled or energy recovered (“no material is wasted in China”).

The Chinese organisation called CEPA (Closer Economic Partnership Arrangement) provides Chinese importers of used electric cables with an official authorisation. Most of the time, the European traders exporting to China get a written guarantee that the plastics contained in used electric cables will be actually recycled. According to an expert interviewed: “for 95% of the tonnages exported, the procedure is not transparent. It’s very easy to obtain a paper certifying that the waste will be recycled.”

Due to their low labour costs, Chinese cable recyclers are in a position to perform a manual stripping of plastics in cables, giving them a possibility to separate the PVC from other polymers (cf. high price paid by Chinese importers for mixed plastics from toys, packaging, etc…).

Electric cable scraps recycling in China: the Chinese viewpoint

Chinese legislation

The central government issues licenses giving companies the right to import one or more categories of waste.

The scrap category 7 encompasses unprocessed material and is associated with insulated wire (plastics are covered under a license that is quite similar to the restrictive Category 7 license).

Category 7 is heavily regulated due to the potential environmental impact of processing such material "incorrectly." NEPA, the National Environmental Protection Agency, has restricted the total number of Category 7 license holders to 481 in 2003 to maximize its ability to prevent the importation of prohibited materials.

In addition, Category 7 licenses and material tend to be restricted to specific scrap processing zones, namely southern Nanhai and Qingyuan, central coast Taizhou, and northern Tianjin. Companies operating in these zones will be prohibited from outsourcing material to smaller companies.

Electric cable scraps recycling in China: the Chinese viewpoint

Management of used cables

Officially, the recently arrived scrap containers are inspected and if the load doesn't match the shipping documents, the material is shipped back to the supplier at the expense of the importer. The port of Tianjin seems to be the only port to comply with such procedure. Unofficially, non-matching material is routinely admitted into China, especially for the southern ports. Moreover, some prohibited scraps can easily enter through Hong Kong, its huge container volume almost guarantees that a scrap container won't be inspected upon arrival. The load is then hauled to another southern scrap processing zone.

Importers of prohibited material also tend to outsource it to avoid detection during environmental audits. Inside these small scrap yards, child labor is common and safety standards are nonexistent.

Meanwhile, the purchase of wire-processing machinery, for example, makes it legal to import formerly prohibited low-grade No.2 wire and cable, a material which was previously burnt for copper recovery.

As Tianjin is the only major Chinese scrap processing center within a short drive of China's central government in Beijing, it faces tighter regulations than in southern China. But this situation is likely to change in southern China as Tianjin is presented as a model of China's scrap business.

Electric cable scraps recycling in China: the Chinese viewpoint

Specific examples

• Fuzhou Xian Tong Da Trade Co.

This company operates a waste electrical cable recycling plant in Fujian, which covers about 500 m^2 with a treatment capacity of 1-3 tons/h. It practically crushes the waste cables and separates plastics from the copper, magnetically sorts out the iron. Finally, it produces copper pellet and plastic granules.

• Lane Tone International Material Inc.

Lane Tone, based in California, USA, exports every year several thousand containers of scrap materials to China and other Asian market. Lane Tone's business in China includes three non-ferrous yards in Tianjin, Ningbo, and Hebei Province. Lane Tone has a joint-venture yard in Guangdong, a secondary aluminum smelter in Tianjin, and a plastic scrap yard in Hebei. Lane Tone is an authorized CCIC self-inspection company . All the scrap materials shipped to China are processed in their own yards.

• Tianjin Bluekin Metal Products Co.

This company, based in Tianjin, purchases all kinds of plastic scrap, cable scrap, brass scrap and metal sheet scrap in order to manufacture and distribute hardware products (metal wires, meshes and netting, nails and screws, fasteners and DIY products).

Non-regulated sector

Number of recyclers identified (post consumer PVC waste): 5

Total tonnage of post consumer PVC waste recycled: 1 162

of which Vinyl 2010 supported programs: 782

Key findings

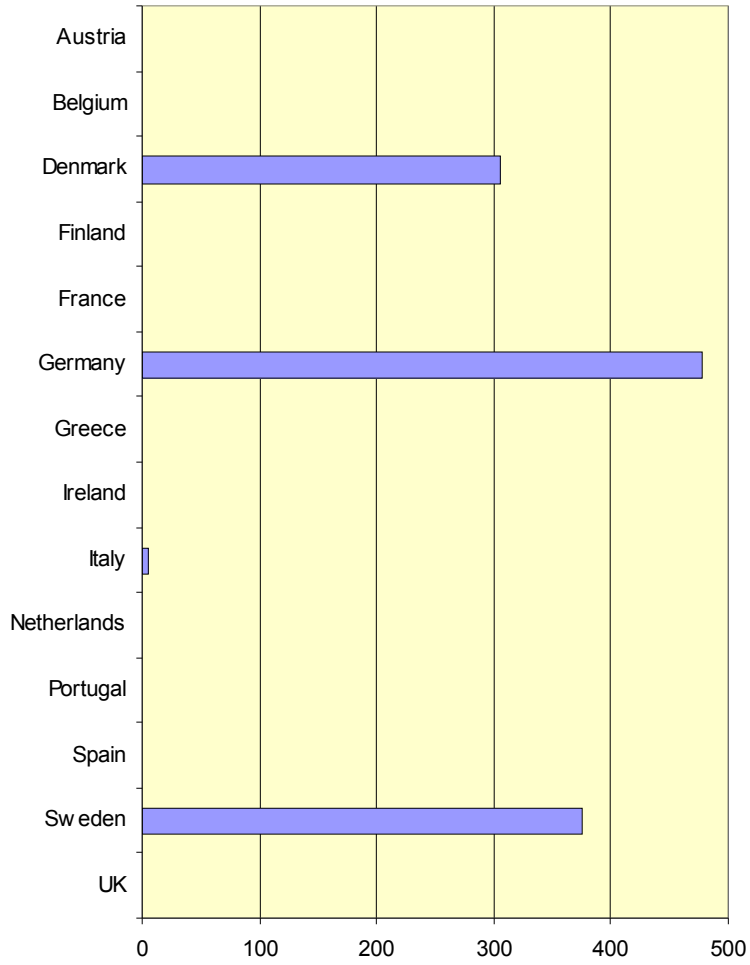
A small number of companies is specialised in the recycling of post user PVC waste floor coverings. One flooring manufacturer is involved in this activity.

AgPR (Germany) is the only integrated collection system for post consumer floor-covering waste in Europe. Waste is collected mainly in Germany, Switzerland and France.

The adhesives and glues remaining on used floorings do not prevent recycling because they can be removed quite easily from PVC.

Because of their geographical dispersion, only a small proportion of installation PVC waste (off-cuts) is recycled, either by flooring manufacturers or by specialised recyclers.

Recycling of used PVC floorings, by country (tonnes, year 2004)



2.5 Results of the survey by application: Extrusion coating

Non-regulated sector

Number of recyclers identified (post consumer PVC waste): 3

Total tonnage of post consumer PVC waste recycled: 265

of which Vinyl 2010 supported programs: 100

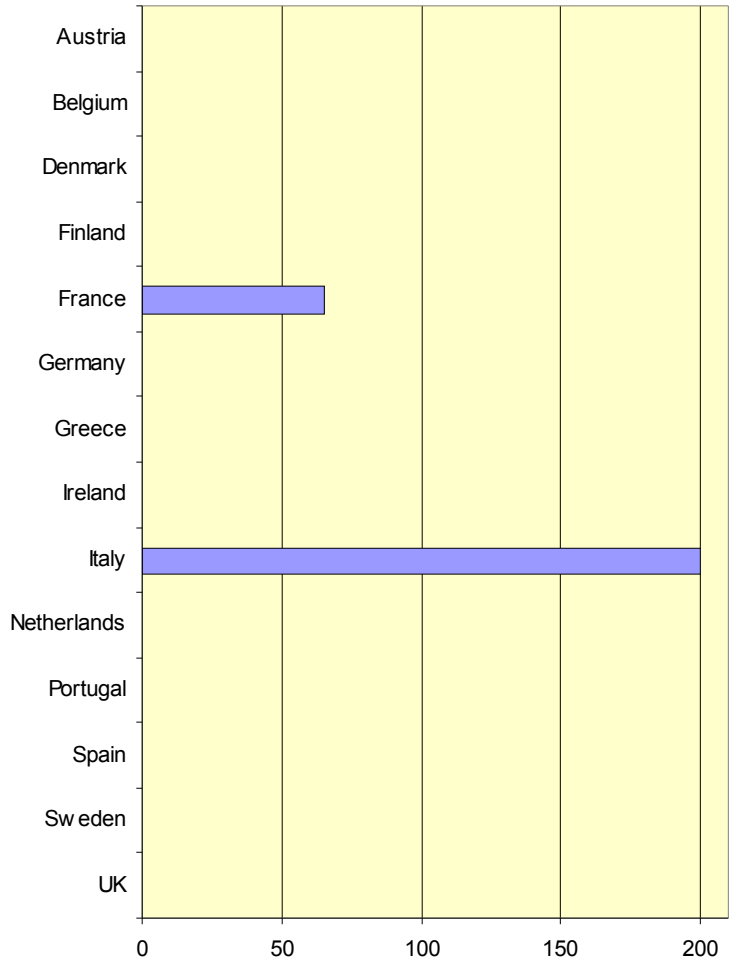
Key findings

22,5 t were collected in 2004 in Germany in the framework of the collection system IVK Sammel-und Verwertungssystem.

The Wilhelm-Klauditz-Institüt (WKI, Braunschweig) has carried-out tests a few years ago, in cooperation with a German manufacturer of PVC-coated wood furniture, in order to separate the wood from PVC, other plastics and rubber. Wood can be re-used for wood based panels but PVC is going to energy recovery.

The French company Ferrari Group -Texyloop process- has collected and stored significant quantity of tarpaulins in 2003/2004. This waste has not been recycled yet. It is supposed to be treated by the Vinyloop plant (Ferrara).

