ANNEX 4 CASE STUDIES

CONTENTS

1 CASE STUDY AUSTRALIA

The Australian Bureau of Statistics (ABS) estimates that more than 500,000 ELVs arise in Australia each year, from a total stock of 12.5 million vehicles in use. The number of ELVs is increasing and is expected to continue increasing as a result of: the continuing upward trend in the rate of vehicle ownership; a declining average vehicle age; and a declining cost effectiveness of owning older vehicles due to the lower price and increased reliability of new vehicles. The Australian Department of the Environment and Heritage believes the number of ELVs might exceed 750,000 by 2010.

Current recycling rates are similar to those in Europe and are largely made up of the recycling of metal components, accounting for between 65% and 75%, in addition to some reuse and reconditioning of high-value parts removed during the dismantling process. There is no reliable data concerning the incidence of parts recycling but it is estimated to account for up to 5% of vehicle weight, although the demand for spare parts is in decline due to increased reliability and increased lengths of warranty periods for new vehicles.

The viability of parts reuse and recyclability is in part dependent on the ease and cost of disassembly, which impacts on the economic cost of the part or material. However the Federal Chamber of Automotive Industries argued against the development of disassembly manuals by manufacturers, claiming this was an unnecessary additional cost burden on manufacturers, given present levels of disassembly, reuse and recycling.

The scrap steel extracted by the metal shredders has an approximate CIF price of US$100 per tonne and is generally sold to steel mills in Korea. Non-ferous metals are worth significantly more than this, with approximate CIF prices of copper and aluminium given as US$250 and US$950 respectively. However, there are substantial transport, handling and processing costs incurred in recycling these materials. Plastics and foams are believed to account for 50% of the total 200,000 tonnes of ASR which is estimated to be sent to landfill each year in Australia, accounting for around 1% of the total annual waste.

The majority of the 500,000 ELVs in Australia are managed through existing ELV recycling processes, with the Australian Department of the Environment and Heritage estimating that more than 90% of ELVs reach recycling facilities. However the Automobile Parts Recycling Association of Australia (APRAA) believes this figure is only 80% and a 1996 study by the NSW Government and APRAA suggests this figure could be as low as 70%. Therefore there are issues in Australia regarding the improper disposal of ELVs and particularly the abandoning of ELVs, especially in Western Australia. This is believed to be a greater issue than in the US or Europe due to Australia's vast landmass and low population density and the costs incurred by local authorities, of retrieving and storing these vehicles prior to disposal, can be significant. While ELVs are frequently removed from even the most remote parts of Australia, the Department of the Environment and Heritage believes potentially greater outcomes and reduced costs to local authorities could be achieved through facilitating formal ELV collection points. They consider that the current lack of any formal ELV deregistration

requirements is likely to be contributing to the costs and inefficiencies currently experienced in collecting and treating ELVs, and there is growing support within the industry for a system whereby a requirement would be placed on the last owner of each vehicle to formally deregister ELVs, leading to appropriate de-pollution and parts recycling at accredited dismantlers, in line with the European legislation.

However, the Federal Chamber of Automobile Industries and their members indicated opposition to any imposed reuse and recycling targets on Australian manufacturers. They claim that the cost impact on local manufacturers would be unwarranted at the present time given the different conditions in Australia compared to Europe and Japan. The lower landfilling charges in Australia and the US reflect the lower population density and greater availability of land compared to Europe and Japan. In conclusion, landfill volumes are less of an issue in Australia.

Some progress has been made towards encouraging ELV recycling through informal encouragement of recyclers and dismantlers. A joint project between the Environment and Heritage Department and APRAA has produced guide booklets on waste oil recycling, which were sent to recyclers and dismantlers throughout Australia during 2003. They are also encouraging recyclers to prepare their own environmental action plan, highlighting the efficiency benefits and improved reputation amongst councils, environmental protection agencies, customers and staff, of any operators taking actions to protect the environment. There is also a current project being undertaken by the Plastics and Chemicals Industries Association (PACIA) looking at the potential for recycling automotive plastics.

The changes to European and Japanese legislation are expected to flow through to Australian vehicles over time. However it is currently unlikely that Australia will impose its own targets because Australia is a relatively small market, with low investment and low volumes, and any imposed targets would have a significant impact on the industry.

Sources: www.apraa.com, www.pacia.org.au, Department of the Environment and Heritage, *Environmental Impact of End-of-Life Vehicles: An Information Paper,* 2002

THE AUTOMOBILE SHREDDER RESIDUE RECYCLING PROMOTION TEAM (ART)

The current vehicle recovery rate in Japan is approximately 80%. The remaining 20% includes substances that cannot be separated or recycled, such as plastic and glass, and is referred to as automobile shredder residue (ASR) which is sent to landfill sites. It has become necessary to develop ways to recycle ASR in preparation for the Automobile Recycling Law that came into effect in Japan in January 2005.

A new alliance for ASR recycling called the Automobile Shredder Residue Recycling Promotion Team (ART) has been formed in Japan between Suzuki, Nissan, Nissan Diesel, Fuji Heavy Industries, Mazda, Mitsubishi and Mitsubishi Fuso Truck & Bus. Nissan has been selected as team leader. The aim of ART is to take responsibility for activities ranging from ASR recovery to recycling and disposal. This will involve working with a number of commercial operators with recycling know-how to set ASR recovery criteria, assign recovery locations, and examine recycling methods. The ART expects to benefit from efficiencies by outsourcing the work involved in shipping management, recycler/final disposal handler management and payment for recycling and disposal fees to businesses and other entities that have the relevant know-how.

The formation of the new alliance enables the carmakers to share their accumulated knowledge and experiences of recycling, and its structure will also allow commercial entities to contribute their know-how. They will ensure transparency in all activities and aim to minimize costs through streamlining those activities. The amassing of ASR from all companies is also expected to generate economies of scale and there is much scope for benefits exceeding those that would accrue if each vehicle manufacturer recovered and recycled ASR independently.

Current recycling methods for shredder residue usually involve high-temperature processing, which allows the recovery of energy and metals. The remaining residue is used for road surfacing and concrete reinforcement materials. Efficient high-temperature processing, which allows the quantity of shredder residue to be reduced, is an extremely complex technology. ELVs tend to include many complex parts made from resins and other non-burnable materials and shredder residue is made up of a large number of different materials.

Nissan were selected as team leaders because they have made significant progress in recycling ASR. From 1997, Nissan has worked on the recycling of ASR which presents a problem in energy recovery because of the intense heat involved. Nissan rebuilt part of their waste incineration facilities at the Oppama plant, tested and achieved solutions to technical problems and started energy recovery of ASR towards the end of 2003. This was the first time any carmaker had used existing incineration facilities at its own plant to process ASR. The vapour generated by the process will be used for heating in the paint process and elsewhere along the production line, making the plant a leader in energy conservation. The technology and know-how adopted by Nissan could be applied at other waste incinerators, and the information is being shared as part of the ART.

Sources: www.theautochannel.com. Mazda, *Social and Environmental Report,* 2004. Nissan, *Sustainability Report*, 2005.

2 CASE STUDY FRANCE

PART A: CURRENT MANAGEMENT OF ELVS

1. Description of the Policy & Institutional Structure (Current & Planned)

In France the Decree n° 2003-727 relative to vehicle construction was adopted on 1 August 2003 and was completed by seven implementing laws:

- 24 December 2004 concerning the dispositions relative to the construction of vehicles, components and equipments aiming at the destruction of ELVs
- 19 January 2005 concerning the annual declarations of producers, certified dismantlers, and certified shredders
- 19 January 2005 concerning the calculation of the rates of re-use, recycling and recovery
- 15 March 2005 relative to the certifications of storage, depollution, dismantling and shredder exploitations
- 6 April 2005 fixing the deregistration rules and the establishment of a certificate of destruction
- 13 May 2005 concerning the compensations due to certified shredders
- 13 May 2005 relative to the composition and the functioning of the monitoring commission.

SUMMARY

There is no producers responsibility in France so the recycling activity is totally dependant on the market.

Today with the best dismantling and shredding operations a recycling, reuse and recovery rate of 83% is reached. Even if 85% is attained it may be hard to meet the 2015 objectives since dismantlers and shredders are not enticed to recycle more unless it becomes economically beneficial and no financial inputs are planned to come either from producers or consumers.

There is no cost to the final owner except for transport costs. A purchase even occurs in many cases (depending in the type of last owner and quality of the ELV).

Some techniques to obtain higher rates exist but they are isolated initiatives which require significant investment costs.

DESCRIPTION OF THE IMPLEMENTATION OF ELV TO-DATE (Distinguish between actual and planned changes)

PART B: TECHNICAL REVIEW

1. Technical description of the system planned / implemented – institutional arrangements

The de-registration procedure takes place in two steps. The dismantler or the shredder, if the vehicle is directly turned in to the latter, will start the de-registration procedure by emitting a Take-back/Dismantling Certificate in view of destruction for each vehicle they receive. This is the first part of the procedure which is continued by the shredder who emits a Certificate of Destruction to attest of the physical destruction of the vehicle. This certificate is then sent to the "prefecture" so as to finalise the de-registration procedure. The acceptance of the vehicle by dismantlers and shredders and the de-registration procedure can only take place after the last owner has submitted the certificate of ownership. (source 3 and 2)

Parts of the vehicle changed in a garage do not enter in the ELV frame. ELVs are either the last owner's responsibility or by an agreement between the garage and the owner, the garage takes over the ELV and delivers it to an authorised dismantler or shredder. (source 5)

According to the French law of 19 January 2005, dismantlers and shredders need to receive an authorisation certificate from the prefect. The prefecture and the Regional Direction for the Industry, Research and the Environment (DRIRE) are in charge of studying the applications for a certification and the DRIRE, elbowed by subcontractors accredited by the COFRAC (Comité Français d'Accréditation), is in charge of yearly controls to make sure that the certified dismantlers and shredders continue to be in conformity with prefectoral regulations. The first authorisation certificates should be given before the end of 2005. (source 3)

The ELV may only be returned to dismantlers or shredders certified by the state. They are the only ones habilitated to take in charge the ELV and to deliver the certificates necessary to the de-registration procedure. Local authorities are responsible for the vehicles falling into its competence such as abandoned vehicles on public ground. (source 3)

Free take-back applies except if the dismantler has to go and get the vehicle. In that case, a transport fee may be asked for (for vehicles sold for the first time before July 2002, this will apply after 1st of January 2007). Free take-back charge does not apply if essential components of the vehicle are missing or if the ELV contains substances or wastes which have been added to it and which will increase the cost of treatment. (source 2 and 3)

Preference should be given to recycling of components and materials rather than destruction. (source 2)

Reuse of components must meet security, health and environmental requirements regarding noise and pollution control. Reused parts must be marked in a way which allows them to be tracked. (source 2)

Until recently there existed around 1000 dismantlers authorised according to ICPE (Classified Installation for the Environment) legislation of which 350 also had the SGS-QUALICERT quality certification. 1500 unauthorized dismantlers were estimated. ELVs could only be handed in to dismantlers (and not shredders – now it has changed – see

below). About 2500 dismantlers make on average around 24 960 inhabitants1 per dismantler or around 560 ELVs per dismantler per year. (source 3)

There is no producer responsibility. Producers must inform dismantlers and shredders in a delay of 6 months after a new vehicle is put on the market about components, materials and hazardous substances as well as instructions for dismantling and disposal. In order to fulfil this obligation, producers have chosen to develop a common data base called International Dismantling Information System (IDIS) available on CD-ROM and DVD but it appears to be very little used and even ignored by dismantlers. (source 3)

2. Technical description of the system planned / implemented – physical arrangements

There are 1 400 000 ELVs per year distributed as follows: 10% car dealers,15% independent garages, 25% private owners, 20% car pounds, 30% insurances. (source 3)

Considering the best actors of the process, that already have a quality or environmental certification, the rate of recycling, re-use and recovery approaches 83% in weight. (source 3)

- The key fractions are:
  - Batteries are withdrawn and stored in specific pans before being sold.
  - Fuels, usually reused by dismantlers, are drained. (source 1)
  - Oils and other liquids (brakes, cooling, and windshield washer) are drained and recovered by gravity or by pumping. The oils and brake liquid are stored in one tank and the other liquids in another one. The former are collected for free by a certified operator but the removal of the other types of liquids are billed to the dismantlers. (source 1)
  - Safety operations are carried out on the vehicle: release or neutralisation of the air bags, seat belt pretensioner… (source 1)
  - Some factors influence the list of dismantled elements: type and state of vehicle, demand of clients for reused parts of this type of vehicle, strategy of the dismantler (stock turnover, use of reused parts as loss leader etc), storage capacities of dismantled reused parts and surface available for the storage of the vehicles, available resources (employees and material) (source 1)
  - After shredding, a flotation installation (heavy liquid separation) separates “non ferrous mix” and ASR. To have more concentrated “non ferrous mix”, a second operation by an eddy current separator takes place. (source 1)

[1] Based on 62.4 millions inhabitants and 1 400 000 ELV treated in France per year

There is research being done on the separation of the different plastics present in a component for recovery after shredding or for dismantling followed by recovery but there is an economic limit to the implementation of such a system in France because plastic recyclers tend to ask money to dismantlers and/or shredders to recycle their plastic. (source 5)

- Current technical developments (as the basis of assessment of current environmental benefits) in the treatment sector to-date:
  - installation (waterproofing) and equipment of storage sites and treatment centres (source 1)
  - depollution (withdrawal of the batteries and the liquid gas tanks; withdrawal or inerting of components susceptible to explode; withdrawal and separate storage of fluids; withdrawal, as much as possible, of all components containing mercury). This is already done by most dismantlers. (source 1)
  - treatments aiming to increase recycling (withdrawal of catalytic converters; withdrawal of metallic components containing copper aluminium and magnesium if these metals are not separated during shredding; withdrawal of tyres and bulky plastic components if they are not separated during shredding in order to be really recycled as material; withdrawal of glass) (source 1)

3. Economic description of the system planned / implemented

Final holders	***% of total ELV***	***ELV purchasing price***
Insurance companies	30%	150 – 300 € / ELV if lot of vehicles intended for dismantling and resale as it comes in 60 – 100 €/ELV if lot of vehicles only intended for dismantling
Private individual	25%	0 – 40 € / ELV
Car dealer	15%	40 – 60 € / ELV
Garage mechanics	15%	40 – 60 € / ELV
Pound	10%	30 – 50 € / ELV
Public authorities parks	5%	40 – 60 € / ELV

Source: ADEME, 2003

There is no producer responsibility in France. The ELV "sector" is economically self-sufficient. Dismantlers and shredders' revenues come from the sale of second-hand and recyclates and cover their costs. Both stakeholders end up with operating profit close to positive.

However there is one exception. The last ELV decree (May 2005) creates a "**double entry system**". Till recently ELVs were accepted by dismantlers only. Now holders are allowed to sell/give their ELV to shredders too. Dismantlers have the possibility to refuse less profitable ELV (which is quite theoretical because in practice they often receive ELV sets from insurance companies for instance which will limit this possibility)

but not shredders. Any deficit that a particular shredder might have linked to the acceptance of certain ELV (which is a new activity for them) will be compensated by each concerned automaker every year. Discussion between shredders and automakers will be on a case-by-case basis. The shredder will send a statement of deficit directly to the producers for a given year and per brand of vehicle. The producer may choose either to compensate shredders for the financial consequences of free take-back of ELVs of his brand, or to take back his own vehicles by appropriate means. (source 1 and 3)

- Charges / payments by dismantlers / shredders:
  - No special charges/payments except for upgrading the facilities by dismantlers but they will have the possibility to refuse ELVs considered having a negative market value/not economically profitable. (source 2 and 3)
  - None for shredders (see above – double entry system) (source 3)
  - Upgrading of facilities to fulfil the new requirements in order to be certified (storage zone of non depolluted ELVs): 2.5 €/ELV (source 1)
  - New installations for dismantlers authorised according to ICPE legislation but with no quality certification (see above proposals / arrangements / environmental controls on the treatment sector): 8 to 17 €/ELV for depreciation expenses
  - Increased labour costs due to more time spent on dismantling and administrative follow-up (respectively 30 to 45 mn/ELV and 15 to 45 mn/ELV) (hypothesis source 1)

4. Collection of data on existing costs and income (from treatment sector)

Dismantling costs (based on 22 audited dismantlers) (source 1)

Euros / ELV	**Average**		**Min**	**Max**
Expenses				
Transport of ELV to the dismantling facility	54,4	10%	18,8	97,5
ELV purchase	154,7	28%	55,6	257,5
Staff expenses	212,2	39%	64,6	435,3
Overheads	97,5	18%	22,4	184,5
Investment depreciation and provision	27,3	5%	4,7	50,5
Total expenses	**546,1**	100%	**286,8**	**913,1**
Revenues				
Second-hand pieces sale	494,6	96%	248,7	858,7
Body shell sale	23,1	4%	4,9	36
Total revenues	**517,7**	100%	**256,3**	**844,6**
Net balance	**-28,4**		**-131,9**	**38,4**

Source: Original data extracted from 'Economic study on the management of End-of-Life vehicles', ADEME, 2003

Shredding costs - Example for France (based on 5 audited shredders) (source 1)

Euros / tonne input	Average		Min	Max
Expenses				
Transport of body shells from dismantling facilities	4,9	5%	1,8	8,4
Body shells purchase	37,8	42%	21	51,3
Staff expenses	6,3	7%	3,9	8,6
ASR disposal	9,6	11%	6,7	16
Overheads	20,4	23%	13,3	29,4
Investment depreciation and provision	10,9	12%	3,4	27,4
Total expenses	**90**	100%	**81,9**	**101,6**
Revenues				
Ferrous materials	72,2	78%	66,3	78,7
Non ferrous materials	20,2	22%	13,1	26,7
Total revenues	**92,4**	100%	**86,1**	**95,7**
Net balance	**2,5**		**-6,6**	**11,6**

Source: Original data extracted from 'Economic study on the management of End-of-Life vehicles', ADEME, 2003

- Labour requirement (per ELV or per tonne of ASR) & skill levels, and unit labour costs dismantlers, shredders:
  - dismantlers: (source 1)
  - worker: 10 to 20 €/h
  - employee: 10 to 25 €/h
  - manager: 30 to 45 €/h
  - general labour costs: 100 to 300 €/ELV (212 €/ELV in average)
  - shredders: 3,9 to 8,6 €/t of body shell entering the shredding facility (source 1)
- Costs by process (e.g. dismantling, shredding, transport);
  - shredding: 40 to 60 €/t (without buying costs) (source 1)
  - maintenance costs for shredders: 6 to 9 €/tonne of body shells shredded (source 1)
  - energy costs for shredders: 1.5 to 2.8 €/ tonne of body shells shredded (source 1)
  - R&D costs for shredders: 0.1 to 0.3 €/ tonne of body shells shredded (source 1)
  - disposal of waste (e.g. oils and other liquids) by dismantlers: 1.8 €/ELV (source 1)
  - investment for depollution facilities: 35 k€ for a facility treating 2500 ELVs (source 1)

  - cost premium of depollution done by shredders (when just added to their activity): 30 €/ELV (without transport) of which 22 €/ELV are labour costs (if the depollution activities were to be carried out on a totally new site the costs premiums would be 75 €/ELV) (source 1)

- Costs by disposal of ASR, other wastes
  - total cost of disposal = cost for disposal + cost TGAP (general tax on polluting activities) = 40 to 45 €/t of ASR + 9,15 €/t of ASR
  - so total cost of disposal of ASR corresponds to 7 to 16 €/t of body shell entering the shredding facility (source 1)
- Transport costs for ELVs (to dismantlers), for body shells (to shredders), for ASR (to disposal), for repair wastes (to shredders?) – costs per tonne/km
  - transport to dismantlers: if transport subcontracted 40 to 50 €/ELV (source 1)
  - transport for body shells: 1,8 to 8,4 €/t but probably underestimation; distance max 200 km (usually) (source 1)
  - transport to disposal: 10 to 15 €/t (source 1)
- Income by stream (re-use, recyclate, cost savings on cost of not going to landfill/incinerator)
  - Ferrous: 90 to 95 €/t of ferrous (source 1)
  - Non Ferrous mix: 200 to 350 €/t of non ferrous mix (source 1)
  - so total represents 86 to 95 €/t of body shell entering the shredder facility as shown on table above (source 1)
  - catalytic converter : 25 € /unit (hypothesis source 1)
  - elimination of tyres : cost zero (hypothesis source 1)
  - elimination of glass (hypothesis source 1):
  - windshield : - 40 to 50 €/t
  - side windows : - 10 to 20 €/t
  - total : - 1.25 €/ELV