Recycling of used PVC coatings, by country (tonnes, year 2004)



2.5 Results of the survey by application: Other non regulated PVC waste

Non-regulated sector

Number of recyclers identified (post consumer PVC waste): 30

Total tonnage of post consumer PVC waste recycled: 5 403

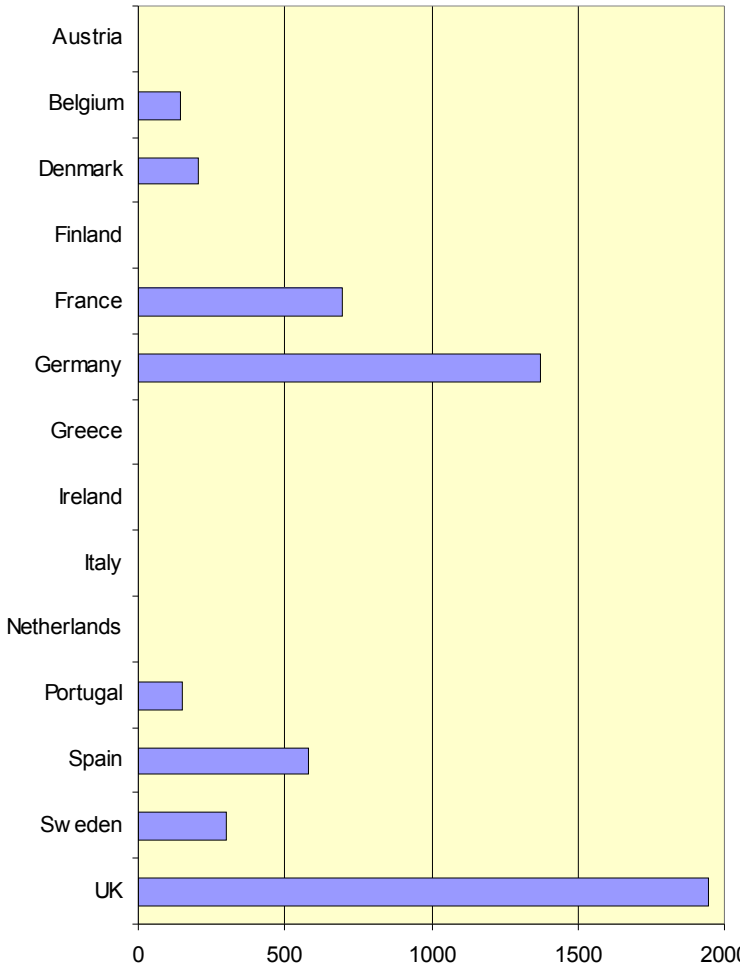
of which Vinyl 2010 supported programs: 1 025

Key findings

Other PVC waste include credit cards, hoses, as well as miscellaneous rigid and flexible (non-packaging) film as roofing, and including the tonnages for which the application was not specified by the recyclers interviewed.

One company (CIFRA, France) recycles used plastic parts from cooling towers located in nuclear power plants.

Recycling of other used PVC, by country (tonnes, year 2004)



Regulated sector

Number of recyclers identified (post consumer PVC waste): 21

Total tonnage of post consumer PVC waste recycled: 7 201

of which Vinyl 2010 supported programs: 0

Key findings

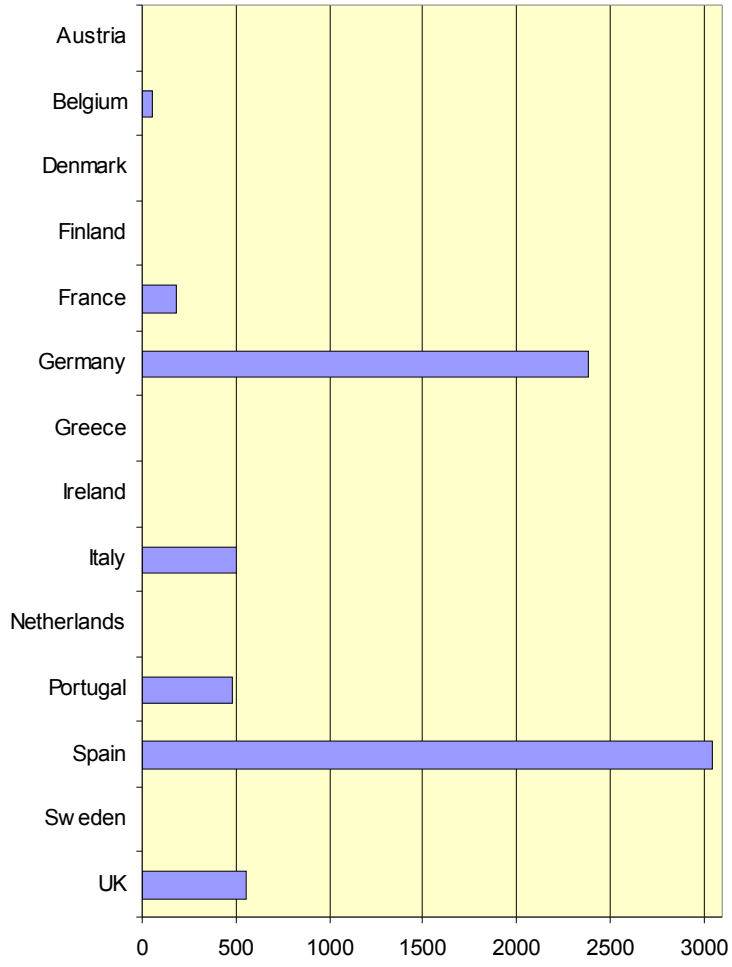
Mixed plastic packaging waste (containing PVC) is not developed. Only one company has been identified (EKOL, Belgium) with a rather small tonnage.

Due to the substitution by PET, the PVC bottles recycling has almost disappeared in the EU15. One PVC bottle filler subsists in the west of France.

In Germany, the PVC packaging contained in household waste is, with few exceptions, treated either by energy recovery or by feedstock recycling*.

** Included in the graphic*

Recycling of used PVC packaging, by country (tonnes, year 2004)



Regulated sector

Number of recyclers identified (post consumer PVC waste): 4 (excluding very small ones)

Total tonnage of post consumer PVC waste recycled: 535

of which Vinyl 2010 supported programs: 0

In the ELV's the PVC weight is approximately 5 kg per vehicle. It is mainly used for the under-body gravel protection layer. There is no suitable recycling technology for it. The second use of PVC in volume is for dashboards (three-layer parts). The attempts to recycle end-of-life dashboards after dismantling (Wipag, Chaise) have not been successful.

Many small companies recycle dismantled plastic parts in low quality mixed-plastics products (particularly in Italy and Germany) but they represent very small tonnages.

There is some PVC in the light fraction of the ELV shredder residue. Several recyclers try to optimise their process in order to obtain a rich-PVC fraction from this light fraction (Norplast and Galloo Plastics in France, Sims Group in the UK, possibly CTR in Belgium….). For the time being they are able to separate the ABS from PP and PS but, as far as PVC is concerned, they can just get a mix of polymers with a PVC content of 50% maximum. This percentage is not sufficient to manufacture recycled PVC products or to use it as input for the Vinyloop process.

In consequence, almost all post user PVC waste from ELVs is currently sent to energy recovery or to landfill (for example, the large collector Remondis (Germany) sends all its post user PVC waste from ELV's in the Hamburg energy recovery plant)
Small quantities of shredder residue are consumed by the feedstock recycling plant at SVZ, but no detailed information is available.

Regulated sector

Number of recyclers identified (post consumer PVC waste): 6

Total tonnage of post consumer PVC waste recycled: 2 653

of which Vinyl 2010 supported programs: 0

Key findings

PVC in WEEE is present in significant proportion in the cords (electric connections between equipment and plugs), where it represents about 70% of total polymer weight, the other 30% being mainly polyethylene and rubber.

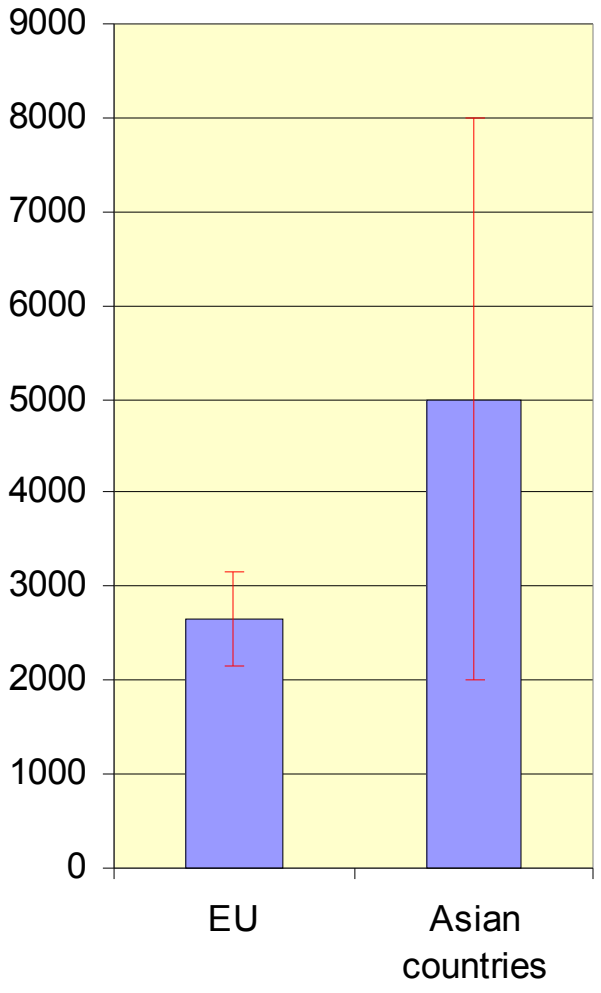
About 95 ktonnes of PVC is contained in the used cords.

Large quantities of WEEE are exported to Asian countries.

According to various sources of information, part of the input of the SVZ feedstock recycling plant (Germany) would be plastics from WEEE. However, due to the impossibility to get information, we have not considered this tonnage.

Note: It has been assumed that the Vinyloop unit (Italy) does not process any “regulated waste” as cords.

Recycling of used PVC contained in WEEE (tonnes, year 2004)



Recycling of PVC in WEEE (except cords)

• There is currently no post consumer PVC mechanical recycling from WEEE, except the cords which are removed from the WEEE before their treatment (this last point is discussed at next page).

• The reason is that the proportion of PVC parts inside the used EEE is very low and these parts are generally too small to be economically dismantled and recycled.

• However, there is some PVC in the light fraction of the WEEE shredder residue. It comes mainly from the WEEE having kept their cords and from the small PVC parts contained in the WEEE. Several recycling companies try to optimise their process in order to obtain a rich-PVC fraction from this light fraction (Norplast and Galloo Plastics in France, Sims Group in the UK….). However, for the time being, they are able to separate the ABS from PP and PS but, as far as PVC is concerned, they can just get a mix of polymers with a PVC content of about 50%. This percentage is not sufficient to manufacture recycled PVC products or to use it as input for the Vinyloop process.

• In consequence, almost all post user PVC waste from WEEE is currently sent to energy recovery or to landfill.

• In addition to the above, small quantities of shredded WEEE are used by the SVZ feedstock recycling plant (Germany). However, no detailed information was available about this tonnage.

Cords recycling in Western Europe

PVC in WEEE is concentrated in the cords (electric connections between each EEE and the plug).

Cords are more and more frequently separated from white, brown and grey products prior to the shredding of the WEEE. Indeed, cords are an homogeneous waste, from which copper is easy to recycle (it should be noted that in 2004, the EU regulation which obliges to remove the cord from each WEEE was not yet effective).

The used cords have the following destinations:

- About 1% belongs to refurbished WEEE.
- When a used EEE is delivered at a shredding unit (mainly white products) the cord is sometimes removed.
- Some used EEE are exported outside the EU15 (mainly to Asia) together with their cord.
- Some used EEE are sent to landfill or to energy recovery together with their cord.

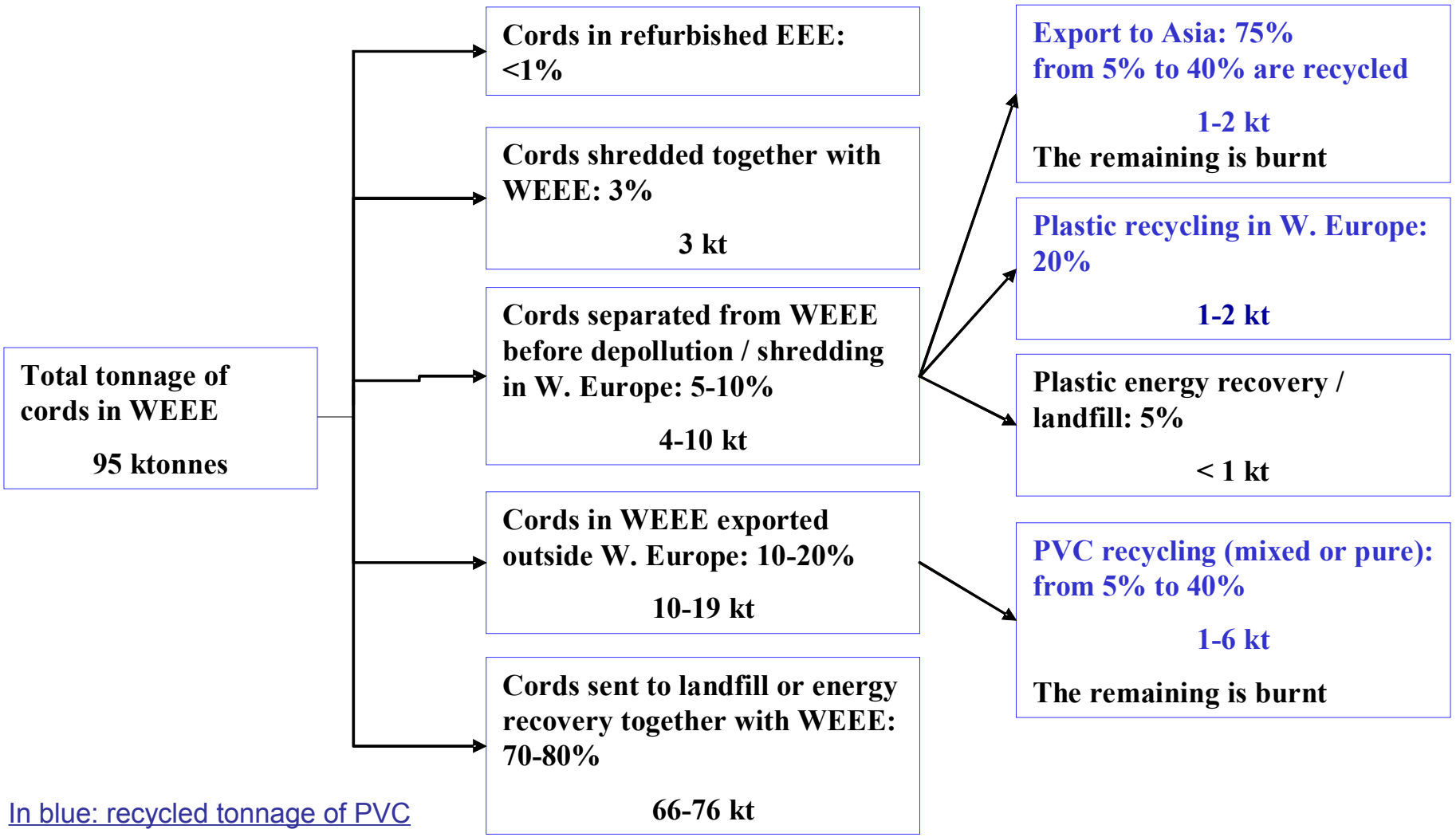
Used cords are collected and managed separately from B&C used electric cables because they need a finer shredding calibration.

For Europe as a whole, we estimate that 8 to 13% of the WEEE (in number) is going to shredding units, 10 to 20% is exported to China and the remaining 70 to 80% is sent to landfill or treated in incineration plants.

Cords recycling in Asian countries

The cords collected are sent to China, either after dismantling or together with the WEEE. Traders request that cords and B&C used electric cables are sent separately.

Cords recycling



In blue: recycled tonnage of PVC

2.6 List of contacts: Austria

Recyclers

Company	Type of waste	Working with Vinyl 2010
Reststofftechnik	Windows	

Sources

Organisation	Contact person
ÖAKF	Johann Pummer
ÖAKR	Ms. E. Novak
VKLÖ - Vereinigung der Kabel- und Leitungsindustrie Österreichs	
VKRÖ - Verein Kunststoff-Recycler Österreichs	Ms. Rubick
ÖKK	
VÖEB - Verein Östereichischer Entsorgungsbetriebe	
API-PVC	Mr. Znidaric
ARGEV	Erwin Janda
LAVU, Oberösterreichische Landes-Abfallverwertungsunternehmen-AG	
Fachverband der Fahrzeugindustrie Österreichs	

2.6 List of contacts: Belgium

Recyclers

Company	Type of waste	Working with Vinyl 2010
Ekol	Mixed plastics	
Raff Plastics / Socaplast	Flexible	
Rulo	Windows, profiles, pipes, credit cards	X
The Last Waste	Window frames, pipes, cables	

2.6 List of contacts: Belgium

Sources

Organisation	Contact person
Fechiplast / Plaremec	G. Scheys
Fedichem	
Kurio Recycling	Richard Gielen ; Xavier Van Kesteren
PVC Info	Richard Gielen ; Xavier Van Kesteren
Dir. Gén. de l'Environnement	Nancy Da Silva
Office Wallon des déchets	Mr. Godzi
OVAM	Marc Leemans
IBGE	Cécile Riffont
Recovinyl	Eric Criel
CRIF-WTCM	Michèle Gasparini
Recupel	Els Verberckmoes
Trans-Vanheede	Peter Vierstraet
Nexans Benelux	Mr. Dame
Coberec	Albert Vermussen

2.6 List of contacts: Denmark

Recyclers

Company	Type of waste	Working with Vinyl 2010
NKT Cables	Cables, flexible	

Sources

Organisation	Contact person
WUPPI	Finn Hjöllund
EPPA	Ulrike Grawe
PVC Information Council	Ole Grandhal Hansen

2.6 List of contacts: Finland

Recyclers

Company	Type of waste	Working with Vinyl 2010

Sources

Organisation	Contact person
Finnish Plastics Industries Federation	Kari Teppola
PVC Network	Vesa Kärhä
Ekokem Oy	Jorma Manninen

Recyclers

Company	Type of waste	Working with Vinyl 2010
Activalor	Construction	
Alterplast	Packaging, profiles, tubes	
Approval 16		
Awego Plat	Windows, profiles, pipes	
Bro-Gen	Pipes, profiles	
BPO		
CIFRA	Cooling towers	X
Cité Plast	Tubes, windows	X
Ecosynthèse	WEEE	
Eurocompound	Profiles, flexible, packaging	
Gibert		
Nord Pal Plast	Pipes, windows	
Norval	Automotive, WEEE	

2.6 List of contacts: France

Recyclers

Company	Type of waste	Working with Vinyl 2010
Norvalo		
PNI		
Recycle logistique	Pipes	
SETI	Profiles, pipes,…	X
Traidib	Pipes, windows	
Valorplast	Packaging (exported to Asia)	
VMB Recycling / Tivaco	Coated fabrics, flexible pipes	
Paprec Recyclage Plastiques	Pipes, windows, profiles	
Prodhag Nord		
Prodhag plastiques		
TRP	Mixed plastics	

2.6 List of contacts: France

Sources

Organisation	Contact person
Galloo Plastics	H. De Feraudy
Valorplast	Robert Bonnefoy ; Pierre Vilatte
PlasticsEurope (cluster France-Benelux)	J.J Couchoud
Renault (Environment department)	R. Lassartesses
RIPS	Isabelle Dupont
ADEME	Sarah Martin
FNCUMA	Marie-Laure Bailly
PVC Recyclage	Eric Chatelain
SFEC	Julie Chaminade
Préfecture du département du Rhône / DRIRE Basse Seine	There are few enterprises handling B&C on the lists of agreed companies

2.6 List of contacts: Germany

Recyclers

Company	Type of waste	Working with Vinyl 2010
Exte	Windows	
Friedola Living	Flexible	X
Gött	Cables, mixed plastics	
KMR	Cables	
Jakob	Pipes	
Jäckering	Pipes	
Jutta Hoser	Construction, mixed plastics	X
Zirec	Cables	
Re-Plus recycling	Cables	
VEKA	Windows	X
Tönsmeier	Windows	X
AfDR	Roofing	X
B-H-S Kunststoff Aufbereitungs	Windows	
Beku Kunststoffe	Rigid	
CBA Kunstsoff	Pipes, rigid	

2.6 List of contacts: Germany

Recyclers

Company	Type of waste	Working with Vinyl 2010
Cablo Metal Recycling	Cables	
Aquila Trading	Pipes, rigid, packaging	
PowerPlast Porta	Windows, pipes, rigid	
Recyplast	Pipes	
Thermoplast Schönhausen	Pipes	
Wemas	Cables	
Gebr. Meisterjahn	Cables	
Sustec Schwarze Pumpe	Packaging	
Rohr Recycling	Pipes	
Dow Olefinverbund / BSL		
AgPR	Flooring	X
PAV	Construction	
Vogt-Plastic	Windows	