5. Changes affecting producers to-date

According to the French Decree, producers in connection with material and equipment manufacturers have to use ISO standard nomenclature for the coding and identification of plastics, elastomer and rubber. (source 2)

Efforts have been made in the design of vehicles by manufacturers to make dismantling easier and to decrease the number of the different types of plastics used in a vehicle. (source 3)

For producers to change their design and to develop new technologies for car recycling, they need to see a financial benefit in the end but since there is no producer responsibility in France, it is not the case. But French producers export their cars to the rest of Europe so if the legislation of other member states insists upon producer

responsibility, it might become interesting for them to change their car conception. (source 5)

6. **National data on trade (i.e. import and export of new, second hand cars, ELVs)**

Many dismantlers deliver their body shells to foreign shredders especially in Spain where the cost of disposal of ASR is lower than in France. (source 1 et 3)

Vehicle exportation per destination

In units	1980	1990	1997	1998	1999	2000	2001	2002	2003	2004
EUROPE**	**1 202 834**	**1 645 276**	**2 171 263**	**2 368 982**	**2 530 391**	**2 636 150**	**2 666 696**	**2 766 527**	**2 874 729**	**2 878 753**
European union	946 760	1 479 316	1 911 331	2 082 493	2 243 906	2 261 904	2 400 035	2 426 637	2 449 696	2 580 944
Germany	202 939	277 424	328 799	365 866	392 945	337 743	352 483	369 097	379 668	325 457
Austria	35 775	36 175	32 927	39 129	41 615	41 510	43 790	51 626	46 587	51 174
Belgium/Luxembourg	105 966	144 896	108 136	130 573	144 947	172 806	177 410	170 568	176 247	178 562
Denmark	4 059	13 919	27 237	35 776	32 927	30 239	36 302	42 662	28 426	35 308
Spain	100 640	297 846	379 718	489 826	553 610	556 934	545 442	514 938	539 194	581 952
Greece		11 458	29 369	33 843	49 668	54 270	50 897	50 527	43 131	45 639
Italy	381 626	324 952	364 971	327 617	356 561	353 616	363 509	392 163	446 294	428 494
The Netherlands	84 063	95 340	100 489	115 506	122 904	120 438	137 705	140 469	136 065	119 814
Portugal	14 729	59 459	54 635	66 634	82 547	68 375	77 841	75 494	64 151	66 279
UK	156 071	245 989	429 344	414 289	395 105	432 507	530 527	523 524	499 392	472 007
Sweden	13 060	18 001	21 035	19 525	26 642	31 473	32 809	42 068	42 154	42 037
10 new member states									206 468	184 082
of which : PECO/CEI***	23 619	31 569	96 430	123 490	147 342	164 814	182 116	251 064	285 723	99 284
Hungary		2 040	9 740	12 160	16 936	23 887	27 599	37 856	44 117	40 674
Poland		806	34 162	53 305	64 257	59 093	53 189	69 399	83 026	63 884
of which Switzerland	51 821	43 832	38 742	40 134	42 500	45 654	49 213	46 219	44 130	40 507
of which Turkey		13 069	108 944	107 755	82 482	148 264	17 970	24 679	76 958	140 873
AFRICA	**133 213**	**45 675**	**29 975**	**31 651**	**45 988**	**69 865**	**75 888**	**85 691**	**81 194**	**110 483**
of which : South Africa	22 439	0	1 423	2 460	4 376	13 913	14 247	14 256	15 998	29 539
Maghreb	15 542	20 432	12 808	15 923	27 115	37 236	37 986	52 147	48 374	65 455
Nigeria	61 133	8 319	4 896	5 378	6 911	8 860	9 679	6 685	6 133	4 661
AMERICA	**145 204**	**29 360**	**163 987**	**166 651**	**151 116**	**230 270**	**221 704**	**202 375**	**216 560**	**288 902**
of which: Argentina	11 899	516	116 987	126 253	85 156	97 605	42 306	16 586	31 277	54 418
Brasil			6 189	15 467	37 291	80 205	117 293	110 187	104 798	127 465
Colombia	11 885	9 112	17 807	10 640	8 386	16 659	23 237	20 222	18 539	26 512
Mexico		20	162	0	182	1 408	8 718	26 225	42 006	60 607
ASIA	**26 178**	**96 645**	**119 955**	**127 593**	**94 819**	**166 261**	**251 715**	**333 598**	**388 732**	**461 879**
of which: Japan	883	14 264	9 428	9 052	9 161	15 976	22 218	23 640	24 288	18 751
China		3 960	40 103	48 997	40 754	54 334	56 000	88 281	106 895	91 431
Iran	12 836	29 852	21 825	35 132	10 805	45 722	106 549	158 923	199 179	292 514
OCEANIA	**6 290**	**5 761**	**10 967**	**8 481**	**8 258**	**9 984**	**14 530**	**18 466**	**19 849**	**16 409**
of which: Australia	2 398	820	5 438	3 674	2 766	2 765	5 544	8 735	10 410	9 354
TOTAL	**1 529 652**	**1 881 998**	**2 526 137**	**2 761 502**	**2 890 364**	**3 174 447**	**3 294 668**	**3 469 381**	**3 638 205**	**3 819 541**
Small collections	471 744	208 241								

*European Union : 9 states in 1980, 10 states in 1985, 12 states from 1990 to 1994, 15 states in 1995, 25 states since 2004.
**Since 2004, exportations to Cyprus are included in Europe and in Asia anymore.
***Since 2004, PECO.CEI except the 10 new EU member states.
From 1996 onwards, exportations of automobiles take into account carriages and collections of detached pieces. Drop-offs towards the DOM (Over seas department) are not counted anymore as exportations.
Source: CCFA 2005

Vehicle exportations

	PRIVATE CARS				DUTY VEHICLES				TOTAL		VAR.
	2003		2004		2003		2004		2003	2004	04/03
	thousands	%	thousands	%	thousands	%	thousands	%	thousands	thousands	%
EUROPE	**2 882**	**79,2%**	**2 879**	**75,4%**	**361**	**88,7%**	**380**	**84,6%**	**3 242**	**3 259**	**1%**
of which :											
European Union (25 states)	2 656	73,0%	2 581	67,6%	312	76,7%	323	71,9%	2 968	2 904	-2%
Germany	380	10,4%	325	8,5%	40	9,8%	44	9,8%	420	369	-12%
Austria	47	1,3%	51	1,3%	4	1,0%	5	1,1%	51	56	10%
Belgium/Luxembourg	176	4,8%	179	4,7%	23	5,7%	21	4,7%	199	199	0%
Spain	539	14,8%	582	15,2%	58	14,3%	62	13,8%	597	644	8%
Italy	446	12,3%	428	11,2%	30	7,4%	31	6,9%	476	460	-3%
The Netherlands	136	3,7%	120	3,1%	19	4,7%	17	3,8%	155	137	-12%
Poland	83	2,3%	64	1,7%	9	2,2%	10	2,2%	92	74	-20%
Portugal	64	1,8%	66	1,7%	25	6,1%	27	6,0%	89	93	4%
UK	499	13,7%	472	12,4%	63	15,5%	64	14,3%	562	536	-5%
Switzerland	44	1,2%	41	1,1%	5	1,2%	5	1,1%	49	46	-6%
Turkey	77	2,1%	141	3,7%	22	5,4%	22	4,9%	99	163	65%
AMERICA	**217**	**6,0%**	**289**	**7,6%**	**16**	**3,9%**	**27**	**6,1%**	**233**	**316**	**36%**
of which :											
Argentina	31	0,9%	54	1,4%	5	1,2%	10	2,2%	36	65	81%
Brasil	105	2,9%	127	3,3%	3	0,7%	6	1,3%	108	133	23%
AFRICA	**81**	**2,2%**	**110**	**2,9%**	**19**	**4,6%**	**28**	**6,2%**	**100**	**138**	**38%**
ASIA	**382**	**10,5%**	**462**	**12,1%**	**8**	**2,0%**	**11**	**2,4%**	**389**	**473**	**22%**
of which :											
China	107	2,9%	91	2,4%	0	0,0%	0	0,0%	107	92	-14%
Iran	199	5,5%	293	7,7%	2	0,5%	4	0,9%	201	297	48%
Israël	18	0,5%	19	0,5%	1	0,2%	1	0,2%	18	19	6%
Japan	24	0,7%	19	0,5%	0	0,0%	0	0,0%	24	19	-21%
OCEANIA	**20**	**0,5%**	**16**	**0,4%**	**2**	**0,5%**	**2**	**0,4%**	**22**	**18**	**-18%**
TOTAL	**3 638**	**100,0%**	**3 820**	**100,0%**	**407**	**100,0%**	**449**	**100,0%**	**4 046**	**4 269**	**6%**
Variation 2004/2003				5%			10%			6,0%	

Source : CCFA 2005

Second hand cars

	Units	1980	1990	1995	1997	1998	1999	2000	2001	2002	2003	2004
REGISTRATIONS												
New cars (N)	**thousands**	1 873	2 309	1 931	1 713	1 944	2 148	2 134	2 255	2 145	2 009	2 014
Second hand cars (S)	**thousands**	4 441	4 759	4 129	4 238	4 686	4 896	5 082	5 396	5 457	5 322	5 444
Ratio S/N		2,4	2,1	2,1	2,5	2,4	2,3	2,4	2,4	2,5	2,6	2,7
Cars less than 5 years	**% S**		**52%**	**43%**	**42%**	**40%**	**40%**	**40%**	**41%**	**42%**	**42%**	**41%**
of which :												
-Cars less than one year	**% S**		12%	12%	11%	11%	12%	12%	12%	12%	11%	10%
-Cars less than one year	**% N**		25%	25%	27%	28%	28%	29%	30%	30%	29%	28%
Cars of more than 5 years	**% S**		**48%**	**57%**	**58%**	**60%**	**60%**	**60%**	**59%**	**58%**	**58%**	**59%**
Total number of registered cars (at 31 Dec)	**thousands**	19 130	23 550	-	-	-	27 480	28 060	28 700	29 160	29 560	29 900
Ratio second hand/total	**%**	23,2	20,2	-	-	-	17,8	18,1	18,8	18,7	18,0	18,2

Source: CCFA 2005

External trade

In billions of euros	New cars	Light duty vehicle	Industrial vehicles	Pieces and motors	Industrial automobile branch	Second hand vehicles	Automobile branch	Total*	Share of automobile
EXPORTATIONS (FAB)									
2003	25,7	2,2	2,2	17,1	47,3	1,4	48,7	323,2	15,1%
2004	27,4	2,8	2,8	19,4	52,4	1,6	54,0	342,7	15,8%
Variation 04/03 in %	6,7%	29,5%	25,3%	13,1%	10,9%	10,9%	10,9%	6,0%	
IMPORTATIONS (CAF)									
2003	18,2	2,4	2,6	13,1	36,3	0,6	36,9	326,2	11,3%
2004	19,8	2,7	3,1	15,0	40,6	0,6	41,3	356,5	11,6%
Variation 04/03 in %	9,2%	10,8%	18,2%	15,0%	12,0%	6,0%	11,9%	9,3%	
SOLDES									
2003	7,5	-0,2	-0,4	4,0	11,0	0,8	11,8	-3,1	
2004	7,6	0,2	-0,3	4,3	11,8	0,9	12,7	-13,8	
COVERAGE RATIO									
2003	142	91	85	131	130	233	132	99	
2004	138	107	90	129	129	244	131	96	

*comprising military material
**Exportations/importations x 100
FAB : Franco à bord : transactional value of the merchandise, comprising transport and insurance costs until the boarder of the exportating state.
CAF : Cost, insurance, fret ; transactional value of the merchandise, comprising transport and insurance costs until the boarder of the importating state.
Sources : Customs data treated by CCFA. The Nation's accounts, base 2000
See also www.ubifrance.fr

Car sales per range and per body

	1990		1995		2000		2002		2003		2004	
Ranges	units	%	units	%	units		units	%	units	%	units	%
INFERIOR	986 532	42,7%	840 880	43,6%	855 134	40,1%	798 637	37,2%	765 401	38,1%	770 003	38,2%
INFERIOR AVERAGE	477 631	20,7%	544 062	28,2%	695 146	32,6%	732 474	34,1%	692 165	34,4%	709 456	35,2%
SUPERIOR AVERAGE	555 053	24,0%	334 457	17,3%	303 028	14,2%	302 072	14,1%	228 462	11,4%	210 898	10,5%
SUPERIOR AVERAGE	256 381	11,1%	173 370	9,0%	163 296	7,7%	164 141	7,7%	163 233	8,1%	148 011	7,4%
OTHERS	33 533	1,5%	37 735	2,0%	117 280	5,5%	147 747	6,9%	159 985	8,0%	174 837	8,7%
TOTAL	**2 309 130**	**100%**	**1 930 504**	**100,0%**	**2 133 884**	**100,0%**	**2 145 071**	**100,0%**	**2 009 246**	**100,0%**	**2 013 709**	**100,0%**
Bodies												
BERLINE	2 155 724	93,4%	1 731 191	89,7%	1 527 676	71,6%	1 483 681	69,2%	1 300 495	64,7%	1 201 594	59,7%
BREAK	61 418	2,7%	78 278	4,1%	119 739	5,6%	148 658	6,9%	146 588	7,3%	137 606	6,8%
CONVERTIBLE	36 269	1,6%	30 067	1,6%	50 527	2,4%	58 035	2,7%	53 714	2,7%	67 527	3,4%
MINIVANS	28 682	1,2%	58 376	3,0%	369 434	17,3%	368 476	17,2%	409 325	20,4%	494 463	24,6%
of which: MICROVAN	-	-	-	-	241 190	11,3%	240 644	11,2%	244 669	12,2%	292 597	14,5%
ALL TERRAIN VEHICLE	17 129	0,7%	25 684	1,3%	57 116	2,7%	75 470	3,5%	87 598	4,4%	98 744	4,9%
OTHERS	9 908	0,4%	6 908	0,4%	9 392	0,4%	10 751	0,5%	11 526	0,6%	13 775	0,7%
TOTAL	**2 309 130**	**100%**	**1 930 504**	**100,0%**	**2 133 884**	**100,0%**	**2 145 071**	**100,0%**	**2 009 246**	**100,0%**	**2 013 709**	**100,0%**

Source : CCFA 2005

EXAMINATION OF TECHNICAL OPTIONS TO INCREASE RATES OF RE-USE, RECYCLING & RECOVERY

Dismantlers are studying the possibility to improve the recovery of ELVs by looking for ways (e.g. the separation of different kinds of plastics when they are mixed in components) to recycle the dismantled pieces of the vehicles. The dismantler INDRA participated in a study, cofinanced by ADEME (French governmental Agency for the Environment), on the economic feasibility of a complete dismantling of ELVs and the existence of opportunities for the dismantled parts. Even if they exist, it will only be possible if they are profitable for dismantlers since they do not benefit of a producer financial responsibility in France. (source 3 and 5)

The shredder GALLOO is very active in France and is currently doing research with RIETER Automobile, co-financed by ADEME, on the recovery of light ASR such as textiles and foam. A study showed in 2002 that the treatment chain of ASR developed by GALLOO attains a rate of re-use, recovery and recycling of 85% without taking into account second-hand pieces. The processing steps are: Shredder residue Treatment Line which increases the recovery of ferrous metals and has for output a non-ferrous metal concentrate then processed by Galloometal to produce non-ferrous metals, a plastic concentrate then processed by Galloo-Plastics to produce polypropylene and polyethylene granulates, and a concentrate of non-chlorinated rubber and other carbon-based shredded parts suitable for energy recovery. But most shredders do not want, or do not have the means, to invest in the development of post-shredder technology and recycling of ASR. (source 3 and 6)

7. National / international recyclate markets for key components / material fractions (components, glass, tyres, rubber, plastics, metals):

Opening of the market for new parts which can be legally copied (parts known as of equivalent quality) which will compete with reused parts. See possible review in/after 2005 of directive 98/71/CE of October, 13th 1998 on the juridical protection of drawings and models: until now this directive protected the parts manufactured by the producers and indirectly favoured the market of reused parts. (source 1)

Increasing complexity of the vehicles (more electronic parts) will limit the use of reused parts. (source 1)

Also: Fear of new regulations and constraints that will penalise market of reused parts (see closing of Polish market to imported ELVs, prohibition of sales of Economically Non Repairable Vehicles to private owners in France) (source 1)

All this leads to a degradation of the net balance of the dismantlers despite new benefits due to the sale of catalytic converter. A positive balance is possible if the expenses due to the purchase of ELVs fall and if dismantlers bill to the last owner the transport of ELVs. But for this to take place, unauthorised dismantlers need to cease their activity. (source 3)

DATA SOURCES

1 – Etude économique sur la filière de traitement des véhicules hors d'usage, Ernst&Young pour l'ADEME, September 2003, http://www.ademe.fr/htdocs/publications/publipdf/vhu.htm

2 – Transposition of the ELV Directive in the other EU member states, Perchards for the UK government, November 2004, http://www.arge-altauto.de/docs/DTI_ELV.pdf

3 – Note relative à l'impact de la réglementation sur les véhicules hors d'usages (VHU), Eric Lecointre de l'ADEME, July 2005

4 – Comité des Constructeurs Français d'Automobiles, http://www.ccfa.fr/ , September 2005

5 – Eric Lecointre, ADEME –*Waste and Soil* Direction – *Prevention and Recycling* Department, September 2005 – Tel : +33 (0)2 41 91 40 31 – eric.lecointre@ademe.fr

6 – Mass Balance in post-shredding technology: results of a trial based on the shredding of 201 ELVs – a joint work of Galloo, PSA and Renault, paper and powerpoint presentation by Olivier François, Environmental Manager, Group GALLOO Recycling, 2003

3 CASE STUDY GERMANY

PART A: CURRENT MANAGEMENT OF ELVS

1 Description of the Policy & Institutional Structure (Current & Planned)

General Waste Management Policy

Waste management and disposal is regulated at national (Federal Government) level and at the *Länder* level. The *Länder* adopt their own implementation acts regulating selected aspects of the organisation of waste disposal and waste management planning. Local Authorities also play an important role as public waste disposal agents and bear particular responsibility for the disposal of domestic and commercial waste.[2]

The process of establishing environmental and recycling policies started in Germany in the 1990s. The Closed Substance Cycle and Waste Management Act entered force in 1996.

ELV Policy prior to EU Directive

Following the Closed Substance Cycle and Waste Management Act, 1998 saw the signature of a voluntary agreement on ELVs and the first ELV Ordinance, which came into force on 1 April 1998 to complement the voluntary agreement.

The voluntary agreement brought together 16 sectors representing car manufacturers, automotive industries and recycling operators. It included the following targets:

- Improve recycling capability in construction
- Development, creation and optimisation of material cycles and re-utilisation possibilities
- Improvement in the re-utilisation advice to automobile manufacturers
- Decrease waste from automobile disposal to 15% by 2002 and 5% by 2015 on average per automobile producer
- Qualified assurance of taking back free of charge ELVS not older than 12 years and under certain qualifying conditions
- Building up of a monitoring report system to control the devices

Car manufacturers also agreed to take back ELVs made by them on the usual markets terms and to further improve the capability of their products for recycling. Under certain condition car manufacturers would take back free-of-charge those cars that were not older than 12 years and had been registered for the first time after the ELV Ordinance coming into force.

The Ordinance specified that anyone wanting to dispose of an old car is required to hand it over to a recognised recycling business or recognised reception point, where a

[2] BMU (2005), *Sustainable Waste Management in Germany*, BMU Berlin

recycling certificate will be issued. The recycling certificate has to be submitted to the registration authority when deregistering the car.

The 1998 ELV Ordinance was the first act regulating end-of-life vehicles by setting out minimum technical standards for the disposal of ELVs, including measures for deconstruction and drainage; removal of specific parts; inclusion of liquids taken and parts removed in re-use or recycling; and inclusion of 15% of total weight of an ELV in re-utilisation. However, it did not stipulate any producer responsibility or binding procedure to share cost.