2.6 List of contacts: Germany

Sources

Organisation	Contact person
Rewindo	Michael Vetter
DuD eV (Roofcollect)	Ms. Arz
Land of Mecklemburg-Vorpommern	
AgPU	Michael Vetter
AgPR	M. Zimmermann
Tecpol	Ulrich Schlotter
Consultic	Christoph Lindner
DOW	G. Grothe
Fraunhofer-Institut für Holzforschung Wilhelm-Klauditz-Institut - WKI	Timon Gruber
Fachverband Kabel	
DKR	Michael Heyde

2.6 List of contacts: Greece

Recyclers

Company	Type of waste	Working with Vinyl 2010

Sources

Organisation	Contact person
PVC Network	Makis Zomias
Association Hellenic Plastics Industries	Constantinos Panagiotopoulos

2.6 List of contacts: Ireland

Recyclers

Company	Type of waste	Working with Vinyl 2010
IPP	Windows, pipes	In preparation
Retech processing	WEEE	

Sources

Organisation	Contact person
uPVC Awareness Group	Tony Line
Construction Industry Federation	
IBEC - Irish Business and Employers Confederation - Plastics Industries Association	

2.6 List of contacts: Italy

Recyclers

Company	Type of waste	Working with Vinyl 2010
Plastic Planet	Construction	
Levio Loris	Tubes	
Ogemp	Windows, tubes	
Eco Emballaggi	Tubes	
Gio Plastic	Cables, profiles	
F.Lli Montagna	Flooring	
Madre Perla	Packaging	
Vinyloop	Cables, flooring	X
Corepla	Packaging	
Tecnometal	Cables	
Plastic Veneta	Tubes, coated fabrics	

2.6 List of contacts: Italy

Sources

Organisation	Contact person
Light Concrete	Carlo Ciotti
Centro sul informazione del PVC	Marco Piana
AICE	
COREPLA	Cesare Anzivino
Assoplast	Roberto Saettone
Unionplast	Mariarosaria Sarnataro
Associazione Italiana Polistirene Espanso	
CONAI	Irene Piscopo
Chamber of commerce (Lombardia)	

2.6 List of contacts: Netherlands

Recyclers

Company	Type of waste	Working with Vinyl 2010
Morssinkhof	Pipes	In preparation
TRH	Cables	
KRT	Cables	
Moes Cable Recycling	Cables	
Osbo International	Cables (exported to Asia)	
De Hoeve	Pipes	X
De Jonge Sebra	Pipes	2005

Sources

Organisation	Contact person
Mirec	Paul Verhappen
FKS	Roger Loop
Federatie NRK	Ms. Marga Van der Sman
ARN (Auto Recycling Nederland)	Mr. Eyjelaar
SRVKG	Ary Stigter
NEDEK	Mr. Van den Dries
Mirec (Eindhoven)	Johann Zwart
De Pauw	Mr. Evers
Van Straalen	Natalia Sapuga
PVC Steering Committee	Jacob Bouwma

2.6 List of contacts: Portugal

Recyclers

Company	Type of waste	Working with Vinyl 2010
Plasticos Reciclados	Pipes, cables, windows, packaging	
Socabo Lda	Film, blisters	
Barnartrade Materias Plasticas	Pipes, packaging	

Sources

Organisation	Contact person
APIP / Plastval	Ms. Ferreira da Costa
Icep Portugal	Myriam-Lise Da Silva
Ministry of Environment	Humberto Delgado

2.6 List of contacts: Spain

Recyclers

Company	Type of waste	Working with Vinyl 2010
Essi Plast		
Moltuplas		
Plagesa		
Plasticos Diaz Cabellos		
Recycling Plast	Windows	
Sernaplas	Windows, pipes	
Tecni-plasper		

Sources

Organisation	Contact person
ANARPLA	
ASETUB / CICLOTUB	B. de Arteche ; Beatriz Remiro
AMICLOR	Pep Rocher
ASOVEN	Isabel Larrea Velasco
Ministerio de Fomento	
CICLOPLAST	Alberto Caldeiro ; Teresa Martinez
FACEL (Asociacion espanola de facricantes de cables)	Alejandro Saenger
Foro Ibérico del PVC	Beatriz Meunier
Gremio de Entidades del Reciclaje de Derribos	
Communidad autonomas de Catalunia, Madrid, Valencia	

2.6 List of contacts: Sweden

Recyclers

Company	Type of waste	Working with Vinyl 2010
Stena Metall	Cables (exported to Asia)	
Ha Industri	Rigid	
Swerec	Pipes, windows, profiles	X
Tarkett Sommer	Flooring	

Sources

Organisation	Contact person
Assoc. Prod. of Chemical Products	Lena Lundberg
Tracing PVC papers	
Swedish Plastics and Chemical Federation (Plast-Och Kemibrandschernas)	Torbjörn Trangteg
Hydro Polymers	Mikkel Heiberg Storm
Swedish recycling industries association	Anna Helker Sundstrom ; Viveke Darpo Ihd

2.6 List of contacts: United Kingdom

Recyclers

Company	Type of waste	Working with Vinyl 2010
Avon reclamation	Windows	X
Dekura	Windows	X
Ecoplas	Windows	X
Anglian Windows	Windows	X
Associated Polymer Resources		
Dell Plastics	Cables	
Holt and McIntosh		
JSP	Cables, other flexible	
K2 Polymers		
Lomond Recycling	Credit cards	
Plastics Trading	Windows, pipes	
Trafford Services		
Veka	Windows	
EB Waste	Windows	X
Ruberoid	Cables	
PVC Group	Windows, pipes	X

2.6 List of contacts: United Kingdom

Recyclers

Company	Type of waste	Working with Vinyl 2010
Rainbow Products	Windows, rigid	
Melba Products	Cables	
Swintex	Cables	
Tempakerb	Cables	

Sources

Organisation	Contact person
PVC Network	Philip K. Law
The Waste Doctor	
BPF	Peter Davis
Faraday Plastics	Jan Czerski
Bradford University	www.recycling.co.uk

AUSTRIA

Total post consumer PVC recycled in the country (year 2004): 250 tonnes
Number of recyclers identified: 1

The Austrian public authorities and the industry do not promote the development of post consumer PVC waste recycling. This is due to the bad image of PVC in Austria. Consequently, the biggest part of collected post consumer PVC waste is exported to Germany, where it is recycled.

The PVC content in household waste is low. This waste is energy recovered.

BELGIUM

Total post consumer PVC recycled in the country (year 2004): 800 tonnes
Number of recyclers identified: 4

Three recyclers who are currently processing post industrial PVC waste plan to treat post consumer PVC waste in the short term: Verpola, High 5 Recycling and Sita.

DENMARK

Total post consumer PVC recycled in the country (year 2004): 581 tonnes
Number of recyclers identified: 2

Post consumer PVC waste management in Denmark is very specific. Indeed, all quantities of used PVC pipes and windows collected through the WUPPI system are sent to Sweden where they are recycled.

The sole significant recycling activity for post consumer PVC waste in Denmark is dealing with used cables (one large recycler).

FRANCE

Total post consumer PVC recycled in the country (year 2004): 4 337 tonnes
Number of recyclers identified: 24

PVC recycling activity is mainly focused on rigid PVC (used windows, profiles and pipes). There is no recycling of PVC from cables.

Although very recent, the collection systems developed in the framework of Vinyl 2010 are now mature and operational.

Many small and medium recyclers have been identified. They do not seek for post consumer PVC waste but recycle it if they get in touch with.

Three recyclers who are currently processing post industrial PVC waste plan to treat post consumer PVC waste in the short term: Périplast, Plasticollect and Recytech.

FINLAND

Total post consumer PVC recycled in the country (year 2004): 0 tonnes
Number of recyclers identified: 0

Many problems prevent the development of post consumer PVC waste recycling in Finland. There is no functioning commercial recyclate market for post consumer PVC. Several reasons explain this situation:

- Experiences in pipe collection scheme and other plastics recycling projects have not been successful. Transporting and gate fees to other European PVC-recyclers would have meant high costs
- PVC is scarcely used for packaging as retailers have recommended their suppliers to reduce its use as much as possible. So, the proportion of PVC in household waste is low
- There's no use of plastic windows in Finland because of the competition of wood (which can be found in abundance)
- The electric cords removed from the WEEE before treatment are exported to China for recycling
- Collection costs are high because the country produces only a small amount of PVC waste on a large area
- Transport costs (particularly for waste exports) are high for the same reason as above and because distances to mainland Europe are big
- Sorting, treatment and recycling costs are high compared to those of the Asian countries.

In conclusion, almost all post consumer PVC waste still goes to landfill or is exported to China.

GERMANY

Total post consumer PVC recycled in the country (year 2004): 17 879 tonnes
Number of recyclers identified: 29

Post consumer PVC waste collected through pipe, windows and floor-covering collection systems (AgPR, Rewindo, etc…) is recycled either on the own sites of each system or in a small number of recyclers. Most profiles and windows collected through Rewindo are recycled in a close-loop. The small proportion of colored windows (brown) goes generally to the manufacture of window profiles. If there is no capacity available at converters level, it is used for pipe manufacture (internal layer).

Most German recyclers are focused on high-quality recycled plastic products. For them the recycling of mixed plastics and polluted PVC fractions is not relevant (costly technological constraints and low value added recycled products).

The PVC contained in household waste (mainly packaging) is, with few exceptions, treated either by energy recovery or by feedstock recycling. It was proven to be more profitable and eco-efficient than PVC separation followed by mechanical recycling. The whole mixed plastic waste fraction obtained by DKR after sorting is energy recovered or feedstock recycled.

The feedstock recycling plant owned by the German company SVZ consumes an estimated amount of 1000 / 2000 tonnes of post consumer PVC waste containing packaging in majority. This tonnage is corresponding approximately to 1% to 2% of the 100 ktonnes annual input of this plant, this percentage being the proportion of PVC in MSW. As this plant can accept an input containing a proportion of chlorinated products higher than most energy recovery plants, there is no need to control the chlorine content of the feed. This may explain why it was not possible to get any information about the PVC content.

Two recyclers who are currently processing post industrial PVC waste plan to treat post consumer PVC waste in the short term: Büchl Entsorgungswirtschaft and Sita Böhm.

GREECE

Total post consumer PVC recycled (year 2004): 0 tonnes
Number of recyclers identified: 0

There is no organised system at national or regional level for the collection of used windows, pipes or floor-coverings.

The recyclers which act independently have developed rather primitive recycling schemes.

Until recently, PVC was scarcely used in windows. Therefore the tonnage of collectable windows is quite low.

Used pipes are left underground every time it is possible or go to landfill.

It seems that few cables are exported to Asian countries. They are rather recycled locally, but for the metal content only. Plastics are landfilled.

IRELAND

Total post consumer PVC recycled (year 2004): 250 tonnes
Number of recyclers identified: 2

Collecting schemes do exist but they consist in general to export PVC waste for recycling outside.

Construction and demolition PVC waste is rarely recycled.

ITALY

Total post consumer PVC recycled (year 2004): 7 169 tonnes
Number of recyclers identified: 11

The tonnage of post consumer PVC waste recycled in Italy as well as the number of recyclers involved in this activity have significantly decreased during the last 5 years. In 2002 and 2003 many recyclers stopped using post consumer PVC waste (Fumagalli, Dife, Essegiemme, Eurotecno) or even disappeared (CIER).

All types of PVC waste are subject to this evolution: used cables, bottles, agriculture film, ELVs.

According to Plastic Consult (Milano) the total recycling of post consumer PVC declined from 11 500 tonnes in 1997 to 2 900 tons in 2001. It can be compared with the tonnage obtained in the framework of the present study: 4 250 tonnes in 2004 (excluding the tonnage treated by the Vinyloop plant).

It is likely that the increase observed in 2004 compared with 2001 is not reality but is rather due to the fact that some small and medium size recyclers, not identified up to now, have been taken into account in our survey.

THE NETHERLANDS

Total post consumer PVC recycled (year 2004): 19 557 tonnes
Number of recyclers identified: 6

Pipes and cables recycling is strongly developed, by a small number of large recyclers.

No PVC parts are dismantled for the time being in the framework of the ARN (Auto Recycling Nederland) system.

Large tonnages of windows and profiles are collected in the Netherlands, but they are recycled in other countries.
PVC recycled from used cables in the Netherlands come in majority from neighboring countries.

One recycler who is currently processing post industrial PVC waste plans to treat post consumer PVC waste in 2007: Automotive Recycling Network.

PORTUGAL

Total post consumer PVC recycled (year 2004): 1 753 tonnes
Number of recyclers identified: 3

SPAIN

Total post consumer PVC recycled (year 2004): 7 660 tonnes
Number of recyclers identified: 8

The plastic recycling industry in Spain is very dispersed. Besides some large companies, there is a wide population of small / very small recyclers.

The number of SME's involved in post consumer PVC recycling seems quite small. This point was confirmed by the "Communidades Autonomas" of Madrid and Catalunia, which deliver the recycling authorisations.

PVC film for agriculture applications is not recycled. This point has been confirmed by two Spanish waste collectors.

The tonnages of used windows and shutters collected with the support of the organisation Ciclotub reached 18 tons (only shutters) in 2004. PVC windows market has developed on a large scale since the end of the 80's, so only small quantities are now at their end-of-life.

The quantities of used pipes collected with the support of the organisation Ciclotub are still small but on a growing trend: 6.2 tons in 2002, 25 tons in 2003, 35.3 tons in 2004

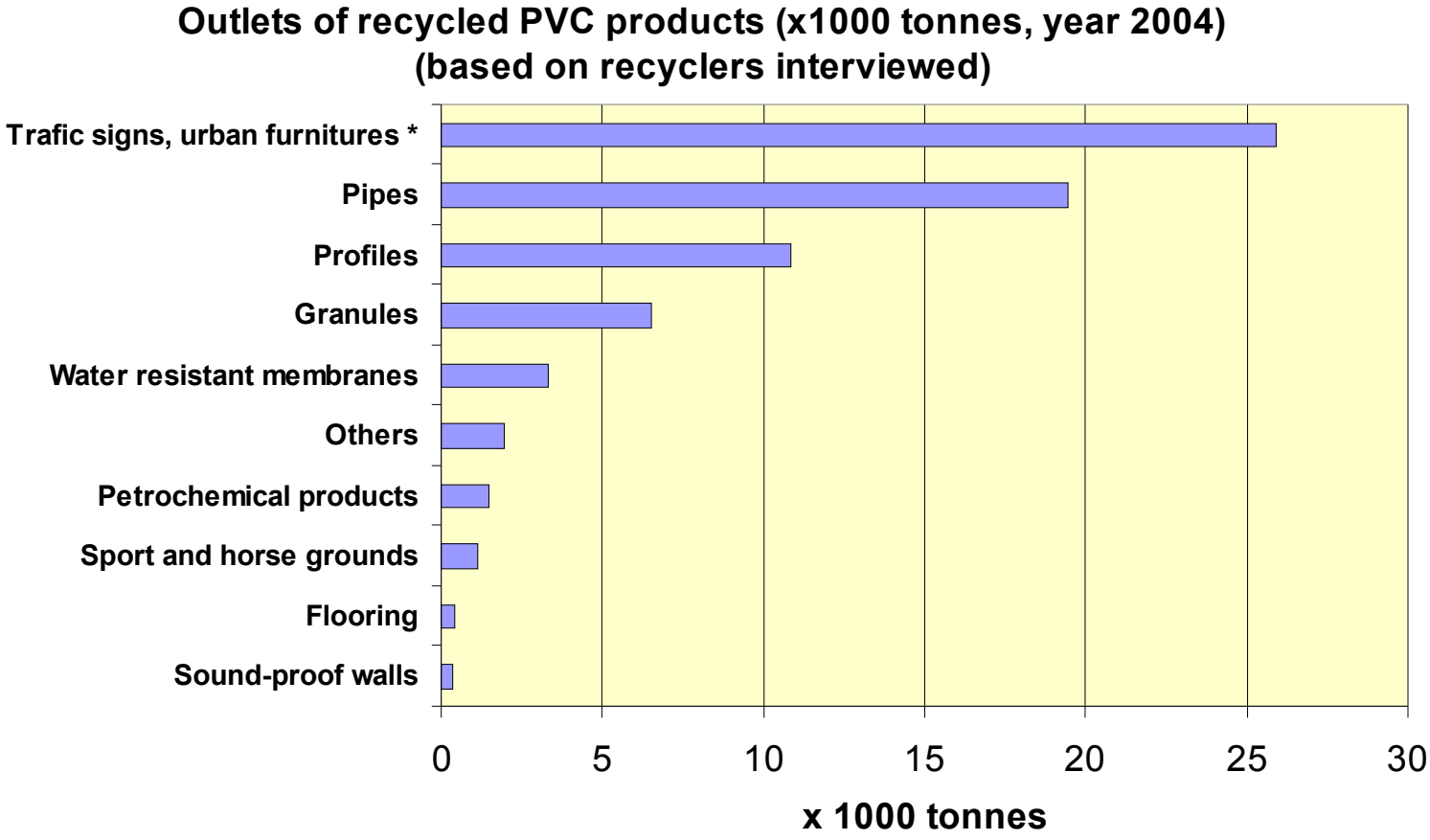
One recycler who is currently processing post industrial PVC waste plans to treat post consumer PVC waste in the short term: Industrias Quimicas de Parets

SWEDEN

Total post consumer PVC recycled (year 2004): 2 675 tonnes
Number of recyclers identified: 3

UNITED-KINGDOM

Total post consumer PVC recycled (year 2004): 13 783 tonnes
Number of recyclers identified: 20



Pipes, profiles and miscellaneous mixed plastics products (traffic signs, road bands, cones) represent 79% of total outlets for recycled PVC products.

** Mixed plastics (PVC + PE + rubber + traces of copper)*

Except specifically mentioned, data presented in the previous pages of this chapter refer to post consumer PVC waste actually recycled by the recyclers interviewed. In order to get an overall "best estimate" of the total tonnage recycled in 2004 (in and out the EU15) it is necessary to take into account some additional tonnages:

• Among the 113 post consumer PVC waste recyclers interviewed, 16 did not accept to provide detailed information about their activity. In majority, these recyclers are small or even very small. We estimate that they contribute for an additional 1.7 ktonnes, i.e. 1.5% of the total tonnage.

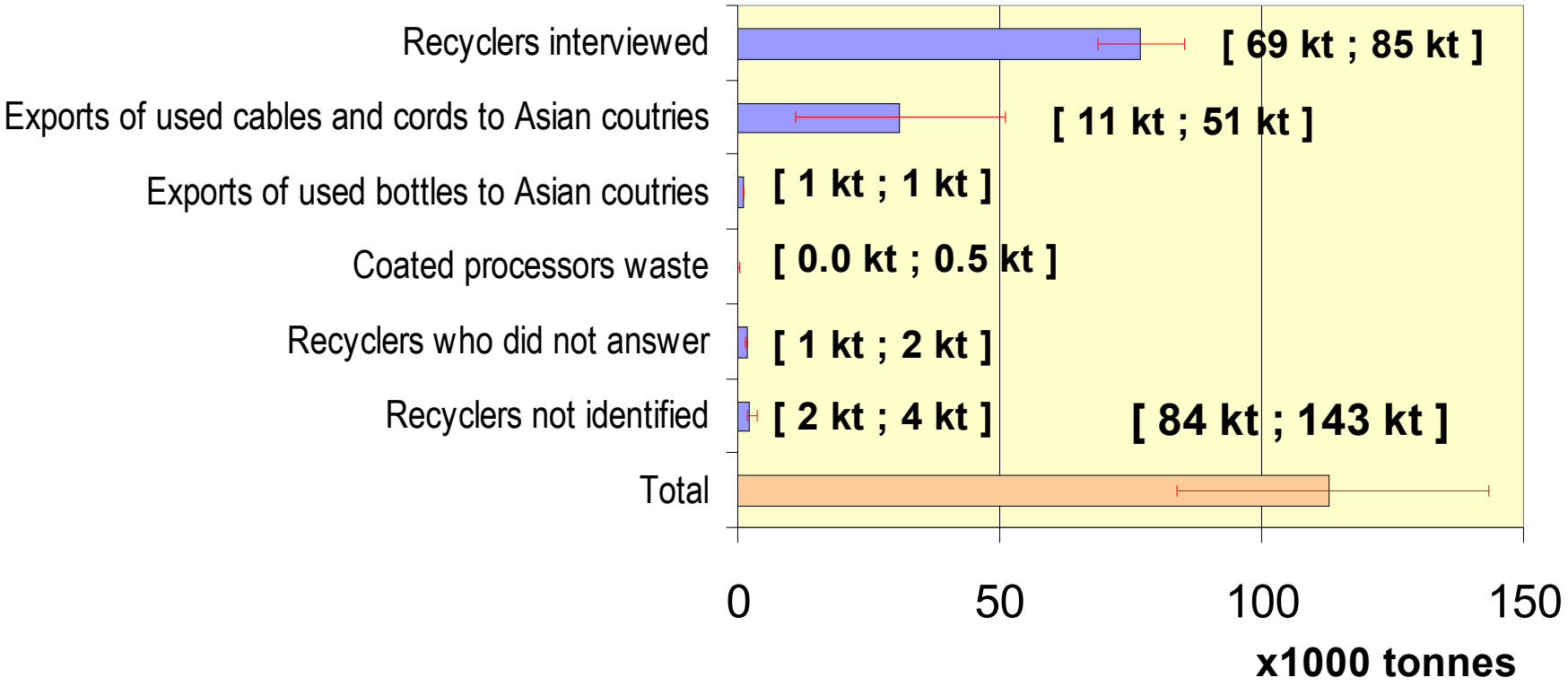
• As in any survey, it is likely that some small or medium size recyclers have not been identified. However, given the comprehensiveness of the investigations carried-out to perform this survey, it is estimated that these "non identified" recyclers do not exceed 2% of the total tonnage.