Policy Following EU Directive

2002 saw the introduction of the ELV Act, which transposed the EU ELV Directive into German law. In comparison to the existing ELV ordinance the main changes were:[3]

- The last owner will have the opportunity to take back an ELV to the manufacturer/importer (immediately for vehicles that entered the market after 1 July 2002, and for all vehicles from January 2007)
- Producers and Importers have the responsibility to take back ELVs and to recycle them in accordance with the law. Costs that arise from take-back and recovery are carried by the manufacturers and importers. The obligation to collect end-of-life vehicles means that they are required to set up a nation-wide collection system or to commission a third party to do so.
- If manufacturers/importers have to create financial reserves for their responsibilities for take-back and recycling, these have to be formed in equal annual instalment until the time when they will have to fulfil their statutory obligation.
- From 1 January 2006, at least 85% of the weight of an ELV have to be recovered and re-used, with a rate of at least 80% being recovered and recycled. [4]
- From January 2015, this rises to at least 95% being recovery and reused, with recovery and recycling of materials at a rate of at least 85% of the weight
- Recycling rates for dismantlers and shredders
- From July 2003 vehicles, as well as materials and components for those vehicles, may only be put on the market if they do not contain any lead, mercury, cadmium or hexavalent chrome

Amendments to the ELV Act were passed by the German parliament in spring 2005, which extended the Act to certain vehicles over 3.5 tonnes (mainly caravans) and expanded the free-of-charge take back to ELVs that were registered within the European Union (rather than registered within Germany only). [5] This was done following legal action by the European Union/Commission.

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[3] BMU (undated), Das neue Altfahrzeufgesetz (Kurzdarstellung) accessed at http:www.bmu.de/abfallwirtschaft/doc/3730.php

[4] Recycling rates of 85% and 95% in 2015 were already accepted by the industry in the 1998 regulation and voluntary agreement, however the Act implemented additional quotas on recovery and recycling.

[5] BMU (2005), Änderung der Altfahrzeug-Verordnung, press notice May 2005

Germany has set itself a target of phasing out the landfilling of domestic and similar waste that is currently deposited on landfill sites by 2020. [6]

Key Institutions

Government	*Federal Government* - Federal Ministry for Environment, Nature Conservation and Nuclear Safety (BMU) - UmweltBundesamt *Federal States* - environmental ministries - GESA: Co-operation of the 16 Federal States on ELV recycling - collates information on accredited dismantlers, shredders and other organisation *Municipalities* - enforcement - car registration
Producers	Represented by German Car Manufacturer Association (VDA) German producers include Volkswagen, Opel, Daimler-Chrysler, BMW, Audi,
Treatment Sector	BDSV - Association of German Steel Recycling and Disposal Companies BVSE – Association for Secondary Raw Materials and Disposal
ARGE Altauto	Co-operation of 16 sectors on ELVs, including car manufacturers & treatment sector Signaturees of a voluntary agreement in 1996 Produced a first (and only) monitoring report in 20000

[6] BMU (2005), *Sustainable Waste Management in Germany*, BMU Berlin

	Now disbanded?

2. Description of the ELV Treatment Sector

The Treatment Sector

The treatment sector is characterised by small and medium sized companies. The first ELV act in 1998 is said to have had a significant impact on the dismantling and recycling sector due to the necessary relevant investments required in order to meet the environmental standards introduced by the act. One estimate suggested that of the 5,000 dismantler that existed before 1998 70% were still there in 2001.[7]

Since 1998, an infrastructure of reception points (where ELVs are collected) and recycling plants has been established in Germany, operating in accordance with the new requirements of the ELV ordinance that came into force the same year. The Ordinance aimed to ensure environmental friendly disposal of ELVs, which meant that ELVs can only be collected, dismantled, recycled and disposed by accredited operators.

The German network consists of approximately 15,000 reception/collection points (e.g. dealerships, garages), which would then pass on ELVs to recycling businesses), 1,000-1,400 recycling businesses and 40-65 shredder plants (40 accredited shredders). [8] [9]

German car manufacturers have said that only around 300 of the 1,400 certified dismantlers will remain as contract partners for the car industry.

Car manufacturers have also moved or plan to move into the dismantling and shredding industry[10]

Examples of arrangements for ELV recycling put in place by car manufacturers:

- *Opel*: over 250 contractual partners throughout Germany, certified by publicly-recognised experts and inspected by Opel recycling specialists
- *Volkswagen*: Agreement with Callparts System GmBH in Etzin, a company which operates a country-wide network of dismantling stations
- *BMW*: Network of recycling centres, waste management partner – CCR Logistics Systems AG, 90% of BMW are already affiliated to this network

[7] Lucas R (2001), *End-of-Life vehicle regulation in Germany and Europe – problems and perspectives*, Wuppertal Papers No. 113, Wuppertal Institute for Climate, Environment and Energy

[8] VDA (2000), *Annual Report 2000*

[9] BMU (undated), Waste Management – End-of Life Vehicles accessed at www.bmu.de/english/waste_management/doc/3443.php

[10] Lucas R (2001), *End-of-Life vehicle regulation in Germany and Europe – problems and perspectives*, Wuppertal Papers No. 113, Wuppertal Institute for Climate, Environment and Energy

Number of ELVs

The total number of ELVs requiring treatment and disposal in Germany is unknown, there are no official statistics other than for deregistration. Estimates of the proportion of cars that stay and are disposed in Germany vary between 20-60%.[11] [12] Some forecast suggest that this share will rise (to 85%) following the saturation of export markets.[13]

Of the 3.4-3.5 million vehicles that are cancelled from registration every year a large number of old vehicles are sold abroad. Many car owners are said to prefer to sell their old cars, if it has small market value, than taking it to a dismantling/recycling facility. (which until recently tended to charge for disposal rather than pay owners for the value of the car – this has changed due to rise in the value of scrap metal. However, the ADAC, the German car owner association, undertook a survey (in 2002?) which found that consumers were getting a bad deal from recycling companies, who would not pass on rest value of ELVs, and charge instead for the recycling/disposal costs. Until the free take-back covers all vehicles it is down to the last owner to negotiate a price or charge for the disposal of the ELV). Car dealers will also resell old cars to exports dealers, who transport them to Eastern Europe and Africa. [14] [15]

An estimate for the total annual quantity of ELVs requiring disposal in Germany was done as part of the ARGE-AltAuto first (and last) monitoring report. For the period 1997 to 1999 it estimated that there were between 1.1 and 1.7 million ELVs in Germany[16]. Another estimate put the total at between 1.3-15 million.[17] Estimates by the German Environment Ministry for 2003 (see Figure 1) suggest that of all deregistered in Germany, 1.75 million are recycled (as ELVs) and 1.75 million are exported as second-hand cars. [18]

Estimates also exist based on shredder input weight data, suggesting that in 1997 about 840,000 ELVs were disposed in Germany and a further 480,000 ELVs in neighbouring countries. [19]

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[11] Umweltdaten Deutschland Online: Entwicklung des Altfahrzeugaufkomments in Deutschland (www.env-it.de)

[12] Lucas R (2001), *End-of-Life vehicle regulation in Germany and Europe – problems and perspectives*, Wuppertal Papers No. 113, Wuppertal Institute for Climate, Environment and Energy

[13] Reinhardt T & Richers U (200 4), Entsorgung von Schredderrückständen – Ein aktueller Überblick, Wissenschaftliche Berichte, Forschungszentrum Karlsruhe

[14] Lucas R (2001), *End-of-Life vehicle regulation in Germany and Europe – problems and perspectives*, Wuppertal Papers No. 113, Wuppertal Institute for Climate, Environment and Energy

[15] BMU (2005), *Sustainable Waste Management in Germany*, BMU Berlin

[16] Lucas R (2001), *End-of-Life vehicle regulation in Germany and Europe – problems and perspectives*, Wuppertal Papers No. 113, Wuppertal Institute for Climate, Environment and Energy

[17] Eyerer P et al (2000), "Kreislauffähigkeit von Werkstoffen" in ATZ Automobiltechnische Zeitschrift 102 (2000)

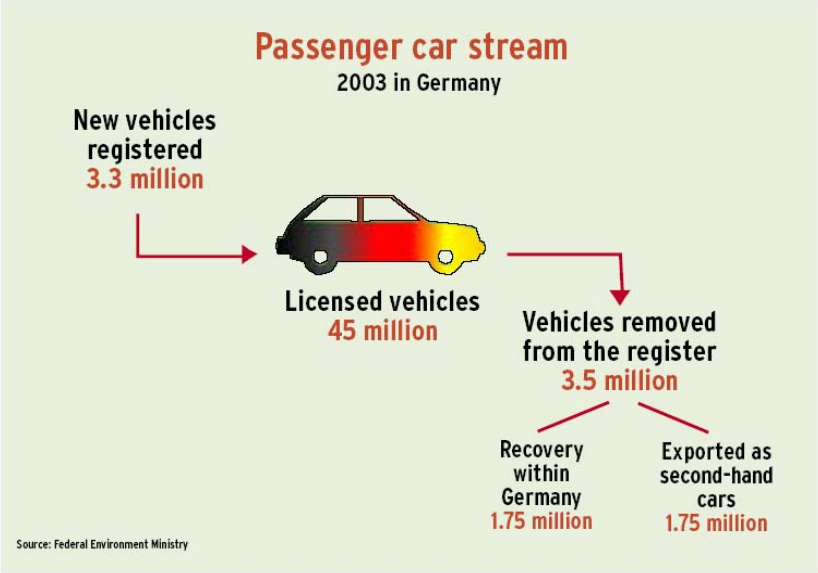
[18] BMU (2005), *Sustainable Waste Management in Germany*, BMU Berlin

[19] Reinhardt T & Richers U (200 4), Entsorgung von Schredderrückständen – Ein aktueller Überblick, Wissenschaftliche Berichte, Forschungszentrum Karlsruhe

The total number of vehicles in Germany continues to rise. In 2003, there were 44.7 million cars, 2.8 heavy goods vehicles and 5.2 million motorbicycles, a total 21% rise from 1991. Forecasts suggest that the total number of vehicles on German roads will be 59.5 million in 2010 and 64.2 million in 2020.[20] in 2003, the average age of a registered car in Germany is 7.4 years.[21]

Around half of all cars currently registered in the European Union come from German manufacturers. [22]

Figure 1: Number of ELVs in Germany



Source: BMU 2005

Current Practice and Recycling Rates

See p.14 Abbildung 3 in "Entsorgung von Schredderrückständen" (Reinhardt T & Richers U 2004) – graphic shows current ELV treatment process and recycling rates

Table 1: Steps in ELV recycling process

Collection	Owner takes ELV to either: - collection points set up by producers/importers - independent collection points Directly at a recycling company/dismantler
Dismantling	Task of dismantling company

[20] Umweltdaten Deutschland Online [www.env.-it.de]

[21] Reinhardt T & Richers U (200 4), Entsorgung von Schredderrückständen – Ein aktueller Überblick, Wissenschaftliche Berichte, Forschungszentrum Karlsruhe

[22] VDA (2001), Annual Report

	- drainage of liquids - dismantling of spare parts for sale to garages and private customers - collection of recycling materials -Collection of tyres for recycling -Collection of batteries for recycling -Collection of plastic parts for re-use or recycling - pressing of car wracks for delivery to shredders
Shredder company	Task of shredding companies - Shredding - Magnetic separation of ferrous metals - Separation and sorting of non-ferrous metals - Separation and sorting of shredder waste - Collection of high energy content residue for

Source: BVSE Altautoverwertung

A recycling rate of 75% for automotives has been common over decades, supported by an automotive recycling industry which mainly focuses on the process of returning metallic materials into the materials cycle. The recycling rate is regarded as one of the highest recycling rates for consumer products.

Estimates of the proportion of remaining materials from ELVs range from 18-25%. These materials consist of organic and inorganic substances. Organic substances are mainly polymer materials (plastics, elastomers) followed by small quantities of derived natural products (cellulose fibre products, leather). Inorganic materials include glass, fillers, dust, rust etc.

The annual total weight of ELVs in Germany has been estimated at 1.5-2 million tonnes, based on 1.3-1.5 million ELVs per year with an average weight of 1000-1500kg.[23]

The average weight of an ELV has risen over the years. Although increasingly lighter materials, such as aluminium and plastics are used in production, consumers have increasingly bought larger/more comfortable cars. The average weight of an ELV in 1999 in Germany was 903kg, whereas the average weight of a car produced in the late 1990s was 1000kg (see Table X for trends in average weight and material composition of newly built cars. [24]

The proportion of plastics components has risen from 5% in 1970 to 10-12% in 2001. The six most important (by weight) plastics, used in cars are PP (35%), PU (20%), PVC (11%), ABS (10%), PA (9%), PE (5%) and other (10%). [25] In vehicles currently

[23] Eyerer P et al (2000), "Kreislauffähigkeit von Werkstoffen" in ATZ Automobiltechnische Zeitschrift 102 (2000)

[24] Reinhardt T & Richers U (200 4), Entsorgung von Schredderrückständen – Ein aktueller Überblick, Wissenschaftliche Berichte, Forschungszentrum Karlsruhe

[25] Fraunhofer (2002) Kreislaufführung von Kunstoffen aus dem Motorraum

[2001] reaching the end of their service lives plastic represent about 6% of total weight.[26]

Table 2: Average weight and material composition of newly built cars 1981-2000

Production year		1981-1985	1986-1990	1991-1995	1996-2000
Weight (empty)	kg	910	933	955	1000
FE-Metal	%	83	67.5	32.4	57.5
NE-Metal	%	4.3	6.1	8.0	10
Plastics	%	3.6	4.9	6.2	7.5
Textiles/Mixed	%	4.0	5.1	6.2	7.3
Tyres/Rubber	%	3.8	3.8	3.9	3.9
Glas	%	3.1	3.8	4.5	5.2
Liquids	%	2.9	2.8	2.7	2.6
Other	%	5.3	6.0	6.1	6.0

Source: Reinhardt T & Richers U (2004), p.19 Tabelle 5

Drainage and dismantling of spare parts by dismantling companies reduces the weight of an ELV before it goes to a shredder by about 25-30%. Estimates of the total input from ELVs that goes to German shredder companies stand at 550,000 tonnes in 1997 (estimates by the German Car Manufacturer Association)[27]

Table 3: Materials from ELV

Materials/Parts Arisings in dismantling companies in North-Rhine Westfalia		Kg per ELV	Kg per 1000kg input
Liquids	Engine and Gear box oil	4.390	4.883
	Other liquids	2.449	2.722
Metals	FE-Metals incl car body	727.594	809.101
	NE Metals	0.191	0.212
	Spare parts and second hand cars	69.378	77.150
Dismantled Parts	Tyres	20.033	22.277
	Lead Batteries	11.552	12.846
	Catalysts	2.448	2.722
	Other parts (plastics, glas, oil filter, airbag)	1.061	1.181
Other		0.440	0.486

Source: Lippe S & Striegel K (2005)

[26] Lucas R (2001), *End-of-Life vehicle regulation in Germany and Europe – problems and perspectives*, Wuppertal Papers No. 113, Wuppertal Institute for Climate, Environment and Energy

[27] Reinhardt T & Richers U (2004), Entsorgung von Schredderrückständen – Ein aktueller Überblick, Wissenschaftliche Berichte, Forschungszentrum Karlsruhe

Shredders typically process ELVs alongside other mixed scrap from household appliances and other sources. The share of shredder input weight originating from ELVS varies considerably between companies, and can be as high as 85%. A study undertaken by Tecpol suggest that the total weight of shredder input in Germany in 2003 stood at 2.7 million [no further details – study report costs €3,000 excl VAT]

The output produced by the 41 accredited shredder operators in Germany included about 2 million tonnes metals, which is normally recycled, and 450,000 tonnes shredder residue which was until recently mainly landfilled. A study undertaken by tecpol in 2003 suggest the shredder output streams consist of 74% FE-metals, 3% NE metals, 6% SSF (heavy shredder fraction) 6%, 17 % SLF (light shredder fraction).

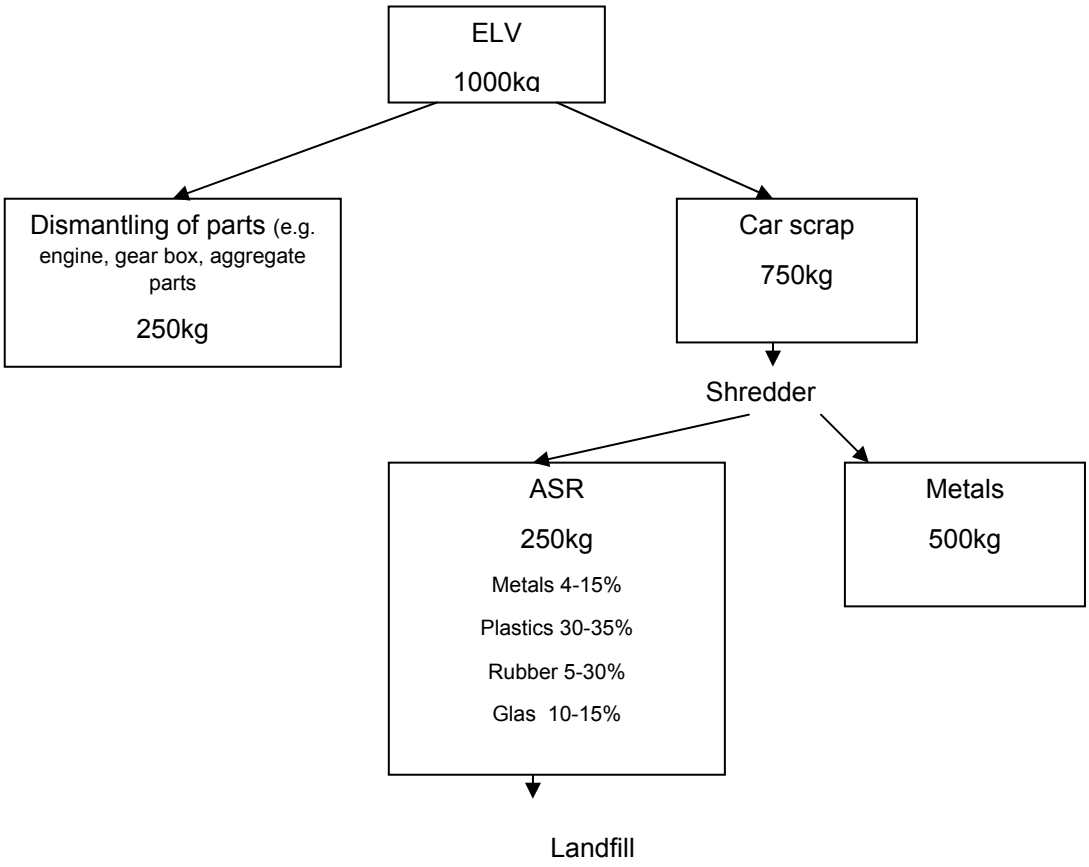
It is commonly assumed that two-thirds of the total shredder output comes from ELVs, suggesting that ELVs account for 300,000 tonnes of shredder residue currently produced. Shredder residue overall however accounts only for a small proportion of total waste. It represents around 1% of total municipal waste in Germany, which was about 45 million tonnes in 2000. The total amount of waste disposal in Germany in 2000 was 400 million tonnes.[28]

Changes to landfilling regulation came into force in July 2005 [Abfallablagerungs-Verordnung (AbfAblV) and the TA Siedlungsabfall (TASi)] requiring that shredder residue is pretreated before disposal. For SR this can only be done through thermal treatment. [29]

[28] Reinhardt T & Richers U (2004), Entsorgung von Schredderrückständen – Ein aktueller Überblick, Wissenschaftliche Berichte, Forschungszentrum Karlsruhe

[29] Reinhardt T (2004), Entsorgung von Schredderrückständen – Stand der Technik und Tendenzen, Forschungszentrum Karlsruhe in der Helmholtz Gesellschaft, on behalf of Citron AG

Figure 2: Material Streams from Current Practice



Source: Eyerer P et al (2000)

3. Current Costs and Income

Guidance provided by the German car owner association, ADAC, suggests that the cost for ELV treatment stand at between €80-130 per car. The rest value of the ELV depends on the market value of any potential spare parts, the type and condition of the car and the negotiation skills of the parties involved. [30] Until 2003 car owners regularly had to pay a charge for the disposal of an ELV, however due to changes in the market value of scrap metal car this has changed so that car owners could expect a payment for the net value of an ELV. A recent market report for ELV suggest that these payment have ceased, which has resulted in a down turn in the number of ELVs by 7%.[31]

[30] www.adac.de

[31] BVDE (2005), „Die Sekundärrohstoffmärkte 2005“, press release 5 July 2005

In 2002, the BDSV reported that the pre-treatment of ELV (handling and drainage) costs circa €50-100 per ELV. Additional cost arise from dismantling, which costs, depending on car type and depth of dismantling, €250-350.[32]

Until recently most of shredder residue was landfilled. Landfill cost for ASR in Germany were put at 60-170 $/t in a 2003 study. [33] However, the liberalisation of markets and the prohibition of landfilling of organic materials have lead to dumping prices in order to fill up landfill sites, which has impacted in the collection of recyclable materials. [34] The new landfill regulation came into force in July 2005.