• As explained in chapter 2.5 ("electric and communication cables" and "WEEE"), about 31 ktonnes of PVC from used electric cables and cords were recycled in Asian countries (mainly China) in 2004.

• PVC converter waste produced during the manufacture of extrusion coated products (including artificial leather products) and recycled outside the production plant is considered as post consumer recycling (see chapter "Definitions"). This represents about 0.25 ktonnes.

Note: The contacts taken with Dow Chemical, Tecpol and AgPU have not allowed to get any information about the quantities of post consumer PVC waste recycled in 2004 at the Dow Chemical plant located in Skopau (Germany). The main current use of this plant (capacity: 35 ktonnes of waste per year) is to treat chemical waste generated by the Skopau Dow chemical industrial platform.

Final extrapolation: Recycling of post consumer PVC waste generated in the EU15 (and recycled in and outside the EU15) (ktonnes, year 2004)



Between 84 and 143 ktonnes of post consumer PVC waste generated in the EU15 were recycled in 2004, either in the EU15 or in Asia. The average "best estimate" is 113 ktonnes.

2.10 Evolution 2000-2004

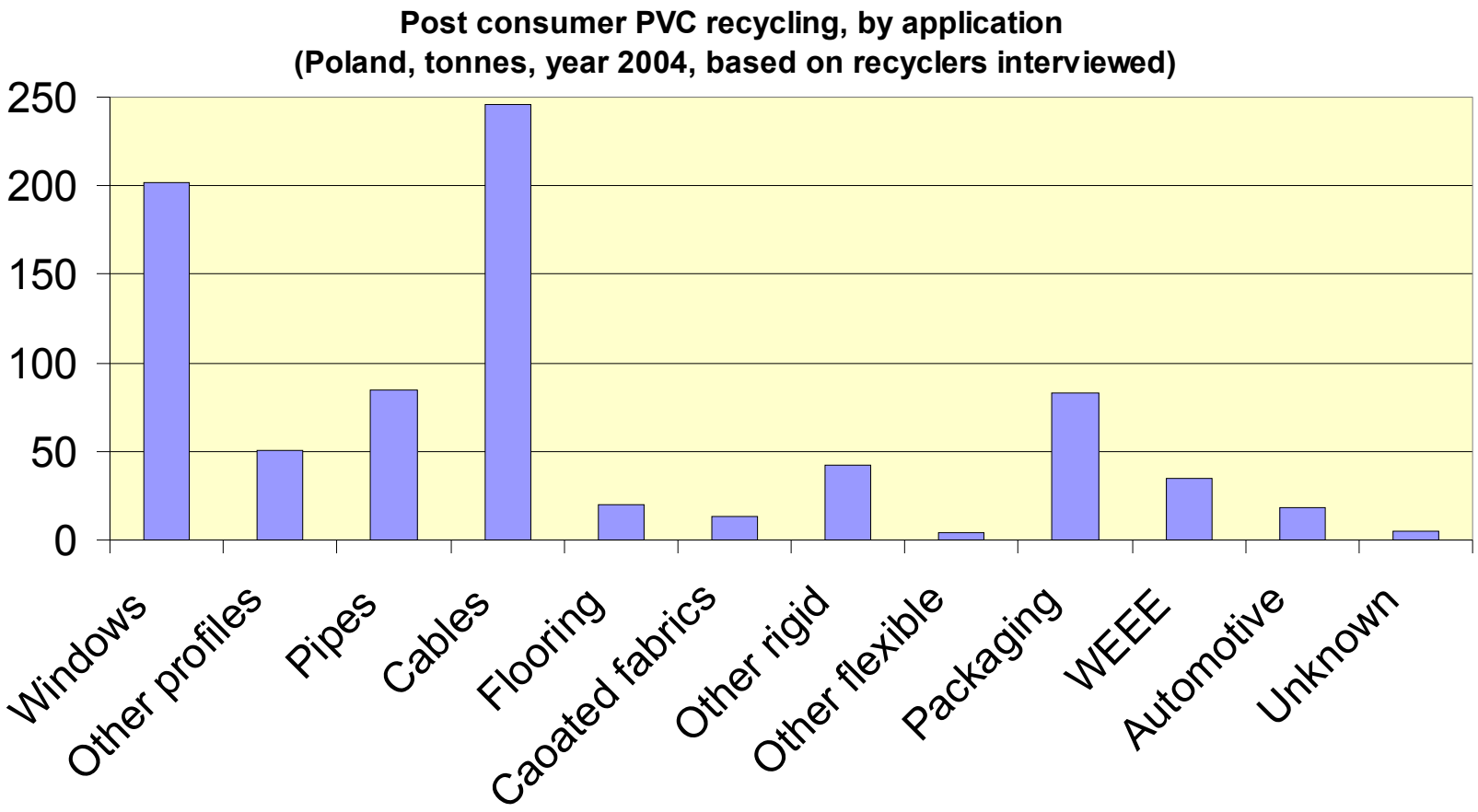
- The study entitled « Mechanical recycling of PVC wastes » carried-out by Prognos, Plastic-Consult and COWI in 2000 on behalf of the DG Environment concluded that 96.4 ktonnes of post consumer PVC waste were recycled by the major recycling systems in the EU. The structure of post consumer PVC recycling has strongly evolved during the last five years.

- **The following types of waste are less recycled in 2004 than in 2000:**
  - The recycling of used PVC Bottles (14.8 ktonnes in 2000) has almost stopped, together with the disappearance of the waste sources (there is an exception in France, for about 1 ktonne per year).
  - Other PVC packaging is less recycled (19.1 ktonnes in 2000, about 7 ktonnes in 2004), because PVC is less used in packaging.
  - The 12.2 ktonnes of "other post consumer PVC waste" recycled in 2000 (mainly in Spain and Germany) are not well defined. If we assume that it deals with PVC contained in car parts, WEEE and other rigid and flexible, then the recycled quantities have decreased at 8.6 ktonnes in 2004.

- **The following types of waste are more recycled in 2004 than in 2000:**
  - Used PVC pipes recycling has strongly increased, from 5.5 ktonnes up to 13.1 ktonnes, as well as used profiles and windows recycling (from 3.6 ktonnes up to 14.7 ktonnes).
  - The recycling of PVC contained in used electric and communication cables has registered a decrease in the EU15 but an increase due to the exports to Asian countries.
  - The recycling of roofing products has slightly increased.

3. Focus on Poland

- PVC waste recycling is fragmented among many SME's. More than 90% of the PVC recycling activity deals with post industrial PVC waste. Recycling permits are delivered by the "Urzad Marszalkowski" of each region.
- 11 post consumer PVC waste recyclers have been identified during the survey.
- The share of post consumer PVC waste in the total PVC recycling activity of the recyclers interviewed reaches 25%.
- There is no organised collection system for post consumer PVC waste (except for packaging with Rekopol). Collection is carried-out by each enterprise individually.
- Small tonnages of used PVC windows are recycled. The PVC window market exists since the 90's but the demand began to grow only in 1993, so the quantity of discarded windows and shutters is very small. There are no imports of used windows for second-hand use.
- Some quantities of PVC contained in used cables are recycled. Conversely to Western Europe, it seems that only a small proportion of used electric cables is exported to Asian countries.
- Investment is hampered by the high cost of new recycling equipment.
- The opinions about the future of post consumer PVC recycling are contrasted. A majority of recyclers thinks that even if the use of PVC is going to decrease, the recycling activity will develop, mainly for PVC windows and shutters.



Total post consumer PVC waste recycled by the recyclers interviewed reached 805 tonnes in 2004 (with a level of confidence of +/- 14.7%).

The "best estimate" is about 1000 tonnes (including the very small recyclers which were not interviewed).

Recyclers

Company	Type of waste
Drewnex Recycling	Windows, packaging, automotive
Koloplast	Pipes, cables, coated fabrics, rigid
Markpol	Windows and profiles
PPH Arcus	Windows, cables, rigid, WEEE
Przetworstwo Tworzyw Sztucznych	Windows, pipes
Recykler Tokarz i S-ka	Flooring, rigid, packaging, weee
Recykling	Windows, pipes, rigid
Markab	Cables
Przetworstwo Tworzyw Sztucznych Recykling	Cables, profiles, packaging, weee
PPHU Kvadrat	Cables
ZPH Olmar	Cables, packaging, automotive

Sources

Organisation	Contact person
PPCA – Polish Plastics Converters Association	Tadeusz Nowicki, Grzegorz Tadych, Agnieszka Wist
Rekopol	Jakub Tyczkowski
OIGR (recyclers association)	Mr. Jerzy Ziaja
Instytut Ochrony Srodowiska (Ministry of environment)	Mr. Czarnonski
Urzad Marszalkowski Mazowickir (Chamber of commerce of Warsaw)	Ms. Anuszewska
PlasticsEurope Polska	G. Rytko

Other sources

List of recyclers from	Web site
OIGR	www.oigr.pl
Plastic manufacturers and converters	www.tworzywa.pl
PVC Windows manufacturers	www.pvckonsorcjum.pl
Yellow pages	www.pkt.pl
B2B finder	www.panoramafirm.pl

4. Post industrial PVC waste recycling

Contents of the module "Survey among PVC converters"

Preparation of the questionnaire (in English, French, German, Spanish, Italian and Polish languages).