Table 4: Selected Prices for Recyclate Fractions

Type	€ per tonne	Source
Autoglass mixed	-25/-35	BVSE Market Report Recycling Materials September 2005
Plastics	Various, e.g. PVC (granulate): 200-720	BVSE 2005
Scrap metal	46-112 NB: Fluctuates significantly over time	BDSV (2002)

Source: BVDS Market Report Recycling Materials September 2005

Investment in collection and waste management from ELV by reception points, dismantler and shredders since 1997 has been put at more than DM 0.5 billion in 2000. [35]

PART B: TECHNICAL REVIEW

4. Changes To-date in the Design & Treatment of Vehicles & ELVs

Changes made by producers

A move towards design and construction for recycling started in the 1980s including the establishment of recycling departments and research by car producers. The German Car Manufacturer Association in their Annual Reports from 1999 and 2000 stated the following activities by car manufacturers, importers and suppliers:

- Reduction of range of materials used (e.g. plastics from 40 to 8)
- Coding of materials (e.g. all plastics of more than 100g)
- Focus on materials with market potential for re-use and recycling
- Co-operation between recycling and construction departments to increase information to dismantlers (dismantling handbooks since 1995, IDIS since 1999)

[32] BDSV (2002)" *Nachteil für den Mittelstand? Entsorgung von Altautos neugeordnet*", press release 25 Januaru 2002

[33] Kanari N et al (2003), End-of Life Vehicle Recycling in the European Union

[34] Eyerer P et al (2000), "Kreislauffähigkeit von Werkstoffen" in ATZ Automobiltechnische Zeitschrift 102 (2000)

[35] VDA (2000), *Annual Report 2000*

- Industry-financed pilot projects to improve treatment and recycling of ASR
- Reduction of waste oil by 50% through Lifetime filling and reduction of oil change intervals
- Use of plastic recyclate in car production (10,000 tons annually)

Table 5: ELV Treatment – Information Published by Selected Car Manufacturers

Opel	Advice and support to vehicle dismantlers re: environmentally friendly handling and disposal of ELV (since 1992) ELV network - over 250 contractual partners throughout Germany, certified by publicly-recognised experts and inspected by Opel recycling specialists Developing relations with dismantlers and other economic operators to find solutions to reduce automotive waste which goes to landfill Dismantling manual (IDIS) Use of recycled materials in 2000 – 30,000 metric tons Internal strategy group of recycling experts (Source: Opel date?)
Volkswagen	Conducts detailed dismantling inspection since 1989 – used in new vehicle design (examples given) IDS collaboration Re-utilisation of vehicle components and assembly groups Set up system of disposal workshops including almost 4,000 Group dealerships in Germany (collected 45,000 tonnes of components and materials in 2003) Agreement with Callparts System GmBH in Etzin, a company which operates a country-wide network of dismantling stations Returns free of charge for vehicles first registered after July 2002 under certain pre-conditions (Source: www.volkswagen-environment.de)
BMW	Core elements of recycling strategy: -design for recycling (examples provided) - designation of materials (IDIS) - Recycling and Dismantling Centre (RDC) Lohhof near Munich (since 1990 – more details provided) Network of recycling centres, waste management partner – CCR Logistics Systems AG, 90% of BMW are already affiliated to network (Source: BMW March 2002)
Daimler-Chrysler	- Design for Environment Department (DFE), based at Sindelfingen Plant, established in 1906 - MeRSy Recycling Management System (collected a total of 31,500 metric tons of parts and materials, including batteries, bumpers and brake fluid, for recycling in 2003) - following the creation of a network of approximately 200 take-back points – complete with associated dismantling operations – DaimlerChrysler has now embarked upon a second stage to establish a take-back network of dismantling operations designed to relieve company-owned sales and service outlets and authorized dealerships. - Mecedes Benz End-of-Life Vehicle and Parts centre (ATC,

	Stuttgart, established in 1996 (deals with around 1,200 vehicles per year) Use of recycled materials in production (Source: www.daimlerchrysler.com)

Changes made by treatment sector

ARGE-Altauto estimated that of the total weight of a car 18-22% remain as waste. Plastics, glass and ASR constitute the main problem for ELV recycling. Plastics and Glass can generally be recycled; however the effort needed for dismantling and sorting is problematic. In principle ASR can be treated and recycled through mechanical sorting technology or energy recycling. A range of technologies are currently in development. [36]

Some technologies for the treatment and recycling of SR exists already, including Galloo in Belgium and SVZ "Schwarze Pumpe" in Germany, others are still in development (SICON, SALYP). The thermal treatment of SR is technically possible and has been piloted/demonstrated at a large scale. This includes incineration mixed with household waste and specific technology (Twin-REC). However, there is as yet no agreement on whether thermal treatment technologies fall into the definition of recycling or disposal. An accreditation as recycling technology would impact significantly on the achievement of recycling rates. [37]

5. Technical Options for Increasing Rates of Re-Use, Recycling and Recovery

Treatment Sector

See p.15-16 Abbildung 4 & 5 in "Entsorgung von Schredderrückständen" (Reinhardt T & Richers U 2004) – graphic shows future ELV treatment process and recycling rates for 2006 and 2015

Current technology is likely to be able to achieve the requirements for 2006, based on the current composition of ELVs. Already 70% of total ELV weight is recycled as FE and NE materials. Additionally, the dismantling of non-metallic materials and parts add another 10% for re-use or material recycling. This already achieves the required 80% recycling rate. An additional 5%, mainly from the shredder residue, will need to be recycled to achieve the overall rate. The 2015 targets are more challenging requiring that a proportion of ASR is recycled as materials (in contrast to energy recycling) and that only 5% are disposed (and cannot be landfilled without treatment) [38]

Recent development and research has focused on plastics and the treatment of shredder residue.

[36] Umweltdatane Deutschland Online: Entwicklung des Altfahrzeugaufkomments in Deutschland (www.env-it.de)

[37] Reinhardt T & Richers U (2004), Entsorgung von Schredderrückständen – Ein aktueller Überblick, Wissenschaftliche Berichte, Forschungszentrum Karlsruhe

[38] Reinhardt T & Richers U (2004), Entsorgung von Schredderrückständen – Ein aktueller Überblick, Wissenschaftliche Berichte, Forschungszentrum Karlsruhe

SR treatment - Thermal technology

Incineration with other domestic waste – tested by including up to 30% of SR in mix. Charges for waste incineration in Germany are €70-300/tonne. For new plants costs of €100 /tonne are regarded as realistic. However, due to the change to landfill regulation from June 2005, it is expected that there not enough capacities within Germany for the necessary treatment of domestic waste. An alternative is provided by "Schwarze Pumpe plant, which creates synthetic gas for the production of methanol. A large pilot was undertaken in 2003 for the treatment of SR, based on which the plant has been accredited for recycling of SR. The capacity of the plant stands at 70,000 tonnes per annum for SR recycling, however costs are significantly above €100/tonne and the economic future of the plant has been insecure. [39]

SR Treatment - Mechanical technology

Belgium SRTL (Shredder Residue Treatment Line) by Galloo. In operation since the mid-1990s treating metals and other fractions (material recycling (PP und PE) or energetic (heavy fraction of rubber, wood and plastic). It has a capacity of 250,000 tonnes per year. There are some issues in terms of achieving recycling targets, but the technology continues to be developed further. The costs are stated as €25/tonne for the technology and €65/ tonne including transport and recycling. [40]

In Germany the companies Sult GmbH and SiCon GmbH are developing mechanical treatment technology for shredder residue. In contrast to Galloo, it is expected that only metal fractions will be see a "material" recycling. For plastic fraction and other organic fraction feedstock recycling or energetic recycling is regarded as appropriate. In 2004, the German Sult GmbH realised a "shredder residue process" mechanical sorting technology for shredder reside in a commercial plant in Japan. The technology operates with a capacity of 4 tonnes per hours and creates an organic faction (60% of input) with a energy value of 20 MJ/kg and a low contamination of copper (0,15 - 0,3 %) and Chlor (0,6 - 1,0 %) can be used in steel plants. Other fractions (FE/NE metals, sand) can also be used. The treatment costs between €50-70/ tonne and additional income can be raised from the sale of metal fractions. The VW-SiCon-Technology develops another mechanical treatment process of SR with the aim to recover part fractions. In addition to VW, it is also supported by other European car manufacturers. It uses a combination of traditional separation and sorting technology to create plastic granules with low levels of chlor and copper (can be used as substitute reduction material in blast furnaces), a PVC rich plastic fraction, a fluff-fraction (conditioning of sludge) and a sand-fraction. PVC and Sand fraction show possibilities for recycling. No information on cost as yet, but cost are supposed to the low in comparison to other processes. No pilot plant built as yet, despite this the technology has already been accredited for recycling by the Environment Ministry of Lower Saxony. [41]

[39] Reinhardt T (2004), Entsorgung von Schredderrückständen – Stand der Technik und Tendenzen, Forschungszentrum Karlsruhe in der Helmholtz Gesellschaft, on behalf of Citron AG

[40] Reinhardt T (2004), Entsorgung von Schredderrückständen – Stand der Technik und Tendenzen, Forschungszentrum Karlsruhe in der Helmholtz Gesellschaft, on behalf of Citron AG

[41] Reinhardt T (2004), Entsorgung von Schredderrückständen – Stand der Technik und Tendenzen, Forschungszentrum Karlsruhe in der Helmholtz Gesellschaft, on behalf of Citron AG

A dry mechanical plant in Eppingen (Heilbronn) sorts ASR into metals, inert materials and high heating value fraction. Estimates cost for treatment stand at €75/Mg – planned to start operation again in 2005[42]

Plastics studies

Only a small number of plastic components are currently recovered, and stem mainly from easily accessible applications (e.g. bumpers). There is no working materials recycling cycle for large, difficult to dismantle and contaminated parts, through recycling companies carrying out materials recovery. [43]

A study to quantify recycling capacities for selected polymer parts (bumper, hub caps, front grills) was undertaken and the results published in 2003.[44] It found that:

- sufficient capacities for materials recycling are available, particularly for modifications of PP and ABS - dismantling and recycling of other polymer parts may be reasonable, if easily accessible and have high parts weight – economic feasibility determined by market price for polymers and mass potential for dismantling
- Parts with potential for recycling are door bumper profiles, motor covers, inner wing covers and in the long terms exterior parts like polymer door panels
- Additional cost for dismantling and material recycling are estimated at €6-17 per ELV
- Estimates mass streams available for recycling: Bumpers: 7000-11,000 Mg/a; Front grills: 450-690 Mg/a; Hub caps: 340-520 Mg/a
- 8 German companies carrying out or capable of recycling ELV polymer parts - Estimated processing capacity: Bumpers: 60,000 Mg/a; Front Grills and Hub caps: 1500 Mg/a; Capacity increased expected for 2003/2004 increasing figures to 65,000 Mg/a and 3000 Mg/a

Another report[45] looked also at plastic in ELVs, which represent a large proportion of shredder residue and shredder light fraction. It stated that it likely that never all plastic parts will be dismantled because it is not feasible economically as well as technically. This includes the 11% of all plastic which can be found in the electronics and other small parts. However studies have also shown that dismantling not feasible for large plastic parts. The principal possibilities for plastics recycling include materials recycling (mechanical recycling, e.g. compounding), raw materials/feedstock recycling (thermal treatment) and energy recover (incineration used to create energy). There are existing eco efficiency studies for the various methods. Additionally, there have been a number of studies exploring the recycling of plastics from ELVS, including:

- PRAVDA project – mechanical recycling – explores plastic waste streams from ELVs and use of recyclates: principally plastics recyclates from ELVs can be

[42] Fraunhofer (2002) Kreislaufführung von Kunstoffen aus dem Motorraum

[43] Fraunhofer (2002) Kreislaufführung von Kunstoffen aus dem Motorraum

[44] Woidasky J & Stolzenberg A (2003), Verwertungspotenzial für Kunstoffteile aus Altfahrzeugen in Deutschland, Fraunhofer Institut Chemische Technologie

[45] VKE (no date), Kunstoff im Automobil: Einsatz und Verwertung Langfassung, Frankfurt/Main

used in production, mechanical recycling economically feasible only to a limited extent; main problem is not the variety of plastics but the many small parts that account for 60% share of total amount of plastics in cars, this should be shredded

- Recycling of plastics fuel tanks – cost of recycling much higher than income – net cost between 1,298-1645 DM per tonne KKB (plastic fuel tank), cost mainly due to dismantling and logistics, recycling in form from ASR much more cost-efficient cost for transport, treatment and recycling DM 300 per tonne KKB
- ASR recycling and undertaken by R-Plus Eppinghausen, SVZ „Schwarze Pumpe", and incinerator in Würzburg. There are two main methods: without any further treatment(e.g. synthetic gas at SVZ) , or further mechanical treatment, e.g. to recover metals and create metal free, high energy fraction (R-PLUS). The incinerator trial (Würzburg) found that up to 5% SR mixed with household waste has no negative impact on the environment.
- SLR treatment into 4 fractions – FE metals. NE metals, mineral fraction and energy fraction

The report recommends that material recycling should focus on parts that can be easily dismantled. All other plastics should be recycled as ASR, either through material recycling or energy recovery.

Dismantling of polymers costs at least €0.5 per kilogramm[46]

PART C: MARKET & ECONOMIC ASSESSMENT

6. Overview of Vehicle and Recycling Markets

Spare Parts markets

The sale of used spare parts faces a number of obstacles, including[47]

- Uniform parts quality
- High stocks of low value or unwanted parts
- Network of authorised vehicle dismantlers
- Distribution system for used parts
- Customer acceptance of used parts
- Matching parts of to model derivatives
- Matching parts condition to vehicles condition
- Lower margins for body shops on used parts than OE parts

Recyclate markets

[46] Fraunhofer (2002) Kreislaufführung von Kunstoffen aus dem Motorraum

[47] Lucas R (2001), *End-of-Life vehicle regulation in Germany and Europe – problems and perspectives*, Wuppertal Papers No. 113, Wuppertal Institute for Climate, Environment and Energy

Table 6: Markets Information for Selected Recyclate Materials 2005

Material	Market Report
FE & NE Metals	Demand and price reductions Price for 'Sorte 2 (Stahlneuschrott) decreased by 45% in the six months of 2005 Prices are expected to level out due to reduced collection scrap metal Steel manufacturers have reduced production (by 5 million tonnes in Europe) Scrap metal market dominated by buyers – scrap metal oversupply has resulted in reduced prices Export to third countries has no seen any significant impulses – turkey is a key importer for German and European scrap metal market Exchange rate changes (Euro /Dollar) hope that Eu market becomes more attractive to third countries Prognosis for steel market, on which scrap metal market depends differ greatly – bvse member are generally more pessimistic Extreme fluctuation in the scrap metal market make it a difficult one to predict
Plastics	Amount of collected materials rising – 2% in the first six months in 2005 Markets have stagnated Export prices higher than from inland demand Second half determined by new ordinance on landfill (Ordinance on the Ecologically Compatible Landfilling of Municipal Waste - AbfAblV), which will lead to a re-organisation of the market for secondary plastics) - material and energu recover from plastics will receive new momentum - increase in the supply of plastics -treatment sector estimates higher costs for disposal
Glass	Decrease in amounts of collected materials, due to consumer behaviour (plastic bottles instead of glass bottles) Glas recycling excellent example of high value cycle management and resource protection Current recycling rate – 91.21%
ELVs	Suffered from falling prices in the last 6 months Supplementary payment had to be stopped due to reduction in proceeds by 75% - resulted in a reduction of ELV arisings by 7% (expected to continue) as consumers have got used to receiving payments Lower scrap metal prices are regarded as positive in that the number of illegal dismantlers reduced (parts sales is supposed to be by accredited dealers, however lack of enforcement from the relevant agencies is noted by dealers) Main export market: Poland and Africa Dismantling regulations from 1 January 2006 for large plastics and glass – not regarded as economically feasible, some shredder already require that parts are removed and, expected that increasing amounts of pre-shredder materials are going abroad
Oil	Arisings slightly reducing by 1% Strong demand Good substitute for primary materials No change expected
Hazardous	Arising expected to decline – 2% reduction during first half of 2005

waste	Prices remain unchanged Trend away from disposal to reduction and recycling Increasing prices for raw materials benefit innovative technologies for reduction of waste or energy recovery Highly specialised market benefiting from separate collection Dominated by changes to the landfill regulations

Source; www.bvde.de "Die Sekundärrohstoffmärkte 2005", Press release 5 July 2005

Recyclate markets for plastics and glass are saturated due to waste from the dual system operating in Germany. [48]

7. Wider Economic Impacts

German Government assessed impact of the ELV Act 2002 as follows:[49]

- estimates of disposal cost due to the free-take back of ELVs from 2007 - around DM 800 million per year [€?].
- Reduction in tax due to building of financial reserves for Federal Government, States and Municipalities €238 million in 2002 (Federal Government: € 79 million, States: 79 million, Municipalities €82 million)
- No additional cost for federal government due to enforcement/administration, and no significant cost for States
- Large cost increases for the treatment sector were not expected as major changes were already implemented following the ELV Ordinance in 1998
  - Collection of ELV – no additional cost
  - Dismantling – some additional cost if depth of dismantling is increased, and parts and materials are not yet marketable
  - Shredders – cost increases are expected, however not significantly by 2006, but can be considerable for changes in 2015 (however cannot be estimated due to lack of forecasts for markets of raw materials and recyclates and lack of information on the cost structures of different treatment options for SLF). However current low cost option of landfilling of will cease from 2005)
  - Producers and importers will see increased cost due to producer responsibility, which is expected to translate into addition DM 200 per new car, which represents about 0.5% of the value of a new car (DM 40,000) and is within the typical negotiation margin of 3%. Additional, there are tax break for the financial reserves that producers have to built to cover future costs
  - Other additional cost arise for producers from the prohibition of certain materials, the provision of dismantling information and other information requirements. However, most of these requirements are already fulfilled by the car industry on a voluntary basis.

[48] VDA (2001), *Annual Report 2001*

[49] Bundesregierung (no date) Begründung zum Gesetzentwurf der Bundesregierung über ein Gesetz zur Entsorgung von Altfahrzeugen – Entwurf-

Appendix – Abstract "Disposal of auto-shredder-residue - a current survey"

End-of-Life-Vehicles (ELV´s) end up being reclaimed and processed. The ELV´s are disassembled by dismantlers. Gasoline, oil and other liquids are drained or removed. The pretreated ELV-bodies are further processed by the shredder-industry. Using large-sized hammer mills called "shredder", the ELV-bodies are pulverized. Metals are recovered from the scrap and at the same time, all other materials are sorted as auto-shredder-residue (ASR) and disposed off in landfills.

ASR is a heterogeneous mixture of all kinds of plastics, rubber, as well as other organic and inorganic materials. The average heat-content of ASR is about 14.000 kJ/kg. Particles < 10 mm in size represent more than 50 % of the ASR gross weight. The chemical and physical properties of a particular ASR-probe will vary in a wide range since theses properties are dependent on the particular composition of the shredder input material.

About 450.000 t of ASR have been disposed off in Germany in 2003. Almost 2/3 of this entire mass results from processing ELV´s. For decades now, the use of steel in automobile-manufacturing is constantly decreasing while at the same time growing amounts of alloy and plastics are found in cars. According to this, and with respect of the growing numbers of automobiles in use, even greater amounts of ASR should be expected during the next years. But since the final fait of ELV´s is effected by a couple of not only technical but also economical and social parameters it is not possible to give an accurate forecast on the actual amounts of ASR during the upcoming years.

According to the German waste-legislation, particularly the Abfallablagerungs-Verordnung (AbfAblV), to dispose off ASR in landfills after June 1st 2005 requires some kind of adequate pre-treatment to reduce TOC-values and heat-content to a given standard.

With respect to the Altfahrzeug-Verordnung, the German national conversion of the EU?guideline 2000/53/EG, a fast percentage of an ELV´s gross weight has to by recycled. After January 1st 2006 it will even be necessary to recycle some amounts of ASR to achieve the given standards. After January 1st 2015 most of the ASR will have to be recycled to cope with the more advanced standards, and even some portions of ASR will have to be reused or recycled as feed stock material.

Thermal treatment of ASR in conventional municipal-solid-waste incineration plants is possible. Even other thermal treatment processes have been developed and are already commercially available.

There is actually only one process providing feed-stock recycling of ASR: That is gasification of ASR and synthesis of Methanol from the gasification-products at SVZ GmbH. A limited capacity to recycle ASR is available at SVZ. Other feed-stock recycling processes are being developed but still have to prove there performances.

According to the decision of the European Court thermal recovery of waste is possible in industrial processes and power-plants. Thermal recovery in waste incineration plants is only possible if a couple of requirements are met. The combination of power-plant and waste incineration plant is likely to meet these requirements since steam from the

incineration plant is used in the power-plant to generate electric power. This could be a promising solution not only for ASR, but also for other waste materials.

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4 CASE STUDY HUNGARY

INTRODUCTION

The EU Directive was implemented in Hungary through the following measures:

- The *Act XLIII of 2000 on Waste Management,* in force from January 2001, together with the implementing decrees, harmonises Hungarian waste management legislation with the relevant part of the EU legislation, including the ELV Directive. It sets out the basic principles of prevention, the precautionary principle, producer responsibility and polluter pays, and also highlights the shared responsibility principle: 'according to the provision of shared responsibility, all participants affected in the total lifecycle of a product and the waste from it shall contribute to fulfilling the obligations arising from the principle of producer responsibility'.
- Government Decree No 267/2004 (IX. 23.) on End of Life Vehicles closely transposes the ELV Directive. It was adopted on 27 September 2004 and will enter into force fully from 1 January 2005.
- Decree No. 29/2004 of the Government of 12. March 2004 of the Ministry of Economic Affairs and Transport on the amendment to the Decree No. 1/1990 of the Ministry of Transport News Coverage and Water of 29 September 1990 on the personal and material conditions of keeping an automobile**.** The decree contains a provision on the issuing of Certificates of Destruction which will come into force on 1 January 2005.
- Government Decree No 98/2001 (VI. 15.) on the Conditions of Activities Concerning
- Hazardous Waste regulates the conditions and authorizations for collection, treatment and disposal facilities, including those relating to ELVs.
- Act No. LVI of 1995 on environmental product price and on the environmental product price of some products amended in 2004 which imposes fees on waste tyres. The
- Ministry of Environment Decree on the Conditions of Landfill 22/2001 (X.10.) prohibit tyres from being landfilled.
- Decree No. 35/2004 of the Ministry of Economic Affairs and Transport of 30 March 2004 on the amendment to the Decree No. 5/1990 of the Ministry of Transport, News Coverage and Building Affairs of 12 April 1990 on the technical control of automobiles on the public ways**.**
- Decree No. 35/2004 of the Ministry of Economic Affairs and Transport of 30 March 2004 on the amendment to the Decree No. 6/1990 of the Ministry of Transport, News Coverage and Building Affairs of 12 April on the technical requirements of placing automobiles for public ways into traffic and of keeping them in traffic**.**

SUMMARY

The transposition of the EU Directive in Hungary mentions producer responsibilities since they have to implement a national collection system but there is no financial responsibility for producers.

Shredders and recyclers are the leaders of the implementation of the Directive. Therefore any recovery or recycling improvement depends on them and thus on the market.

Car-rec, a non-profit organisation founded by six large shredders and recyclers, was established in 2003. It has signed agreements with most of the take-back points, several registered dismantlers and most of the producers and car importers.

An ELV is returned at no cost for the final owner (unless it has been stripped off of essential components). In most cases the vehicle is even paid for by the dismantler.

The current recycling, reuse and recovery rate is estimated to be around 72-75% and should increase. Car-rec thinks that the recycling, reuse and recovery 85% rate prone by the Directive for 2006 is attainable in the following years but the 95% rate for 2015 seems very far and is not the concern for the time being as no particular research seems to be going on.

DESCRIPTION OF THE IMPLEMENTATION OF ELV TO-DATE

1. Technical description of the system planned / implemented – institutional arrangements

At registered collection sites the final deregistration takes place upon presentation of a certificate of destruction which proves that the ELV is transferred to the site. This certificate allows the last owner to stop paying Third Party Liability and the Weight Tax on the vehicle. The certificate of destruction contains an appropriate record of the brand and type of the vehicle, the chassis and engine number, the weight of the vehicle at the time of the transfer and whether the vehicle contains additional components, additional hazardous waste which has been added to the ELV while in use. (source 1)

Registered collection sites (which can be shredders, recyclers or dismantlers) buy the certificate of destruction from the traffic authority for 10 € and give it for free to the last owner of the vehicle who goes to the local place for deregistration when it is not the collection sites that do it themselves. In this case, it is charged to the last owner. (source 3 and 6)

Producers and importers are required to take-back ELVs free of charge and had to set up a collection system by June 30, 2005. The system must ensure a nationwide coverage of registered facilities (take back points and dismantlers) to which an ELV has to be turned in to and which can deliver the certificate of destruction. There should be a take-back point every 50 km which corresponds to 30-35 collecting points per car manufacturer or importer.

Today, there are 50 take-back points and 80 registered dismantlers in Hungary. But there are also hundreds of illegal places and for the first half of 2005, certified dismantlers could only take back around 1500 ELVs instead of 60 00050.

[50] In the beginning of 2005, the Hungarian Minister of the Interior, not taking into account the reticence of the Minister of the Environment and the Minister of Economics and Transport, enforced a law stating that the last owner of a vehicle may keep his car now an ELV if he declares in writing that he will dispose of it

Car-rec, a non-profit organisation founded by six large shredders51 and recyclers, was established on 12 May 2003. It now has more than 70 certified sites. It signs agreements with take-back points (40 contracts to date) and registered dismantlers (20 contracts to date).

Most of the producers and car importers signed a contract with Car-rec. (22 contracts to date). Indeed producers prefer to have individual contracts with dismantlers / shredders / recyclers rather than having a collection system as ARN.

It is estimated that 800 000 vehicles in Hungary are of brands which no longer exist (Trabants, Barkasses, Wartburgs). Therefore the producer responsibility can not apply but nothing has been arranged for these vehicles in the transposition of the EU Directive and no solution found for the time being. Collection sites are under the obligation to accept them, paying 10 € for the certificate of destruction, even though these cars are largely made of plastic and are therefore not economically interesting. (source 6)

2. Technical description of the system planned / implemented – physical arrangements

Mostly the ferrous and non ferrous waste from shredders is recycled so current recycling, reuse and recovery rate is estimated to be around 72-75%. But tyres and glass are starting to be recycled. Plastic is more problematic because there is no customers for recycling and there is a lack of incineration capacity in Hungary where the power plants are not interested because it is too time-consuming and too expensive. According to the Hungarian car manufacturer's association, this is an obstacle to reach the 85% recycling, reuse and recovery rate of the Directive. But Car-rec bets on the use of plastic in cement kilns and thinks the 85% rate may be attained in 2007. The 95% rate of 2015 seems very far because the cement kilns ask for money to use the plastic coming from ELVs which is not economically feasible for the system. (source 3 and 6)

- 100-120 000 ELVs per year (source 1)
- 10-13 000 tonnes of plastic per year are dismantled. (source 1)

In Hungary only dead oils are collected systematically within the framework of a well-operating collection system and they are the ones that are reused up to a certain degree. Out of the almost 90 000 tons of lubricating oil sold annually in Hungary the quantity used by vehicle-motors is 40 000 tons, the amount of the produced and collectable dead oil is about 20 000 tons. The proportion of the reuse and recycling of waste oil is as low as approximately 20% due to the low proportion of collection. (source 1)

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properly. This explains the thousands of ELVs that are not declared and which have gone to illegal recyclers since the beginning of 2005. Car manufacturers, importers, shredders, and dismantlers are strongly protesting and hope this law will be changed in the near future because otherwise Hungary will not meet the targets set by the EU Directive. In the meantime, certified shredders and dismantlers have invested in new installations to meet with the new environmental requirements which are almost never used. (source 6).

[51] Four of the shredders have several branches (i.e. not only ELV)

Every year several thousands of batteries are detached from deregistered vehicles. Because there is no treatment facility in Hungary, recycling lead-acids batteries means a continual and well-organised export activity towards Austria, Slovenia, the Czech Republic and Germany. In Hungary Treatment Coordinating Organisations harmonise the different phases of collection and utilisation. Such organisations are for example Hungakku and Hungarohab non-profit companies. The proportion of the collected batteries is remarkably high: 92-95%. (source 1)

The list and demand for the spare parts suitable for reuse largely depends on the age and technical condition of the ELV, the amount of the vehicles of the same type still in use in Hungary and accordingly the market demand for the individual components, and the costs expected for improvement of the spare part. (source 1)

Energy recovery: the population of Hungary is explicitly against waste incinerators because they are afraid of their adverse impact on their environment. (source 1)

The possible solutions to recycle mixed plastic parts are incineration, but there is not enough capacity in Hungary, and use it in cement kilns but may not be economically feasible. (source 3)

The use for recycled glass depends on where it was situated in the vehicle. For example, due to extra treatment, windscreens are only suitable to be reused as coloured cathedral glass. The requirements regarding quality are extremely strict in Hungary when it comes to glass recycling. In addition to colour homogeneity, the purified scrap glass must meet several other quality requirements. The waste scrap glass mustn't contain any contaminants from metal or minerals because it would adversely affect the suitability of the product.

3. Economic description of the system planned / implemented

The transposition of the EU Directive in Hungary mentions producer responsibilities since they have to implement a national collection system. But there is no financial responsibility for producers. Dismantlers and shredders develop at their own cost so it depends on the current market situation. However, the income of dismantlers and shredders depending on the steel market, Car-rec has agreed with producers and car importers that the recycling contracts they have signed with them can be renegotiated if the steel price is too low . (source 3 and 6)

- Charges / payments by dismantlers / shredders:
    - They usually have to buy the ELV from the last owner. It costs around 20 € for a vehicle which is not stripped off of essential components. (source 6)
    - The authorisation permit in order to carry on their activity costs 600 €. (source 6)
    - Each certificate of destruction costs 10 € paid to the Ministry of Traffic. (source 6)
    - The investment of new equipment to fulfil the new requirements to obtain the certification represent 200 000 €. (source 6)

- It is to be noted that according to regulations the treatment facility can claim financial reimbursement for taking over the end-of-life vehicle if the ELV does not contain the essential components of the vehicle, such as the engine. (source 2, 3 and 6)

4. Collection of data on existing costs and income (from treatment sector)

- By disposal of ASR, other wastes
- Cost to landfill ASR: 40 €/t (source 3)

5. Collect available national data on trade (i.e. import and export of new, second hand cars, ELVs) – identify origins / destinations of possible. Identify any market research that might allow some projection of trends in trade.

Automotive background

	1998	1999	2000	2001	2002	2003
New passenger car registrations (x 1000)	110	140	133	148	172	208
Stock of passenger cars (per 1000 population)	217	221	232	245	260	275
New commercial vehicle registrations (x 1000)	27	29	32	30	35	25

Source 4

Automotive forecast

	2004	2005	2006	2007	2008	2009
New passenger car registrations (x 1000)	204	178	193	209	202	198
Stock of passenger cars (per 1000 population)	290	302	314	327	337	347
New commercial vehicle registrations (x 1000)	24	24	27	30	30	29

Source 4 (estimation of the Economist Intelligence Unit)

- The average age of car is over 11 years. (source 4)
- In 2003, import of second-hand cars reached almost 278 000 units which is the ninth consecutive year of growth. (source 4)
- In 2003, 126 116 vehicles, of which 122 338 were passenger cars, were produced in Hungary and the numbers were 122 666 and 118 590 respectively in 2004. (source 5)

DATA SOURCES

1 – CAR-REC, http://www.carrec.hu/, September 2005

2 – Transposition of the ELV Directive in the other EU member states, Perchards for the UK government, November 2004, http://www.arge-altauto.de/docs/DTI_ELV.pdf

3 – Krisztina Szép, Administrator dealing with environmental protection affairs, Car-rec, September 2005 – Tel: +00 36 1 460 0487 – carrec@axelero.hu

4 – Executive briefing: Hungary, Economist Intelligence Unit, from articles originally published on 28 June 2005 and 9 December 2004, http://eb.eiu.com/index.asp?layout=oneclick&country_id=1710000171

5 – Organisation Internationale des Constructeurs d'Automobiles, http://www.oica.net/ , September 2005

6 – News item, October 2005, Auto Recycling Nederland, http://www.arn.nl/engels/5pers/521.php#2

5 CASE STUDY NETHERLANDS

INTRODUCTION

In the Netherlands, the Decree on Management of End-of-Life Vehicles was adopted on the 24th of May 2002 and entered into force on the 1st of July 2002. The Dutch government decided to bring forward the targets as laid down by the European Directive because those set for 2006 by the Directive had already been reached in 1997 through the existing take-back scheme:

- From 1 January 2003 (instead of 2006 according to the EU Directive) at least 85%by weight of ELVs must go for recovery, re-use and recycling and at least 80% reused or recycled each year.

- From 1 January 2007 (instead of 2015 as fixed by the EU Directive) the annual targets will be at least 95% by weight reused, recycled or recovered and at least 85% by weight reused or recycled.

SUMMARY

The Dutch Decree establishes a producer responsibility where producers must take back ELVs of their own brand and set up a country wide collection system either individually or through a collective organisation. Such a collective organisation actually already existed since the Dutch car industry, dealers, car repair shops and dismantlers have set up in 1993 the Auto Recycling Foundation and its subsidiary Auto Recycling Nederland BV (ARN). Companies affiliated to ARN treat about 91% of the total number of ELVs in the NL.

ARN pays premium prices to dismantlers for different materials based on the number of kilograms, litres or pieces of material submitted dismantled. The whole ARN system is funded by a waste disposal fee of 45 Euros that manufacturers/dealers pay to ARN when a vehicle is registered for the first time. But manufacturers/dealers are free to include this amount, either partially or in its entirety, in the invoice to the customer when the vehicle is sold.

The last owner of a vehicle can deliver it free of charge to a recognised garage, dismantler or vehicle repair company.

Dismantling companies are free to trade among themselves before disassembly. This facilitates reuse since certain dismantlers specialise in a particular brand.

With this system, the Netherlands has managed to reach a recycling rate of 84% and a recycling, reuse and recovery rate of 86%. While little more can be done to stimulate reuse of components further, the potential for material recycling remains unexploited. Further research on post shredder technology has shown that a recycling, reuse and recovery rate of 90% is reachable but this seems as the utmost limit for now.

DESCRIPTION OF THE IMPLEMENTATION OF ELV TO-DATE

1 Technical description of the system planned / implemented – institutional arrangements

Dismantling companies that have an environmental permit from the Provincial Executives of the province issue a certificate of destruction and are then able to cancel an ELV from the national vehicle registration register. These dismantlers are the only ones allowed to treat, process or demolish end-of-life vehicles.

For Dutch licensed vehicles disposed of in another member state of the European Union, the last owner of the vehicle needs to present a certificate of destruction issued in that country to the Road Traffic Services (RDW) for it to be deregistered.

Upon reception of an end-of-life vehicle with a registration number issued by a competent authority in another member state of the European Union, a certificate of destruction will be issued upon request to the person who is disposing of the end-of-life vehicle. The registration certificate of the relevant end-of-life vehicle will be added to the certificate of destruction. In the absence of the relevant end-of-life vehicle's registration certificate it will then be indicated on the certificate of destruction.

Garages and auto repair shops may no longer treat, process or demolish ELVs. This means that cannot take out spare parts of ELVs without the intention of putting them back again or replacing them, or with the intention of putting them completely out of use unless they apply for an environmental permit from the Provincial Executives of the province but according to the memo to information of the Dutch Decree, few are expected to make use of this opportunity as it is not the core of their profession and demands big investments (tens of thousands of euros per company). Furthermore it is stated in the Design Motor Vehicles Environmental Management Decree that no more than four ELVs may be placed on those sites while waiting to be collected for dismantling. (source 5)

ARN (see producer responsibility in section 3) set up a network of car dismantling companies. A company qualifies for inclusion in the ARN network only if it can meet a number of objective standards including requirements for equipment and the dismantling of certain materials. Companies are tested by a certification body recognised by the Dutch Council for Accreditation. Currently ARN has a countrywide network of 265 car dismantling companies treating around 946 ELVs per year[52] and corresponding to one dismantler for 61 132 inhabitants[53]. (source 2)

The last owner of a vehicle can deliver it free of charge to a recognised garage, dismantler or vehicle repair company. It is interesting to note that contrary to most member states, the Dutch Decree provides for free take-back regardless whether the vehicle is complete or not. (source 1 and 5)

[52] In 2004, the ARN network treated 250 495 ELVs. (source 2)

[53] The population of the Netherlands in 2004 is 16.2 million inhabitants.

Dismantling companies are free to trade among themselves before disassembly. This facilitates reuse since certain dismantlers specialise in a particular brand. (source 1)

2 Technical description of the system planned / implemented – physical arrangements

In 2004, 250 495 ELVs were recycled by companies affiliated to ARN in the Netherlands. This corresponds to 87% of the total number of deregistrations (287 100 ELVs) in the country. In 2004, part of the deregistration is due to the clean up of the vehicle registration numbers of ELVs by the RDW so the number of ELVS recycled by ARN companies corresponds to 91% of the total number of ELVs, according to ARN. (source 2)

The average age of the ELVs in 2004 was 15,3 years which is slightly higher than in 2003 (14,9 years), thus confirming the tendency of these last years of an increasing lifespan of the vehicles. (source 2)

Data 2004 (source 2):

	2004			2003		
	Weight per ELV (kg)	Recycling, reuse and recovery percentage	Removal percentage	Weight per ELV (kg)	Recycling, reuse and recovery percentage	Removal percentage
Metals	686,3	75%		683,3	75%	
Materials dismantled by ARN network (exclusive of fuel and LPG tanks):						
Material recycling	76,9	8,4%		84,9	9,3%	
Energy recovery	18,3	2,0%		16,6	1,7%	
Removal	8,2		0,9%			
Residue	125,2		13,7%	127,3		14,0%
Total	915,0	**85,4%**	**14,6%**	911,0	**86,0%**	**14,0%**

Because of the changing composition of cars it is expected that the recovery, recycling and reuse rate will drop in the next few years unless extra materials are dismantled or recuperated after shredding. The average weights of the current ARN materials will further increase in the next few years, because, among other things, the weight of some components such as batteries, glass, oil, brake fluid and tyres will increase in the next few years and others, especially made out of plastic, will become larger and thus heavier. (source 2)

The quantities of materials recycled by the ARN system in 2004, 2003 and 2002 are presented in the following table which shows the quantities of material that were in fact collected and recycled, excluding the materials that are still with the car dismantling companies or in the collecting companies' depots. The statistics for 2004 are lower than 2003 due to the fact that less ELVs were recycled. (source 3)

Type of material	Standard quantity in December 2004	Unit	2004	2003	2002
Battery	13,00	Kg	3 020 104	3 390 983	3 384 271
Rear lights and indicators (Until June 30, 2004)	1,40	Kg	300 454	572 579	27 538
Tyres	27,90	Kg	6 756 317	7 616 913	7 321 248
Inner tubes	0,05	Kg	26 122	30 980	56 719
Fuel (petrol/diesel)	5,00	Kg	172 140	212 920	147 217
Bumpers (PP and PC)	5,60	Kg	1 313 400	1 437 180	1 396 530
Glass	24,80	Kg	5 740 710	6 100 940	6 001 700
Grilles	0,35	Kg	160 106	113 875	62 460
Coolants	3,40	L	771 040	898 460	812 400
Coconut fibre	0,50	Kg	64 760	72 760	74 217
Refrigerants (Since July 1, 2004)	0,01	Kg	0	-	-
LPG tanks	0,04	Pieces	7 987	10 699	6 897
Oil	4,70	L	1 117 000	1 300 220	1 167 200
Oil filter	0,50	Kg	99 160	104 740	73 745
PUR foam	7,10	Kg	1 592 565	1 694 605	1 637 877
Braking fluid	0,30	Kg	63 596	92 706	75 657
Rubber strips	7,70	Kg	1 796 573	1 927 420	1 940 190
Windscreen washer fluid	1,10	Kg	190 260	238 600	258 780
Safety belts	0,35	Kg	87 348	91 445	94 995
Hubcaps	0,70	Kg	158 680	176 680	174 900

The standard quantity is the average number of kilograms, litres or pieces of material per ELV that a car dismantling company is permitted to submit. The data comes from regular dismantling tests that ARN carries out at the car dismantling companies by weighing the dismantled materials. Changes in the supply of ELVs or improvements in the dismantling techniques can lead to changes in these figures. Every quarter, jointly with STIBA, ARN checks to see if adjustments are required. The table below presents the standard quantity in September 2005 for the materials where it is different. (source 2)

Type of material	Battery	Inner tubes	Glass	Grilles	Coolants	LPG tanks	Oil	PUR foam	Windscreen washer fluid
Standard quantity in September 2005	13,3 kg	0,1 kg	25,4 kg	0,5 kg	3,6 L	0,06 pieces	4,9 L	6,7 kg	1,0 kg

The number of different types of materials that car dismantling companies have been commissioned by ARN to dismantle is regularly updated. From 18 when the Dutch Decree was published, the list has grown to 20 (see tables above) and will continue to grow when new recycling processes will be available since research is being carried out on a continuous basis into what materials present in scrap cars are and whether those materials can be processed now or in the future. **More recently, two types of materials have seen changes. ARN started recycling refrigerants**, which fall under the category of hazardous waste, originating from air conditioning systems in end-of-life vehicles as from July 1, 2004. Car dismantling companies must employ a qualified Auto Airco STEK disassembly mechanic and hold a STEK approval certificate. In late 2004 16 companies started recycling refrigerants. Expectations are that the number of car dismantling companies holding a STEK approval certificate will increase, as the number of end-of-life vehicles with air conditioning systems will raise in the future. On the contrary, ARN chose to **stop the collection and recycling of rear lights** since there is an absence of an appropriate and viable recycling method. (source 1 and 2)

3 Economic description of the system planned / implemented

Producers must take back ELVs of their own brand and set up a country wide collection system either individually or through a collective organisation. The Dutch Decree also places a specific obligation on manufacturers and importers to ensure that a processing system is set up for ELVs. To fulfil this obligation, the Dutch car industry, with the encouragement of Netherlands' Ministry of Spatial Planning, Housing and The Environment, set up in 1993 the Auto Recycling Foundation and its subsidiary Auto Recycling Nederland BV (ARN). The Foundation's board members represent STIBA (the dismantler's association), RAI (the car manufacturer's and importer's association), BOVAG (the car dealer's association), and FOCWA (the car repair shop's association). ARN's role is to reduce the amount of waste generated by ELVs.