Phone interviews among a representative sample of PVC converters covering the main processing activities.
58 converters have provided detailed information about their activity and waste ratios.

Selection of the best estimates, by comparing the answers from various converters for each PVC application:
- % of scraps compared to total output
- breakdown between scraps recycled in-situ and scraps sold outside for recycling.

Assessment of the total post industrial PVC waste tonnage for each PVC application, by multiplying the above % of scraps by the PVC consumption at EU15 level.

Assessment of the destination of post industrial PVC waste tonnage for each PVC application, by multiplying the breakdown between scraps recycled in-situ and scraps sold outside for recycling by the PVC consumption at EU15 level.

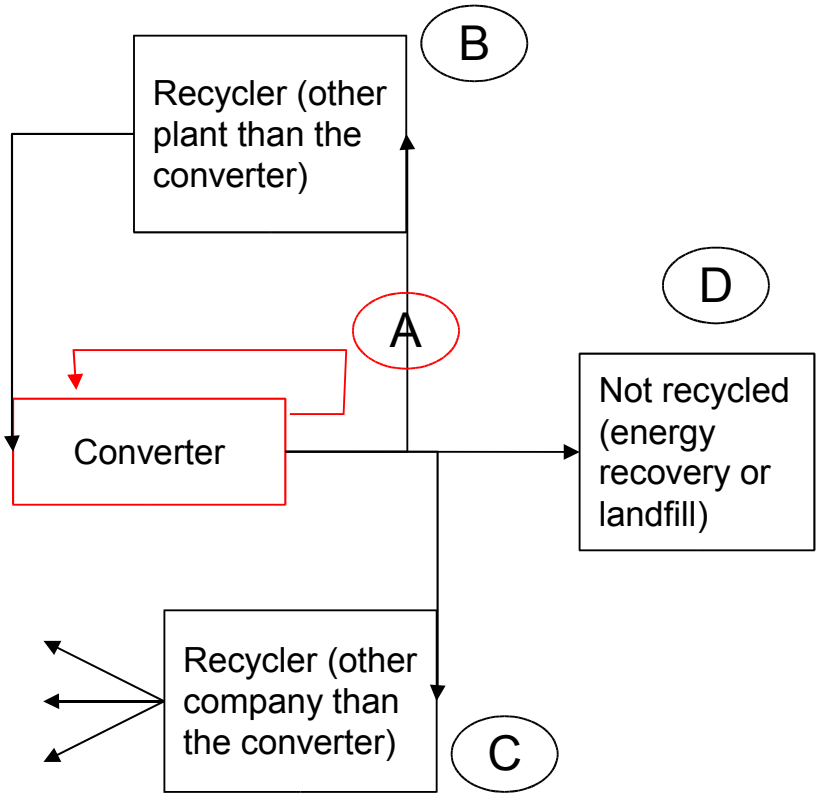
PVC consumption data for the year 2004 have been obtained from two main sources:

- PVC consumption statistics provided by the PlasticsEurope statistical group in June 2004 in the framework of the information system carried-out by AJI-EUROPE and Consultic. The PVC consumption for Switzerland and Norway (respectively 100 and 45 ktonnes in 2004) have been removed from the total European converters consumption (8400 ktonnes). We have considered that the structure of PVC consumption by application in these two countries is the same as the European average.

- ECVM detailed breakdown of PVC processors consumption by application and by sector.

The proportion of scraps in total PVC production is considered by most converters interviewed as a key indicator of competitiveness. This may explain why some of them were reluctant to provide us with detailed data.

- Internal recycling is defined as the re-use in the same plant of production scraps after regrinding (direct loop within the same plant, scheme A).
- External recycling is defined as the processing of production scraps by another plant (same company or another one) than the scrap producer (schemes B and C).
- Not recycled production scraps are either energy recovered or landfilled (scheme D).



Total PVC scraps generated by converters in the EU15 (year 2004)

	PVC consumption 2004 x1000t	Processing Step 1		Processing step 2		**Total steps 1&2 x1000t**
		% production scraps	Total x1000t	% production scraps	Total x1000t	
Thin film monolayer	313	10%	31			**31**
Thin film multilayer	309	12%	37			**37**
Thick film (including roofing)	249	6%	15	2%	5	**20**
Extrusion coating	395	5%	20			**20**
Small packs / thin walled containers	164	6%	10	25%	41	**50**
Bottles <5l	77	7%	5			**5**
Pipes	1537	6%	92			**92**
Fittings	156	10%	16			**16**
Windows	1335	8%	107	9%	120	**227**
Other profiles	601	2%	12	7%	42	**54**
Cables	970	3%	29			**29**
Flooring / Walling (calendered in rolls)	899	5%	45			**45**
Flooring / Walling (calendered, tufted tiles)	524	16%	84			**84**
Flooring / Walling (coated)	40	20%	8			**8**
Others (mainly moulded)	822	5%	41			**41**
TOTAL	**8391**					**760**

PVC converters in the EU15 have generated about 760 ktonnes of post industrial PVC waste in 2004. 51% is due to pipes, fittings, windows and other profiles.

Since 1999, the structure of the PVC consumption has significantly evolved (PVC bottles consumption decrease …).

Destination of PVC scraps generated by converters in the EU15 (year 2004)

	Processing Step 1			Processing Step 2			Total internal recycling x1000t	Total external recycling x1000t	Total not recycled x1000t
	% internal recycling	% external recycling	% not recycled	% internal recycling	% external recycling	% not recycled			
Thin film monolayer	99,9%	0,0%	0,1%				31	0	0
Thin film multilayer	45,0%	50,0%	5,0%				17	19	2
Thick film (including roofing)	89,9%	10,0%	0,1%	50,0%	45,0%	5,0%	16	4	0
Extrusion coating	1,0%	69,0%	30,0%				0	14	6
Small packs / thin walled containers	89,9%	10,0%	0,1%	40,0%	50,0%	10,0%	25	21	4
Bottles <5l	98,9%	1,0%	0,1%				5	0	0
Pipes	89,0%	10,0% *	1,0%				82	9	1
Fittings	89,0%	10,0% *	1,0%				14	2	0
Windows	98,0%	1,0%	1,0%	0,0%	99,9%	0,1%	105	121	1
Other profiles	98,0%	1,0%	1,0%	0,0%	99,9%	0,1%	12	42	0
Cables	25,0%	70,0%	5,0%				7	20	1
Flooring / Walling (calendered in rolls)	98,9%	1,0%	0,1%				44	0	0
Flooring / Walling (calendered, tufted tiles)	5,0%	50,0%	45,0%				4	42	38
Flooring / Walling (coated)	98,9%	1,0%	0,1%				8	0	0
Others (mainly moulded)	89,0%	1,0%	10,0%				37	0	4
TOTAL							**407**	**294**	**58**

53% of total post industrial PVC waste generated by converters in the EU15 is re-used within the plant.

39% is recycled outside the processing plant.

8% is landfilled or energy recovered.

** This percentage includes the quantities of pipe scraps which are recycled through subcontracts.*

5. Recycling forecast 2010

Contents of the module ”Forecast 2010”

Two types of information have been used to carry-out the forecast of post consumer PVC waste recycling at the 2010 horizon:

- First, each PVC recycler interviewed in the framework of the survey has been asked about the future evolution of PVC recycling in his company as well as the main factors of evolution.
- Second, the knowledge of AJI-EUROPE acquired during recent studies on plastic waste management in WEEE, and ELV sectors.

The opinions expressed by recyclers concerning the future evolution of PVC recycling

113 post consumer PVC recyclers have been identified but only 59 expressed their views about the future:

- 8 declared that they intend to increase their recycling capacity in the short / medium term, for a total of 25 000 tons in 2007/ 2008
- 1 stopped its activity in 2005
- the other recyclers have expressed qualitative opinions (see the following pages).

Moreover 8 recyclers have started post user PVC recycling in 2005 of which 3 of them have planned a total of 3000 / 4500 tons/year.

Main factors of change in favor of post consumer PVC recycling growth (figures are the number of answers)

- Increase of the post consumer PVC waste stream available for collection: 39
- Landfill regulations and higher incineration cost: 10
  - More stringent European and national legislations
  - In Italy, a decree adopted in 2003 stipulates that at least 30% of all products and equipment purchased by public administrations should contain recycled materials. However, the impact of this law is difficult to assess.
- Increasing scarceness of post industrial PVC waste (the percentage of scraps generated by PVC converters is decreasing for productivity reasons. Moreover, the converters recycle more and more by themselves: 3
- The EC is preparing a directive to limit used cable exports: 1
- Strong growth of mixed plastics recycling resulting from the increasing co-operation of citizens: 1
- Increase of post industrial PVC waste price: 1
- Increase of virgin PVC price: 1

Main factors of change preventing the future growth of post user PVC recycling

- Increasing competition from Chinese recyclers: 2
- Decreasing quality of post consumer PVC waste: 1
- The phthalate content in some products has a negative impact on the PVC image, leading to less waste available: 1

Windows, shutters, other profiles and pipes

–In Germany, the Rewindo scheme plans a strong increase of recycled quantities, due in particular to the new TASi legislation.

–In Spain, the quantities managed by Ciclotub are still very small in 2004 (0.035 ktonne of pipes and 0.018 ktonne of shutters) but on a growing trend. The forecast is 100 tonnes in 2005 and 1000 tonnes in the medium term .

–In Austria, according to ÖAKF, PVC windows collection could be increased up to 590 tonnes/year, compared with 93 tonnes (16%) in 2004.

Collection systems similar to WUPPI or Rewindo are likely to develop in the other EU15 countries. As far as windows are concerned, the main brake will be the low availability of waste in the countries where the PVC window market is relatively recent.

Shredder residue from WEEE and ELV's

The current R&D developments aim at increasing the purity of the PVC-rich fraction obtained from the light fraction of the shredder residue. Some recyclers can already produce (by post-sorting after flotation process) a fraction containing 40% PVC. However, the Vinyloop process requires a minimum proportion of 80%. An additional post-sorting is necessary. The problem is to know with which probability and at which horizon such process improvements will emerge. The stake is big because about 3% of the light fraction of the shredder residue is PVC.

ARN (Netherlands) plans to separate a PVC-rich fraction from the shredder residue in 2007. A new plant is supposed to use the SiCon (VW) process. Outlets are intended for use by the Vinyloop process. However, for the time being, the PVC rich fraction obtained by the SiCon process does not meet the Vinyloop specification.