ARN uses premium prices for different materials. The payment made to the car dismantling company part of ARN's network is based on the number of kilograms, litres or pieces of material submitted by the company. There is a specific payment for each type of material based on the time needed to dismantle that material. The payment is made exclusively on the basis of quantities of material actually dismantled and submitted for processing and not per ELV. This encourages dismantlers to sign a contract with ARN and therefore ensures proper dismantling as well as improvement of recycle facilities and skills. ARN also chooses transport companies and recyclers for the materials obtained after dismantling. These companies are selected on the basis of an annual tendering process.

The whole ARN system is funded by a waste disposal fee paid when a vehicle is registered for the first time, as provided for in the Environmental Management Act. Only after payment of the fee will the Department of Road Transport issue a registration certificate. The waste disposal fee has been fixed by the Ministry of Housing, Spatial Planning and Environment at 45 € for the period 1 January 2004 up to 31 December 2006. This fee is calculated according to the number of new vehicle registration, the costs of dismantling and recycling, the number of ELVs estimated for the following years, and the existing fund. The amount of the fee until 2001 has generated enough revenues to lower it after that period. The producers pay this fee to ARN but they are free to include this amount, either partially or in its entirety, in the invoice to the customer when a vehicle is sold. (source 1 and 5)

Producers must set up and manage a coherent intake and processing system to furnish dismantling information to dismantling companies and consumers. Source 5 estimates that this will cost between 3,6 to 4,5 million € par annum.

The costs involved for drawing up a notification to the Ministry for Housing, Planning and the Environment of the measures they would be taking to fulfil their obligation are estimated at 227 000 € which comes to 4 500 € per manufacturer or importer if they choose a collective approach. Assuming a 3-yearly notification, this will become 1 500 € on an annual basis. (source 5)

The annual reporting to the Ministry for Housing, Planning and the Environment on the execution of the measures described in the notification is estimated to cost 9 to 13,6 thousand euros. In order to complete this report a registration and control system is necessary. In the current collective system this cost around 908 000 € in 2002. (source 5)

The dismantlers must process cars registered in another country than the Netherlands in the same manner as Dutch ELVs but he cannot recover these expenses through the waste management fund as no waste contributions were made for these foreign vehicles. But foreign ELVs are usually young ELVs that have been involved in an accident and have thus an economical value estimated to be between 227 and 1 361 €. In the case of foreign vehicles, the free-of-charge take back is not obligatory. (source 5)

4. Collection of data on existing costs and income (from treatment sector)

ARN expenditure (in x1000 €): (source 3)

	2004	2003
Recycling costs:	26 961	30 843
Dismantling, collection and processing	approx. 25 600	approx. 29 000
Research	approx. 1 400	approx. 1 800
General costs	3 325	2 947
Monitoring data and information	1 554	1 623

Financial expenditure	48	55
Total expenditure	31 888	35 468

Recycling related costs per ELV processed by ARN for 1995-2001 (Euro): (source 6)

	1995	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**
The number of ELVs processed by ARN	*126 000*	*210 092*	*237 266*	*232 685*	*251 943*	*286 595*	*278 972*
Recycling cost per ELV	**80**	**110.6**	**108**	**93**	**77**	**85**	**96**
Recycling premium per ELV	**79.1**	**108.7**	**105.7**	**86.3**	**72.9**	**83.4**	**91**
General cost per ELV	28.5	8.1	8.2	8.3	8.8	8.4	9.8
Monitoring and information cost per ELV	7.4	11.9	4.4	2.4	2.8	5.1	6.2
Financial expenditure per ELV	1.2	0.5	0.7	0.7	0.3	0.4	0.5
Total ARN cost per ELV	**124**	**159.9**	**121.2**	**104.3**	**89.0**	**99.1**	**112**

According to source 4, in 2000 the maximum premiums of ARN were as follows but the average amount claimed by dismantlers was 62,9 €:

Dismantling	71,05 €
Collection	13,39 €
Recycling	3,11 €
Total	87,55 €

- Certification costs: 772 €/yr (source 5)

5. **Changes affecting producers to-**

Material and spare parts coding system is nothing new so minor costs are expected from the resultant obligations but they are difficult to quantify more precisely. (source 5)

6. **National data on trade (i.e. import and export of new, second hand cars, ELVs) – identify origins / destinations of possible.**

- -The number of exported vehicles rose considerably in 2004 to 234 000 compared to 166 000 in 2003. For the majority, these vehicles go to Eastern Europe: Poland, Bielorussia, Czech Republic, Bulgaria, and Hungary.(source 2)

- - In 2004, 51 000 vehicles were imported in the Netherlands. This is constant in regards to 2003. (source 2)

- - 630 000 new vehicles sold in 2004 which represents a 1,6% increase. (source 3)

- - In 2003, 215 281 vehicles, of which 163 080 were passenger cars, were produced in the Netherlands and the numbers were 247 503 and 187 600 respectively in 2004. (source 7)

EXAMINATION OF TECHNICAL OPTIONS TO INCREASE RATES OF RE-USE, RECYCLING & RECOVERY

To improve recycling rates from ASR, ARN initiated an experiment together with the Delft University of Technology and TNO, the Dutch organisation for applied scientific research, in late 2003 to investigate the possibility of increasing the recycling percentage and simultaneously cutting costs looking at post-shredder technologies.

The objective of the test is twofold: investigate whether the introduction of this technology can raise the recycling percentage, and establish whether this post-shredder technology can be used to keep recycling costs manageable. 1153 Dutch end-of-life vehicles ended up in the shredder in Châtelet, Belgium. The wrecks chosen for the test were a good representation of the end-of-life population in the Netherlands. During the test, a number of materials that are normally removed manually were left on the wreck to see whether they could also be separated after being shredded. The materials were rubber strips, bumpers, PUR foam, hubcaps, rear lights, radiator grilles, safety belts, coconut fibre and glass.

The results of the experiment, combined with a number of other studies carried out in 2004, showed that increasing the current recycling percentage is technically feasible and provided precise information on the technical possibilities.

It also showed that at least the same recycling rate can be achieved at considerable lower cost.

The results show that a recycling (and reuse and recovery? not clear in the original document) percentage of about 90% is possible. The follow-up research will have to show what the options are for actually recycling the various fractions. These options include re-using the new raw materials as well as finding buyers for the materials that become available in the Dutch market.

DATA SOURCES

1 - Transposition of the ELV Directive in the other EU member states, Perchards for the UK government, November 2004

2 - Auto Recycling Nederland, http://www.arn.nl/engels/index.php, September 2005

3 - Environmental report 2004, KPMG for Auto & Recycling Foundation and Auto Recycling Nederland BV

4 - Etude économique sur la filière de traitement des véhicules hors d'usage, pp.136-140, Ernst&Young for ADEME, September 2003

5 – Decree on Management of End-of-Life Vehicles adopted by the Dutch government

6 – Technical Support to the extended Impact Assessment on the Thematic Strategy on the Prevention and Recycling of waste

7 – Organisation Internationale des Constructeurs d'Automobiles, http://www.oica.net/ , September 2005

6 CASE STUDY POLAND

PART A: CURRENT MANAGEMENT OF ELVS

1 Description of the Policy & Institutional Structure (Current & Planned)

Transposition of the ELV Directive into the Polish law: Act of 20 January 2005 (Dz.U. z 2005 r. Nr 25, poz. 202) on the recycling of end of life vehicles. (Poland was supposed to transpose the Directive as of the 1st of May 2004 and was the last EU country to implement the Directive).

The act was approved on the 25th of November 2005 by the Parliament, which took into consideration the changes introduced by the higher chamber, the Senate to the proposal.

Entry into force of the act:

30 days after the public announcement of the act. However, some articles (as 7,8,44,45,57 and 62) apply from the 12th of August. Art. 11-17, art. 28, art. 47, art. 55, art. 56, art. 57 p. 3, art. 58 p. 1 and art. 60 apply from the 1st of January 2006.

The act is a result of a compromise between the economic operators (producers, importers, recyclers, representatives of dismantling stations…) and the Ministry of environment responsible for ELV.

The act affects the following target groups:

- car producers, importers and owners
- entrepreneurs of dismantling and shredding companies
- the public administration

The layout of the Regulations is described below:

- Obligations of Persons Bringing Vehicles into the Country's Territory: art. 6 to 17
- Obligations of the car owners: art. 18 to 20.
- Obligations of entrepreneurs of dismantling centres: art 21 to 31
- Obligations of entrepreneurs of collection points: art 32 to 36
- Obligations of entrepreneurs of shredding companies: art 37 to 38
- Obligations of the public administration: art. 39 to 43 (set up the regional authorities responsible for setting up the permissions for dismantling and shredding companies as well as the ones responsible for inspections.

Adaptation to the Polish context[54]:

has not taken into account the problems being typical in the Polish circumstances, e.g. meaningful individual exports or the inter-Community purchase of vehicles (the Directive imposed its obligation exclusively on the operators, including so called

[54] http://www.resol.com.br/curiosidades2_ing.asp?id=1803

professional importers), or the problem of "no-one‘s" vehicles, (i.e. such ones, the manufacturers and importers of which and their legal successors no more exist).

Moreover, the Directive imposed the obligations in a manner not too much precise, while introducing mainly the category of so called "economic operators", that includes the manufacturers and importers of vehicles, on one hand, and also the operators who perform their disassembling and recycling, and the insurance companies, on other hand. That brought about controversy between various operators‘‘ groups.

Those were just the reasons for so long-lasting legislative work. In the Polish End-of-Life Vehicle Act, the major obligations are assigned to those who are introducing the vehicles on the market (manufacturers and importers) and to the operators who manage the disassembly stations, and to those entrepreneurs who manage the vehicle collection sites in co-operation with the former. Those who have been introducing the vehicles on the market are now being held responsible for operation of such vehicles which have been only properly designed and manufactured (including those which contain limited amounts of hazardous substances appropriate for recovery and recycling and those parts have been made of plastics and marked adequately), and for establishment and maintenance of a network for collection of the end-of-life vehicles (e.g. by means of entering contracts with the operators who manage dismantling stations).

The operators who manage dismantling stations, on admission of the vehicles in their stations, shall be held responsible for granting the disassembly certificates and de-registration of the vehicle documents, appropriate disassembly of the vehicles, and achievement of the recovery and recycling levels as prescribed. On reception of the vehicles in their stations the operators of the vehicle collection sites shall grant the disassembly certificates and de-register the vehicle documents, and they are obliged for delivery of the vehicles received to the dismantling station, which they have concluded relevant contract with. The role of the vehicle users within the system as the whole has to be emphasised. They have been held responsible for delivery of an end-of-life-vehicle into dismantling station or to vehicle collection site, and then, for de-registration of the vehicle within 30 day deadline.

Main consequences of the act:

Every person bringing a vehicle into the country’s territory is bound to provide a vehicle collecting network covering the country’s territory in a way enabling the vehicle’s owner to hand over an end-of life vehicle to the authorised facilities for vehicles collection or to the authorised treatment facilities, situated in a distance not longer than 50 km in straight line from the residence or the place of business of the vehicle’s owner.

Every person bringing a vehicle into the country’s territory, referred to in the paragraph 1 hereto, who does not provide the network, as well as an entity not being an entrepreneur, who pursues an intra-Community acquisition or import of a vehicle, are bound to provide, for a separate bank account of a National Fund for Environmental Protection and Water Management, payments in the amount of PLN 500 for each vehicle brought into the country’s territory.

A simulation of costs of the Ministry of the environment shows that the adoption of the act is supposed to increase the total cost of each new car of 500 zloty (125 euros).

The owner will decide when deregister the vehicle. He may hand it over exclusively to a dismantler or a collector. To do so, he will have to show a document from the dismantling station stating that the car was dismantled.

Each dismantling point will be obliged to own a permit/authorisation. This obligation may have a negative impact on certain points that will have to close, as they do not comply with the new norms.

The dismantler is bound to obtain a level of recoverability and recycling of end-of life vehicles in the amount of accordingly 95% and 85% of the mass of vehicles accepted in his authorised treatment facilities. For the vehicles manufactured before January 1st, 1980, the levels of recoverability and recycling mentioned in the paragraph 1 hereto, are of accordingly 75% and 70%.

The collector shall be obliged to hand over all the collected end-of life vehicles to the dismantler operating an authorised treatment facility with whom the collector has concluded an agreement.

District Authority (Staroste) after having agreed with Voivod, territorially competent to issue integrated permit or other decision on waste management, required for operating authorised treatment facility by the dismantler with whom the collector had concluded an agreement, grants to the collector the permit to operate in waste collection.

A Voivid constitutes the body authorised to issue integrated permit or any other decision concerning the waste management, required for operating an authorised treatment facility.

The recently noticed fall in the rate of imported used cars in Poland could be another consequence of the act.

According to the Samar Institute, the fall in imported used cars continues[55]. July more than 71,000 of them were imported, 11.9% less than in June. From the beginning of this year 511,338 used cars were imported, 98% from countries of the European Union.

Somewhat fewer of the oldest cars, more than ten years old, were imported - in July their proportion of total imports was 66.5% as compared to 67.6% in June.

The estimated average value of a used car imported in the first seven months of this year was 1,891 zl.

Tax revenues from excise duties for used imported cars were nearly 542.9 million zl. in July.

The most popular group among cars imported in July, were cars produced in the 90-ties 83% of all cars imported. Most interest was shown in cars made in 1992. They formed nearly 13% of all cars imported into Poland.

[55] http://eng.flota.com.pl/cms/?id=5082

The number one make among used cars imported in the first 7 months of the year continues to be Volkswagen, Further down the list are: Opel, Ford, Audi, Renault, BMW, Mercedes, Seat, Nissan and ending the top ten list is Peugeot.

Institutions:

The ministry of Environment http://www.mos.gov.pl/

The national found for environmental protection and water management http://www.nfosigw.gov.pl/site/

2. Description of the ELV Treatment Sector

In Poland there are approximately 500-800 dismantling points, of which 20-30 of big proportions.

Before the introduction of the act - data from 2001:

http://www.getf.org/file/toolmanager/O50F24282.htm

Although there are some 1500 scrap yards in Poland, only 500 are authorized by provincial governors and only 200 more have applied for such an authorization. A typical company processes 200 to 250 cars annually and employs 5 to 7 people. Most of these companies are located in the Southern and Western parts of Poland. Their combined annual output equals about 300,000 cars scrapped. Over half of these companies do not seek certification (a permit granted by the provincial governor to issue certificates of scrapping vehicles withdrawn from the registry), because it amounts to taking on the responsibility for the ways in which waste materials are treated and utilized (i.e. recycling), rather than just their scrapping activity.

Investments are required not only in equipment and infrastructure for protecting soil and water, but also in know-how, i.e., documentation and training as organized mainly by the Industrial Institute of Automation and Measurement (Przemyslowy Instytut Automatyki i Pomiarow). Nevertheless, the recycling base in Poland has developed sufficiently to recover or utilize practically anything from a scrapped car. The most significant problem is a seasonal scrapping over-capacity alternating with a lack of capacity. For example, Orzel Bialy and Baterpol may recycle practically any number of automobile batteries, including imported ones, but they lack a strategy for utilizing tires.

The only entity which has worked out a plan to deal with tires is the Gorazdze cement plant. There, tires are burned in an inefficient process which actually raises the cost of factory operations. Gorazdze burns some 12,000 tons of tires annually, about 10% of the total domestic output. It is estimated that some 7% of used tires are burned illegally, causing a negative impact on the environment.

However, the number of companies utilizing tires in different ways is on the rise. Eko-Tyres, based in Pruszkow, is the only company with a machine which can grind up tire cords. Another such company is to be established in Tczew, and it is expected to process up to 30,000 tires annually. The resulting granules are sold to Germany and Holland. They may be added to asphalt and may also be used in the production of flag stones.

Poland does not have a sufficient number of rippers, i.e., the machinery for processing old cars into chips. There are only four such machines in the country, and all of them are old and unable to meet the demand. Transportation costs also rule out their ability to process old cars from outside their region. As long as there are no investors willing to put up the necessary funds for new ripping machines, the problem may be ameliorated via a reduction in the cost of transporting cars from scrap yards to rippers by pressing the cars before transporting them. This could be done using car crushers which make a 30 – 35 cm cube of the car's body. The problem there is that Poland also lacks these machines, even though they are much cheaper than rippers.

Most equipment used in Polish scrap yards is manufactured by several domestic companies, the most versatile of which is the Industrial Institute of Automation and Measurement (Przemyslowy Instytut Automatyki i Pomiarow). It produces and sells sets of machinery for drying used cars, freeing them of all types of liquids, testing individual parts and so-called turntables, i.e. the equipment for rotating cars. The majority of these products may be bought on credit granted by the Bank for Environmental Protection, (Bank Ochrony Srodowiska).

A significant portion of the equipment used in Polish scrap yards comes from abroad, imported by several companies who buy mainly second-hand equipment from leading industry manufacturers operating in the West.

No of De-registrations & ELVs (requiring treatment)

The number of deregistered vehicles during the period 1997-2000 was 250 000 (according to the latest National Waste Mangement Plan). The annual mass of waste from vehicles was approximately 235 000 tones.

Future estimations:

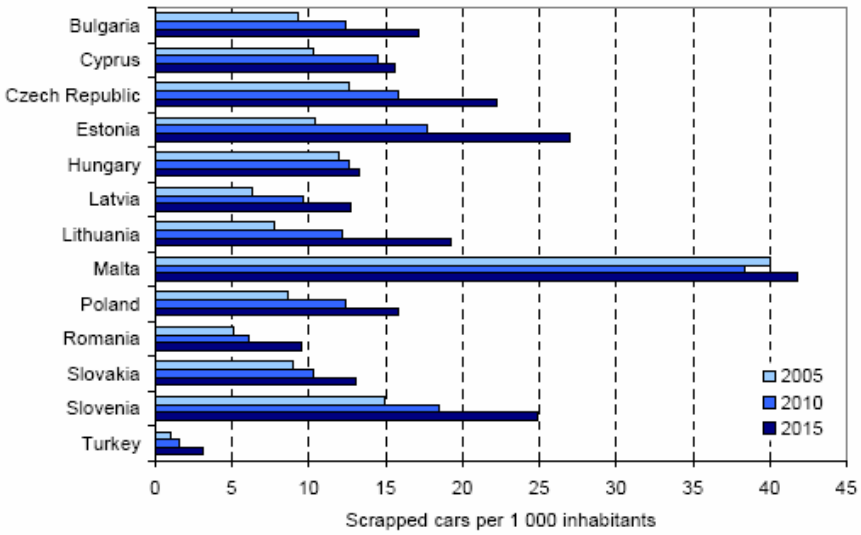
for 2006: 540 000 ELVs.

for 210: 700 000 ELVs.

for 2012: 800 000 ELVs.

for 2014: 950 000 ELVs.

Figure 1 Modelled estimated numbers of scrapped cars per capita in selected countries



Sources: EEA–ETC/WMF, 2001; United Nations population statistics, 2001.

Poland stands out from the rest of the countries by accounting for about 30 to 34 % of the estimated number of scrapped cars in absolute figures in AC-13 from 2000 to 2015. Poland accounts for about 23 % of the population in AC-13.[56]

Table 1 Modelled no of passenger cars scrapped per capita

Unit: Scrapped cars per 1 000 inhabitants

	2005	2010	2015
Bulgaria	9	12	17
Cyprus	10	15	16
Czech Republic	13	16	22
Estonia	10	18	27
Hungary	12	13	13
Latvia	6	10	13
Lithuania	8	12	19
Malta	40	38	42
Poland	9	12	16
Romania	5	6	10
Slovakia	9	10	13
Slovenia	15	18	25
Turkey	1	2	3
AC-13	**148**	**182**	**236**

Source: EEA–ETC/WMF 2001.

File: TERM 2002 11a AC — Waste from road vehicles (elv).xls

56 http://themes.eea.eu.int/Sectors_and_activities/transport/indicators/consequences/TERM11,2002/TERM_2002_11_AC_Waste_from_road_vehicles_elv.pdf

Tonnes of ASR and other waste materials disposed

Used tyres

The development of motorization contributed to increasing number of used tyres. Used tyres left usually at places of accidents in the environment or deposited at municipal storage yards cause a number of technical and environmental problems.

Present state of waste management

It is every difficult to define exact resources of used tyres since there is no such register.

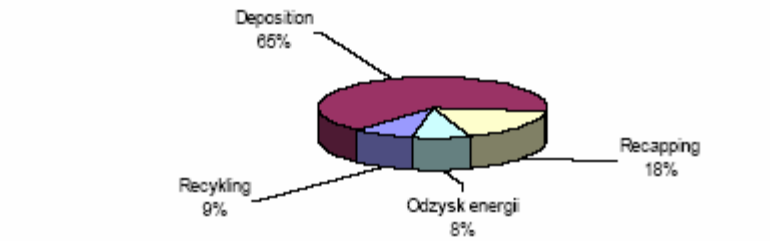
Whereas, we may estimate them given the number of tyres purchased for exchange purposes or the number of cars registered, including tyre consumption time. In both cases, we have to know the structure of tyre market and the number of tyres introduced to the market. Such estimations based on paper PBZ-030-8 entitled "Development of the nation-wide system for rubber waste utilisation" showed that in 2000 in Poland there were around 100 thousand tons of used tyres, including around 35% of waste that was recovered or disposed.

To eliminate or reduce the quantity of waste kept at the storage yards (or left in the environment), we may apply various methods and techniques for waste management. The existing research and experience show that withdrawn tyres may be reutilised by means of:

- recapping,
- using the whole tyres,
- using products from their mechanical and chemical treatment,
- combusting and using the energy.

The structure of the management of used tyres is presented in the fig. below.

Figure 2 Structure of the management of used tires



Recycling - 9%, Recovery of energy – 8%

In Poland, there are technical capacities to recover used tyres in various ways (e.g. companies disintegrating rubber and producing regranulate, cement production plants adjusted to combust used tyres), but business entities handling tyre recycling have big difficulties to obtain the waste since there is not system for used tyres collection.

The management of used tyres should be significantly improved given the fact that there are new legal regulations resulting from the adjustment of the Polish law to the EU law. The act of April 27, 2001 on waste (Journal of Laws No. 62 item 628 et seq.) introduces a ban on storing tyres, whereas on the grounds of the act of July 27, 2001 on introducing the act:

Environmental Protection Law, act on waste and amendments to some acts (Journal of Laws

No. 100, item 1085), this ban comes into force on July 1, 2003 for the whole tyres and on July

1, 2006 for parts of tyres (cut tyres).

At the same time, pursuant to the act of May 11, 2001 on duties of producers of some products and product and deposit fees (Journal of Laws No. 63 item 639 et seq.), producers and importers of tyres to be marketed are obliged to recover tyres used.

The ordinance of the Government of June 30, 2001 on annual recovery and recycling of package waste and used products (Journal of Laws NO. 69 item 719) defines the following levels of recovery of used tyres for particular years:

2002 – 25%

2003 – 35%

2004 – 50%

2005 – 60%

2006 – 70%

2007 – 75%.

Whereas, the ordinance of the Government of September 11, 2001 on product fees (Journal of Laws No. 116 item 1235) defines product rates for particular types of tyres. The principles and ways of the management of product fees are defined in the ordinance of the Minister of the Environment of July 8, 2002 on detailed principles and ways of the management of product fees (Journal of Laws No. 122 item 1052).

Forecasted quantity and quality of waste

The forecast for the production of used tyres was presented on the grounds of statistic data and IGO experience in the document “Development of the nation-wide system for rubber waste utilisation”.

The forecast for 2003 – 2014 is as follows:

2003 – 110,000 tons

2006 – 120,000 tons

2010 – 135,000 tons

2014 – 150,000 tons

Need related to waste management

In Poland there are technical capacities to recover or dispose (excluding deposition) used tyres, but there is no organised collection system. Therefore, to improve the management of used tyres, we have to organise the collection of used tyres to be carried out by an organisation associating producers and importers of tyres. In addition, since in Poland there are companies disintegrating rubber and producing regranulate, we have to introduce an obligation to recycle rubber tyres.

Tasks:

- Organise the system for collection and transport of waste tyres.
- Prepare guidelines to indicate preferred methods for used tyres recycling.
- Waste from shaping, physical and mechanical treatment of surfaces of metals and plastics:

Waste of this type is generated during the production of metal and plastic elements and final treatment, as well as during repair processes. Metal and plastic elements are constructed during the production of electrical devices, furniture, means of transport and other equipment, and elements for industrial, commercial and household purposes.

Processes applied in the production of metal and plastic products include, among others: cutting, machining, grinding, treating die cavities, welding and polishing.

Present state of waste management

Waste coming from shaping, physical and mechanical treatment of surfaces of metals and plastics is generated all over Poland. They are highly dispersed in small and medium-sized metallurgical companies, companies processing plastics and in companies producing parts and accessories to mechanical vehicles and engines.

In 2000, Poland generated 771.3 thousand tons of waste of this type.

These waste include mainly waste from turning and filing iron and its alloys, other waste of iron and its alloys. Both the above types of waste constitute 79.6% of the total waste generated.

The structure of the management of waste coming from shaping, physical and mechanical treatment of surfaces of metals and plastics is as follows:

- recovery 94.8%
- disposal, excluding landfilling 1.4%
- deposition 3.2%
- storing 0.6%.

Waste fully recovered are waste coming from turning and filing iron, iron alloys and nonferrous metals, as well as waste oils from metal treatment. The following types of waste prevail among deposited waste: used abrasive, sludges from mechanical surface treatment, welding waste and used electrodes, waste of plastics.

Waste disposed, but not deposited, are waste emulsions from metal treatment and waste from vapor and water degreasing, which are dangerous waste.

Basic types of waste in this group, i.e. chips and cuttings of metals are recovered in metallurgical processes. The existing methods for the recovery of waste chips and cuttings is accurate and allows for complete recycling of these waste.

Dusty waste cause some problem as, due to their form, they have to be first treated before being recovered in metallurgical processes.

Forecasted quality and quantity of waste

We do not expect any important changes to the quantity and quality of metal waste from shaping, physical and mechanical treatment of surfaces of metals and plastics.

Needs related to waste management

As regards metal waste from shaping, physical and mechanical treatment of surfaces of metals and plastics, the problem has been solved and no additional investments are required. In the case of the management of used liquids coming from metal treatment, we also have got sufficient processing capacity of adequate systems. However, we have to pay a bigger attention to minimising the production of such waste like used oils and emulsions from metal treatment. We have, for example, to improve the quality of emulsifiable oils and apply procedures for device maintenance, cleaning liquids from impurities, etc. at production plants to prolong their use. In addition, it is important to standardise cooling liquids used at a given production plant to simplify their recycling.

Tasks

- Develop methods and techniques required to minimise waste resulting from shaping, physical and mechanical treatment of surfaces of metals and plastics.
- Increase the recovery of waste to be deposited at storage yards: used abrasive, sludges from mechanical surface treatment, forgery waste, used electrodes.

3. Current Costs and Income

Unit Treatment Costs per ELV - Component / Material Fraction (reference to labour and capital costs) PLUS transport costs per ELV

As shown by Table I , the cost to dispose of ASR in a landfill is different in the selected countries and is not very high in Poland.

Table 12. ASR Landfill Costs in Different Countries

Country	Cost ($/t)
E.U. countries	
Austria	140
Belgium	55
Denmark	70–110
France	40–60
Germany	60–170
Italy	75–80
Netherlands	70–90
Spain	20–60
Sweden	90–100
United Kingdom	30–35
Eastern European countries	
Poland	25–30
Czech Republic	30
Non-E.U. countries	
Australia	20
Japan	135–160
Norway	50
United States	50–60
South Africa	25–40
Switzerland	120

PART B: TECHNICAL REVIEW

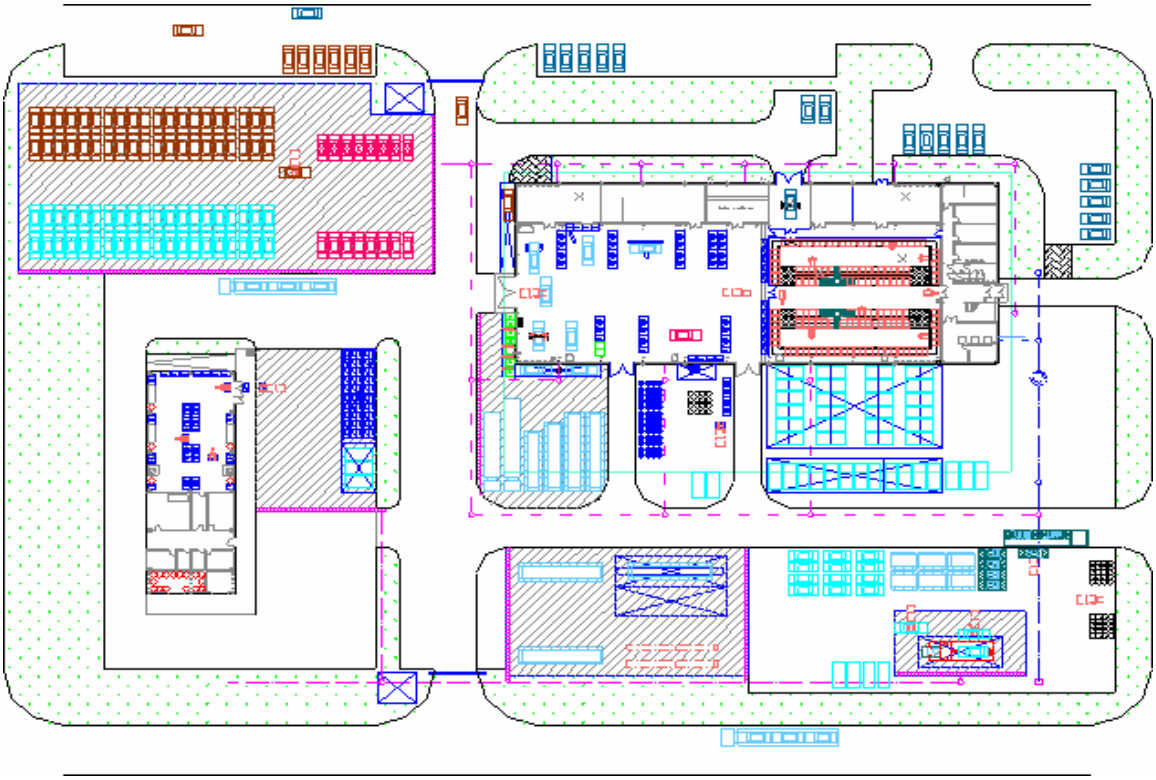
4. Changes To-date in the Design & Treatment of Vehicles & ELVs

- Changes Made by Producers
- Changes Made by Treatment Sector

5. Technical Options for Increasing Rates of Re-Use, Recycling and Recovery

- Review of Options for Vehicle Design
- Review of Options for Treatment Sector

In order to comply with the requirements of the ELV Directive, the Industrial Research Institute for Automation and Measurements – PIAP proposes a plan for setting up or modernising a dismantling point[57]



PART C: MARKET & ECONOMIC ASSESSMENT

6. Overview of Vehicle and Recycling Markets

Vehicle market

Sales of new passenger cars

Sales of new passenger cars was rising in Poland from the beginning of the 1990's. The year of 1999 was a record one - over 640,000 new cars were registered. Unfortunately, the years of 2000 - 2002 were much worse due to the economic crisis. In 2000 478,000 new cars started driving on Polish roads and in 2001, only 327,200. The worst result was achieved in 2002 when 308,000 new cars were sold. The results for 2003 and for the first months of 2004 allow for assuming that the results of the sales of new cars will be better. In 2003 358,432 new cars were registered which was 16,25% more than in the previous year. In the first quarter of 2004 98,000 new cars were sold which was 22,35% more than in the same period of the previous year. Fiat has been the sales leader for many years now and it has a 20,14% share in the market after the 3rd month of 2004. Skoda, with its 12,83% share of the market is the runner-up and the third place is taken by Toyota (12,17%).

[57] http://www.piap.pl/piap/oferta/recykling/projekty_stacji_demontazu_samochodow.php

Production of passenger cars

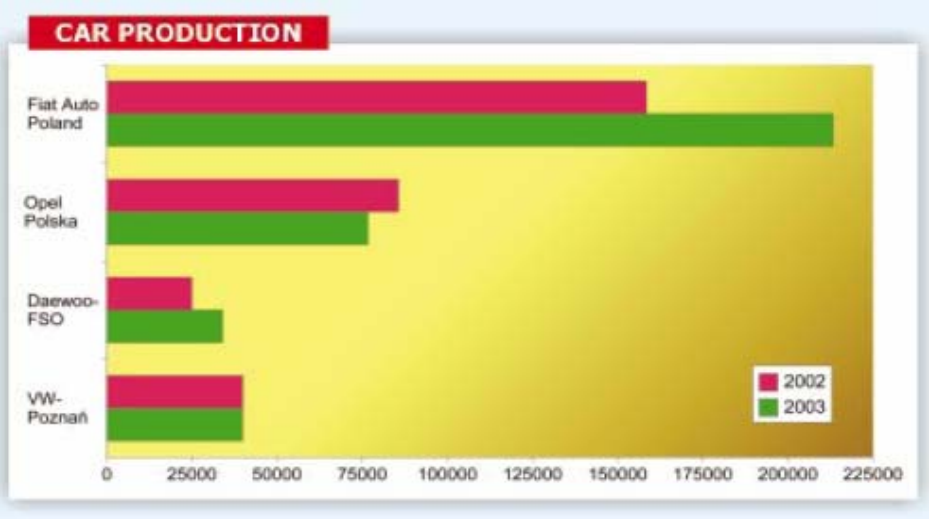
Production of passenger cars, thanks to investments of such manufacturers as Fiat, was growing from the beginning of the 1990's to achieve the level of 660,000 cars a year in 1999. Unfortunately, the recession of the following years as well as the fall of Deawoo company, the second largest final car manufacturer, caused the drop of production in the following 4 years to the level of 288,000 cars in 2002. However, thanks to new investments of Fiat (new Panda), VW (vans Caddy, T5) and GM (transfer of Astra II production to Poland in 2003) caused an increase in car production to the level of 325,000 in 2003. The results of the first months of 2004 also indicate that the current year will be better than the last one.

Located in Tychy, Fiat Auto Poland (FAP) produced 29,000 thousand cars in April which is 108% more than last year. This was caused, among other things, by great popularity of the Panda model, which accounted for 79% of the last month's production volume of the Polish plant. FAP should manufacture 355,000 - 365,000 cars throughout 2004.

Production output of Warsaw-based Daewoo-FSO nearly doubled in April. 14,100 cars have rolled out of production line in the first 4 months of the year, 50% more than in the same period of the last year. Daewoo-FSO plans to manufacture 60,000 cars in the whole year.

The Polish plant of Opel produced 10,940 cars in April 2004, 44% more than last year. GM assumes that this year's production in Gliwice will increase by 10%, up to 110,000 vehicles.

Major automotive investors (in mln $)		
	invested	**planned**
Fiat	1 768.7	
General Motors	1 010.0	
Volkswagen AG	390.7	250.0
Daewoo	936.38	



Suppliers

1992 was the year that marked a change in the sector of sub-contractors. Fiat Auto Poland (FAP) purchased FSM car factories in Bielsko Biała and Tychy and took over the existing network of suppliers. While preparing production of a new car in the 1990's, FAP outsourced manufacturing of some components to external companies, mostly to suppliers related to Fiat, eg. Magneti Marelli, Er.Si, Sila, CF-Gomma, Teksid, that also invested in Polish production plants.

Also new investments by Daewoo (acquisition of Warsaw FSO plant in 1996) and General Motors (greenfield in Gliwice) resulted in investments of their strategic suppliers (Kirchhoff, Gedia, Tower Automotive).

There over 200 hundred plants in Poland which are owned by foreign investors. These include Delphi Automotive Systems (6 plants) and Faurecia (7 plants), TRW (5 plants), Lear (4 plants), Autoliv (2 plants), Eaton (2 plants), Magneti Marelli (4 plants), Toyota (2 plants), Isuzu, Fiat-GM Powertrain, Michelin, Bridgestone, Gestind, Denso (2 plants), SEWS (2 plants), GKN, Hutchinson (3 plants), Metzeler (2 plants), Wabco.

Foreign investments and increase of car production in Poland resulted in the increase of employment in sub-contractor sector from 41,600 in 1999 to 46,700 at the end of 2003. The preliminary results for the beginning of this year allow for assuming that by the end of 2004 employment level may exceed 50,000.

Delphi Automotive Systems, employing 6,000 workers, is the largest investor in terms of the number of employees.

Major OEM investors (in mln $)	
	invested planned
Fiat-GM Powertrain	432.5
Delphi Automotive Systems	345.0
Pilkington	295.0
Toyota	180.0

Michalin	161.3
Faurecia	140.0

Poland has 17 Special Economic Zones (SEZs - of which 15 are active), where foreign investors receive preferential treatment and tax breaks, including partial or total exemption from income tax for a defined period of time, treating certain parts of investment outlays as revenue expenditure, and exemption from certain local taxes. By the end of 2000, nearly 700 investors had initiated business activity in SEZs, among them such companies as General Motors, Isuzu, Delphi and Toyota.

In 2001 Poland amended the privileges granted to companies investing in SEZs, in order to adapt the rules for public assistance to meet EU regulations. At the end of 2000, in order to adjust Polish law to EU requirements, the Polish parliament adopted legislation regulating SEZs and public assistance. According to the new regulations, the value of public assistance for an investor must not exceed 50 per cent of the value of the investment. Another novelty is the provision enabling local governments to impose real estate taxes on companies operating in the zones, or to exempt them. The forms of public assistance offered by the SEZs include subsidies, tax relief and bonuses for creating new work places.