Cords (from WEEE)

According to the EU Directive 2002/96/CE dated 27th January 2003, cords must be separated from WEEE prior to any treatment of the WEEE. This should result in a significant increase of volume for used cords separately collected and available for recycling.

PVC in used cables

The future evolution of PVC recycling from used electric and communication cables is rather unpredictable. Two scenarii can be envisaged. The first one is the extrapolation of the current trend, resulting in more and more exports to Asia. The second one is a progressive (or sudden) prohibition of waste imports by China, resulting either from a new legislation or from a modification of the supply-demand balance of PVC waste in China. The second scenario would lead to a dramatic increase of post consumer PVC waste available for recycling in the EU15. However, whatever may be the future evolution, it should not modify drastically the total tonnage of post consumer PVC waste recycled from used cables in the EU15 and abroad.

Floor coverings

Some recyclers are in discussion with large floor-covering manufacturers which have set-up a collection system, in order to take some post consumer waste.

Coated fabrics and wall coverings

For Germany, IVK Sammel-und Verwertungssystem plans a strong increase from 0.02 ktonne in 2004 up to 10 ktonnes in 2005. Moreover, a new recycling route could be an interesting issue for used wall coverings. The company Plasty Vinyl Recycling (Mouscron, Belgium) has developed a physical process based on centrifugation and gelification for the recycling of wall coverings made of paper or fabrics. This project is supported by Solvay, AgPU and the ”Syndicat Français des Enducteurs.” This type of waste is considered as hazardous because it contains plasticisers and solvents. For the time being, this company treats converter waste from coaters (one tonne per day from the end of 2005).

Forecast 2010 for post consumer PVC waste recycling (x1000 tonnes)

PVC applications	2004 (ktonnes)	Forecast 2010		Increase (%)	
		Mini (ktonnes)	Maxi (ktonnes)	Mini	Maxi
Windows and shutters	13,3	27	40	100%	200%
Other profiles	1,4	3	43	100%	3000%
Pipes	13,1	26	52	100%	300%
Electric and communication cables	31,7	35	41	10%	30%
Coated fabrics and wall coverings	0,3	0,3	30	10%	High (2)
Flooring	1,2	2	5	100%	300%
Other rigid	2,2	4	7	100%	200%
Other flexible	1,3	2	6	50%	350%
Unknown	1,9	3	6	75%	200%
Sub-total non-regulated recycling	66,4	100	224	50%	238%
Packaging	7,2	8	9	10%	20%
ELV	0,5	1	5	10%	High (1)
WEEE (including cords)	2,7	3	8	20%	200%
Sub-total regulated recycling	10,4	12	22	13%	109%
Sub- total recycling in the EU15	**76,8**	**111**	**246**	**45%**	**220%**
Export for recycling in Asia	31	34	62	10%	100%
TOTAL	**107,8**	**145**	**308**	**35%**	**186%**

(1): Hypothesis of a new process allowing to obtain a rich-PVC fraction from shredder residue
(2): New chemical recycling process

According to the above scenarios, the recycling of post consumer PVC waste could increase up to 145 ktonnes in 2010 in the scenario ”low” and 308 ktonnes in the scenario ”high.”

Appendix

A.1 Procedure for calculation of confidence levels

In this kind of survey, all recyclers interviewed do not answer with the same degree of accuracy. For this reason, we have assessed a confidence level for each data collected. The following examples illustrate how the confidence level is evaluated:

1- To the question ”How many tonnes of post user PVC waste did you recycle in your plant in 2004?”

- If a recycler answers « 784 tonnes » the range of accuracy is +/- 1 tonne (< 1%).
- If he answers « 800 tonnes » the range of accuracy is +/- 50 tonnes (+/- 6%)
- If he answers « between 600 and 800 tonnes » then the tonnage is 700 tonnes and the range of accuracy is +/- 100 tonnes (+/- 14%).

2- Then, to the question ”What is the breakdown of post consumer PVC recycling between various types of waste?”

- If he answers ”322 tonnes of used windows and 534 tonnes of used pipes” the range of accuracy on each product is +/-1 tonne on each (<1%))
- If he answers ”about 70% windows and 30% pipes” the range of accuracy is respectively +/- 7% (5% of 70%) and +/- 16% (5% of 30%).

• Finally, the percentages obtained in 1- and 2- are added, in order to get the overall range of accuracy on each data.

The following sheets give detailed lists of:

- Post consumer PVC recyclers by country
  including the name of the company, a contact person, the address, phone number and email
  Most of them recycle also post industrial PVC waste

- Post industrial PVC recyclers
  including the name of the company, its phone number and country
  This list is not comprehensive. It includes only the names of recyclers contacted during the survey but which appeared to recycle only post industrial PVC waste.

- PVC converters and corresponding associations
  including the name of the company, a contact person, the address, phone number and email
  This list is limited to the converters interviewed for the assessment of their post industrial PVC scraps recycling practices.

A.2 Detailed list of contacts: post consumer PVC recyclers

Austria

Reststofftechnik GesmbH	Mr. De Lorenzo Hof 61, 5302 Henndorf am Wallersee	+43 621 46517 13	j.delorenzo@reststofftechnik.at

Belgium / Luxemburg

EKOL NV	Mr. Bart Van Gorp Europark 1075; 3530 HOUTHALEN	+32 11 45 41 46	bartvangort@ekol.be
Rulo SA	Mr. De Mees Chaussée d'Audenarde, 82; 7742 HERINNES-LEZ-PECQ	+32 69 55 93 71	rulo@skynet.be
Raff Plastics / Socaplast	Piet de Bruyn Kaaskantmolenstraat, 49; 1840 LONDERZEEL	+32 52 30 13 22	
Tarkett	Mr. Cobraiville 2, op der Sang Zone industrielle Eselborn-Lentzweiler L-9779 Lentzweiler	+352 94 92 11 85 08	
The Last Waste	Etienne Van de Loise Zoning ouest, 16, 7860 LESSINES	+32 68 33 80 14	etienne@tlwsa.com

Denmark

NKT Cables	Henrik Rysyaard	+45 57 89 05 17	henrik.rysgaard@nktcables.dk

France

TRP	Mr. Tronche Rue de la Sucrerie - 59113 Seclin	+33 6 22 13 12 06	contact@trp-nord.com
Activalor	ZA les Acacias - route de Krautergersheim - 67870 Bischoffsheim	+33 3 88 49 22 21	
Gibert	Bruno Caroen 59280 Bois Grenier	+33 6 26 97 72 65	bruno.caroen@gibert.fr
BPO	Annie Briand Parc d'Activités l'Oseraye; 44390 Puceul	+33 2 40 51 39 09	bpo.briand@free.fr
Alterplast	Ms. Poncet 69330 Pusignan	+33 4 78 04 43 40	
Cité Plast	Philippe Taillez 29 rue tessé; 72170 Vernie	+33 6 73 89 08 90	philippe.taillez@sita.fr
EuroCompound	Mr. Maubert 6, rue Dumont D'Urville; 75116 Paris	+33 1 47 23 48 10	amaubert@eurocompound.fr
Paprec Recyclage Plastiques	Yves Leray ZI de la Coindrie; 49 340 Trementines	+33 2 41 49 16 20	
Prodhag Nord	Mr. Thomasset RN 32 - 60400 Passel	+33 3 44 09 60 10	
Prodhag Plastiques	Xavier Picquet-Gauthier ZI Le Grand Combeau; 38690 Colombe	+33 4 76 06 91 91	xpg@prodhag.fr

France

Norvalo	BP 80002; 59316 Valenciennes Cedex 9	+33 3 27 22 44 00	
Ecosynthèse	Mr. Tournup 6 rue Michel Servet; 63200 Riom	+33 4 73 64 08 79	
Bro-Gen	Bruno Delpino La Plaine; 81220 Guitalens	+33 5 63 70 71 15	bdelpino@bro-gen.com
Aproval 16	Mr. Michaud ZI La Braconne; 16600 Morniac Ruelle	+33 5 45 65 91 97	aproval16@aproval.fr
VMB Recycling	Mr. Debode 1 Rue des Freres Saint Leger; 59117 Wervicq Sud	+32 51 77 16 40	
Traidib	Mr. Verdez 3 rue Pierre Boucher; ZA du Canal; 18150 La Guerche sur l'Aubois	+33 2 48 76 14 18	
Tarkett	M. Montserret ; M. A. Cazoli Sedan	+ 33 3 24 29 84 04 + 33 3 24 29 84 59	
CIFRA	Michel Py ZI de la plaine BP6; 02400 CHATEAU-THIERRY	+33 3 23 83 82 03	mpy@cifra.fr
Nord Pal Plast	J.Ph. Carpentier 28 rue de la tannerie; BP33; 59481 Haubourdin cedex	+33 3 20 02 17 33	jphc-jpcpartner@wanadoo.fr
SETI	Mr. Marrocano RD 988 Les Baules BP 114; 81604 Rivières	+33 5 63 81 55 08	

France

PNI	Mr. De Monza 13170 Les Pennes Mirabeau	+33 6 89 15 73 02	demonza@wanadoo.fr
AWEGO PLAST	11 bv de l'industrie; ZI Saint Andoche; 71000 Autun	+33 3 85 52 31 69	
Recycle logistique	Bernard Sablé Parc d'activité du val d'Oust; 56460 La Chapelle Caro	+33 2 97 74 74 15	
NORVAL	Bruno Dessaux ZI DU BOIS DE LA MARE; 76480 BERVILLE SUR SEINE	+33 2 35 05 94 10	bruno.dessaux@norval.fr

Germany

AfDR	Karin Arz Troisdorf	+49 6151 21187	karin.arz@dud-ev.de
AgPR	Jochen Zimmermann Paul-Baumann-Str. 1, Bau 1133/Postbereich 16, 45772 Marl	+49 2365 495048	info@agpr.de
Aquila Trading GmbH	Mr. Vössing Unter der Schirmecke 2, 37688 Beverungen	+49 5273 36370	h-d.voessing@aquila-trading.de
BEKU Kunststoffwerke GmbH	Mr. Bartoldus Im Knick 1, 37688 Beverungen	+49 5273 88712	m.bartoldus@beku.biz
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A.2 Detailed list of contacts: post consumer PVC recyclers

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A.2 Detailed list of contacts: post consumer PVC recyclers

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A.2 Detailed list of contacts: post consumer PVC recyclers

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A.2 Detailed list of contacts: PVC converters and corresponding associations

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A.2 Detailed list of contacts: PVC converters and corresponding associations

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