Strengths of Automotive Sector in Poland

- low cost
- sound supply base
- quality standards
- highly qualified labour force
- long industrial traditions

Vehicles associations

Polska Izba Motoryzacji (Polish Chamber of Automotive Industry – PIM)

http://pim.org.pl/pub/english/automotive.html

The Polish Chamber of Automotive Industry is a nation-wide business sector self-government institution with members from all entities involved in the Polish automotive industry. The chamber was founded in April 1994 and operates on the basis of its charter and the Act on Chambers of Commerce of 1989. Since 1996 the chamber is a member of the Polish Chamber of Commerce.

Members:

- parts and components producers
- workshop equipment and tool producers and distributors
- car dealers
- authorized service stations
- unaythorized repair shops

- unions and associations
- publishers

Goals and Assignments

1. Representing and supporting the interests of automotive industry entities associated with the chamber.

2. Inspiring the creation of legal acts associated with entrepreneurship, motorization.

3. Improvement of traffic conditions and automotive infrastructure as well as presenting opinions on these acts.

4. Co-operation with local and central government entities as well as business and communityorganizations in creating better conditions for the development of entities functioning in the automotive sector.

5. Collecting, providing and publishing information associated with co-operation, organizational structures and financing.

6. Promoting companies associated with the chamber as well as their goods and services.

7. Organizing business co-operation with domestic and foreign partners.

8. Co-operation with chambers of commerce in other countries as well as international organizations operating in the automotive sector.

9. Promotion of moder management methods and use of the most modern equipment.

10. Organizing conferences, symposiums, training seminars and executing publishing activities.

11. Co-operation in preparing trade fairs, equipment presentations and economic missions.

12. Organizing vocational training courses in the automotive sector.

The Polish Chamber of Automotive Industry maintains a database entitled „AUTOINFO" which contains information on companies operating in Poland. The main part of the database consists of materials gathered by the chamber on automotive parts and components producers, dealers and authorized service stations. In addition to this, the database contains information on car producers and importers as well as automotive trade fair and exhibition organizers. In total, the database contains over 4,000 entries.

The Polish Automobile & Motorcycle Federation http://www.pzm.pl/index_en.asp

The Polish Automobile & Motorcycle Federation (PZM) is the Federation of associations acting on the basis of Law pursuant to associations (Law dated of 7 April 1989) associating members and fans of motorization in over 283 automobile clubs and motor & tourists clubs. The Polish Automobile & Motorcycle Federation was founded 30 January 1950 after the Automobile Club of Poland (was founded in 1920) has merged with the Polish Motorcycle Federation (in 1924).

PZM continues tradition of these two organisations. Hence, the date of forming PZM is the date of the establishment of the Automobile Club of Poland and the Polish Motorcycle Federation that is in 1921 after the First World War.

PZM affiliates sport and tourist clubs such as automobile clubs, motorcycle clubs and sections and speedway and carting organisations.

All in all, there are over 283 clubs affiliated to PZM with some 96.000 physical persons being their members. PZM has been granted by the Government The highest title of social organisations the title of an association of higher public services.

The main objects of PZM's activity as described in the Statute, are as follows:

- integration of associations working for motorization;
- promotion of the knowledge about the auto & motor, especially auto, motorcycling, carting, speedway and organising events and competitions;
- popularisation of traffic regulations and promoting of safety traffic regulations and environmental protection;
- promotion and programming of tourism for motorised people;
- co-operation with appropriate bodies of the state Administration and the implementation of its own propaganda and educational activity with a view to improving traffic safety;
- expansion of amateur and professional motor sports;
- development of motor tourism both in Poland and abroad;
- protection of interests of car and motorcycle users.

FORS association forum of vehicles' recycling. http://www.fors.pl

FORS is a member of the European association EGARA (European Group of Automotive Recycling Associations.

Industrial Research Institute for Automation and Measurements – PIAP

http://www.piap.pl/piap/english_version/about_us/general_information.php

was established in 1965 and from the beginning of its activity it realizes its basic task which is solving technical problems in various sectors of economy.

Main area of the Institute activity is implementation of specialised tasks within the scope of widely understood automation, robotization and industrial test equipment. Scope of PIAP competence includes: development, implementation and start-up at user's site and post-sales maintenance of:

- automated and robotized work centers and production lines
- new generations of control systems and drives for modernized production installations
- industrial measurement systems
- stations for visual process inspection
- monitoring and telemetry systems
- intelligent systems and mobile robots for special applications
- specialized test equipment
- installations for recycling of cars and household appliances (mechanization, automation, IT solutions)

We specialize in integration of large systems with components from various manufacturers.

Main recycling operators:

Scrapena S.A. www.scrapena.com.pl
Stena sp. z o.o. www.stenametall.pl
Baterpol sp. z o.o. www.baterpol.pl
Oiler sp. z o.o. www.oiler.com.pl

Others:

Used oil: Rafineria Jedlicze

38-460 Jedlicze, ul. Trzecieckiego 12

Car batteries: ZGF Orzel Bialy S.A.

Bytom, ul. Siemianowskiego 98

Tires: Eko-Tyres

05-800 Pruszkow, ul. Bohaterow W-wy 64

Laminated glass: DSS Recycling Sp. z o.o.

Slawkow, ul. Walcownia 2

Used oil filters: ALGADER

00-651 Warszawa, ul. Gwaizdzista 21

Electric wiring and small engines: WTORMET Bytom

41-922 Bytom, ul. Nalkowskiej 6

Trade of parts that can be reused:

Wyszukiwarka części z demontażu grupy ARES www.czesci.ambit.pl
Cześci z demontażu firmy Autokasacja www.presim.com.pl

A list of 223 dismantling points and 3 collection points whit their address and contact details available at http://www.fors.pl.

7. Marginal Cost Assessment

Future Unit Labour Costs (costs per person hour)

According to the OCDE, the evolution of the labour costs in manufacturing from 2000 to 2003 is as follows:

	2000	2001	2002	2003
Relative unit labour costs in manufacturing	100.925	104.875	94.464	77.014

7 CASE STUDY SPAIN

INTRODUCTION

The Directive is being transposed through:

- a National Plan for Control of End-of-Life Vehicles for the period 2001-2006, approved on 3 August 2001;
- Royal Decree 1383/2002 of 20 December 2002 on the management of vehicles at the end of their useful life, which transposes most of the ELV Directive;
- Ministry of the Interior 2586 Order INT/249/2004 of 5 February 2004, which regulates the deregistration of decontaminated vehicles at the end of their useful life.

SUMMARY

There is a producer responsibility. More precisely economic operators (manufacturers, distributors, dealers and importers) must assume responsibility for recycling and recovering of ELVs, at no cost to the final owner except for transport costs. Car and car components producers must guarantee take back installations throughout the country and can either manage this themselves or through integrated management systems. According to the National Plan economic operators and public authorities have to financially help dismantlers and shredders to fulfill the technical, environmental rules to obtain an authorisation but in reality there is no financing from producers to upgrade the facilities and only few dismantlers (around 25) have received subsidies from Spanish Autonomous Communities.

A management company, SIGRAUTO, was set up in 2002 by manufacturers and importers, dismantlers and recyclers, shredders. SIGRAUTO's objectives are to coordinate and facilitate the actions linked to the new ELV legislation such as inform where authorised dismantlers are located (Authorised Centres for Reception and Decontamination of vehicles CARDs at which all ELVs are to be deposited), ease the exchange of information between CARDs and car manufacturers and importers and shredders, try to find technical solutions to meet the 2015 targets.

The CARDs network is shared by all economic operators. By signing contracts with them CARDs have to accept all vehicles of their brands.

Even if the actual recycling is around 75%, the 2006 rates set by the Directive seem reachable. Research is actually going on about post shredder technology to improve the current rates by developing new technologies,

For 2015, SIGRAUTO is carrying out research projects with the agreement of the government who subsidises part of it.

DESCRIPTION OF THE IMPLEMENTATION OF ELV TO-DATE

1. Technical description of the system planned / implemented – institutional arrangements

The owner of an end-of-life vehicle must deliver it to an authorised treatment centre or reception facility, together with relevant identification documents. The authorised treatment centre will issue a Certificate of Destruction, which authorises the deregistration of the vehicle as of that date. The centre must, within two weeks of issuing a Certificate of Destruction, send a copy with supporting documentation to the regional Traffic Headquarters. Authorised Treatment Centres must apply for an electronic identification certificate prior to sending any Certificates of Destruction to the Traffic Headquarters. The Traffic Headquarters will send out a monthly invoice to the treatment centres for fees incurred on the vehicles that have been deregistered. Treatment Centres can pass on the fees payable for the notification of deregistration to the last owner of the vehicle. (source 1)

Before the implementation of the EU Directive there were few controls in the treatment sector. In 2001 around 3500 dismantlers existed (i.e. on average around 12 342 inhabitants58 per dismantler or around 286 ELV per dismantler). The majority of which was illegal with almost no environmental control. The dismantled pieces were reused or sold with no control and not depolluted. (source 2)

The National Plan provides for a nationwide network of at least 1,085 Authorised Centres for Reception and Decontamination of vehicles (CARDs), at which all ELVs are to be deposited but they can also be delivered to a reception facility (e.g. manufacturer's depot). Decontamination and removal of liquids and gases are carried out at the CARDs, as well as the separation of materials from the vehicle. Each waste product will then be sent to a specialised centre for reuse or recycling. Local authorities must deliver abandoned vehicles to a treatment centre for decontamination, without prejudice to compliance with regulations on traffic, the movement of motor vehicles, and road safety. (source 1)

A management company, Sigrauto, was set up in April 2002 by AEDRA, the Spanish Association for Automobile Dismantling and Recycling; ANFAC, the Association of Spanish Automobile and Lorry Manufacturers; ANIACAM, the Association of Spanish Automobile, Lorry, Bus and Motorcycle Importers; and FER, the Spanish Recovery Federation which groups the 21 shredders present in Spain. AEDRA has 530 affiliated dismantlers of which more than 300 are authorised as CARDs. SIGRAUTO's objectives are to coordinate and facilitate the actions linked to the new ELV legislation such as inform where CARDs are situated, ease the exchange of information between CARDs and car manufacturers and importers and shredders, try to find technical solutions to meet the 2015 targets.

After harmonizing the criteria used to grant the authorisation in the different Autonomous Communities, Sigrauto initiated in November 2003 a new agreement between the various stakeholders to provide a network of authorised treatment centres and since then, Sigrauto has set up contracts with more than 300 authorised centres and centres in the process of being set up for the reception and treatment of vehicles

[58] Based on 43.2 millions inhabitants and 1 million ELV treated in Spain

of all brands sold in Spain. This network of CARDs is shared by all economic operators (manufacturers, dealers, distributors, and importers). Contracts are signed with the CARDs that are disposed to take back vehicles of their brand and to work on a competitive basis.

Another recovery organisation, Ecopartes, was set up in early 2003 by SERNAUTO, the Spanish Asociation of Manufacturers of Equipment and Components for the Autmobile, to manage recovery of end-of-life parts and components. It has carried out a pilot project of collection and treatment of end-of-life components in Victoria. (source 1 and 3)

Operators carrying out treatment operations on ELVs must keep a statistical record of the ELVs treated. In the first quarter of each year a summary report must be sent to the Autonomous Communities in which at least the number and type of vehicles must be stated, together with the weight and percentages reused, recycled and recovered. Such information can be supplied directly or via a management company where there is a voluntary agreement or an integrated management system. In order to meet the requirement to supply information to the European Commission, Autonomous Communities must send a copy of the above reports to the Ministry of the Environment. (source 1)

2. Technical description of the system planned / implemented – physical arrangements

- The rate of recovery, recycling and re-use is estimated to be around 75%. (source 2)
- With the recovery of tyres and glass that will be generalised in 2006, the 85% rate should be attained. (source 2)
- For 2015, SIGRAUTO is carrying out research projects with the agreement of the government who subsidises part of it. These projects are confidential but Spain also expects that solutions will be found in other Member States. (source 2)
- Reporting and information by the actors of the system is recent. The government will thus be able to give the first quantitative results mid 2008. (source 2)
- 40% of the 17 million private cars in Spain are over 10-year old.(source 6)
- According to the Ministry of the Environment in 2001, around 1 million ELVs per year are expected during the next 5 years. (source 6)
- Tonnes of waste/components of ELVs between 2001 and 2006: (source 6)

  594 000 to 795 000 t of ferrous parts

  41 000 to 55 000 t of non ferrous material

  212 000 to 283 000 t of diverse materials (plastic…)

2500 to 3000 t of fuel

8000 to 11 000 t of oil

- Since 2005, 80% of oil lubricants should be recovered. (source 6)

3. Economic description of the system planned / implemented

Economic operators (manufacturers, dealers, distributors, and importers) must assume responsibility for recycling and recovering of ELVs, at no cost to the final owner except for transport costs (from 1 January 2007 for all vehicles and from 23 january 2003 for vehicles put on the market after that date). In order to comply with the obligation to take back vehicles of their brand and proceed to their depollution or dispatch them to authorised treatment centres, car and car components producers must guarantee take back installations throughout the country and can either manage this themselves or through integrated management systems which are voluntary agreements in which all economic agents may participate. (source 7)

Integrated management systems (i.e. collective organisations) must be authorised by the Autonomous Communities in which they are geographically located, and the authorisation must be published in the corresponding official bulletin. Applications for authorisation for integrated management systems must contain, as a minimum, the following:

- targets for reuse, recycling and recovery with corresponding deadlines, together with any additional environmental targets it is hoped to achieve. These targets must not be set at levels lower than those contained in Article 9 of the Royal Decree*;*
- financial mechanisms;
- mechanisms for monitoring, operational control and verification of the level of compliance with forecast ecological targets;
- identification of the entities to which the management of ELVs has been consigned and the self-financing of such a system;
- a system for gathering data and supplying information to the Autonomous Communities;
- information on reception facilities available in the geographical area in which it is planned to conduct operations.

Autonomous Communities may only grant authorisation when they can determine, from the documentation supplied by applicants, the level of compliance with the corresponding criteria for integrated management systems as set out in the Royal Decree, and their ability to meet the obligations laid down. (source 1 and 7)

According to the National Plan a scheme for co-financing of the activities linked to the management of ELVs should have been set in place in 2004 according to producer responsibility and shared responsibility principles. (source 6)

Economic operators (manufacturers, distributors, dealers and importers) are to help financing the necessary investments for the facilities to upgrade to the new legislation but in reality there is no financing from producers. (source 2 and)

If an ELV has a negative market value, the producer supports the corresponding loss or directly takes in charge the vehicle for dismantling. Economic actors of the system

have the possibility to ask for an independent evaluation of the value of different types of ELVs. (source 7)

The implementation of the ELV directive should result in no cost for dismantlers and shredders since they receive money from producers (see above) and subsidies from public structures (the government and Autonomous Administrations) for the investment due to backfitting with the transposition of the EU Directive but in reality they have had to make the necessary investments themselves. (source 2 and 6)

4. Collection of data on existing costs and income (from treatment sector)

Putting in place CARDs will cost/costed an estimated 263 746 million € of which the majority should have been paid by the producers and subsidies from the provincial authorities, state and EU. This corresponds to the investments dismantlers need to make to fulfil the technical, environmental rules demanded by the new legislation. (source 4)

The National Plan for Control of ELV for the period 2001-2006 assumes that the costs due to the implementation of the CARDs network will depend among other things on their size and number. A comparative economic analysis between three capacities (A: 2 ELVs/day thus 440 ELVs/yr treated; B: 5 ELVs/day thus 1100 ELVs/yr treated; C: 10 ELVs/day thus 2200 ELVs/yr treated) shows that the optimum is a centre that treats 5 ELVs per day. The following table shows an estimation of the costs of setting up the CARDs network for the three scenarios mentioned above. (source 6)

	Total Investments/Installation costs estimated (in Euros / CARD)		
Scenario	A	B	C
Fencing (180/220/284 m)	3 245.46	3 966. 68	5 120. 62
Paving (1500/2000/4000 m^2)	22 537. 95	30 050. 60	60 101.21
Labour costs	2 043.44	7 813. 16	14 304.09
Depollution area (50/100/200 m^2)			
Labour	9 255.59	18 030.36	34 918.80
Equipment	11 118.72	15 025.30	30 050.60
Dismantling area (100/200/400 m^2)			
Labour	23 920.28	43 152.67	82 218.45
Equipment	9 616.19	13 222.27	18 631.37
Office buildings (40/60/80 m^2)	16 227.32	24 641.50	33 055.66
Crane (1/1/2 units)	24 040.48	24 040.48	48 080. 96
Administrative costs	4 207.08	4 207.08	5 409.10
TOTAL	126 212.51	184 150.10	331 890.90

The following table summarises the total investments necessary to create the CARDs network throughout the whole country considering these hypothesis: (source 6)

I – 25% of the CARDs are type A, 50% type B, and 25% type C

Type of CARD	Number of CARDs	Installation costs in Euros
A	306	38 621 037,83
B	597	109 937 614,94

C	287	95 252 689,53
Total	1190	243 811 342,30

II – 40% type A, 50% type B, and 10% type C

Type of CARD	Number of CARDs	Installation costs in Euros
A	594	74 970 249,90
B	763	140 506 533,00
C	145	48 124 181,12
Total	1502	263 600 964,02

III – 7% type A, 69% type B, and 24% type C

Type of CARD	Number of CARDs	Installation costs in Euros
A	80	10 097 003,35
B	749	137 928 431,47
C	256	84 964 071,49
Total	1085	232 989 506,31

5. **National data on trade (i.e. import and export of new, second hand cars, ELVs) – identify origins / destinations of possible.**

In 2003, 3 029 826 vehicles, of which 2 399 374 were passenger cars, were produced in Spain and the numbers were 3 011 010 and 2 402 103 respectively in 2004. (source 5)

National parc of vehicles (source 8):

Years	Passenger cars		Light and Heavy trucks		Buses and coaches		Tractors		Total	
	Units	% growth	Units	% growth	Units	% growth	Units	% growth	Units	% growth
1999	16 847 387	5,0	3 604 972	6,2	53 540	3,3	130 216	12,0	21 007 423	5,3
2000	17 449 235	3,6	3 780 221	4,9	54 732	2,2	142 955	9,8	21 838 571	4,0
2001	18 150 880	4,0	3 949 001	4,5	56 146	2,6	155 957	9,1	22 766 429	4,2
2002	18 732 632	3,2	4 091 875	3,6	56 953	1,4	167 014	7,1	23 548 524	3,4
2003	19 293 263	3,0	4 198 662	2,6	56 613	-0,6	177 005	6,0	24 273 739	3,1

Age of passenger cars on 31 December 1999: (source 6)

Year of registration	Share (%)
Before 1983	16,89
1984	1,91
1985	2,34
1986	3,06
1987	4,42

1988	5,45
1989	6,19
1990	5,62
1991	5,20
1992	5,80
1993	4,47
1994	5,42
1995	5,02
1996	5,61
1997	6,36
1998	7,50
1999	8,73

Car exportations (source 8)

Year	2001	2002	2003
Units	1 791 265	1 823 675	1 961 071

6. Implications for administrative costs of securing higher rates

Research is currently being done in Spain on post shredder technology to attain 2015 objectives by SIGRAUTO who does not wish to reveal the details. This research is financed partly by the economic agents and by public subsidies. (source 2)

- Spain is also interested in the results of research in other Member States. (source 2)
- With the low landfill costs and the recycling industry situation, post-shredding technologies are not economically sustainable. In regards to energy recovery from ASR, part of the population does not want this type of facility. (source 2).

DATA SOURCES

1 – Transposition of the ELV Directive in the other EU member states, Perchards for the UK government, November 2004, http://www.arge-altauto.de/docs/DTI_ELV.pdf

2 – Manuel Kindelan, SIGRAUTO – Manager, October 2005 – Tel : +34 91 703 01 01 – sigrauto@sigrauto.com

3 – SIGRAUTO, http://www.sigrauto.com/home.html , September 2005

4 – Aprobado el Plan para el reciclaje de los coches viejos, El Mundo, http://elmundomotor.elmundo.es/elmundomotor/2001/08/03/usuarios/996855771.html , September 2005

5 – Organisation Internationale des Constructeurs d'Automobiles, http://www.oica.net/ , September 2005

6 – National Plan for Control of End-of-Life Vehicles for the period 2001-2006, Ministry of the Environment, 3 August 2001

7 – Royal Decree 1383/2002, 20 December 2002

8 – Association of Spanish Automobile and Lorry Manufacturers (ANFAC), http://www.anfac.com , September 2005

8 CASE STUDY UK

PART A: CURRENT MANAGEMENT OF ELVS

1. Description of the Policy & Institutional Structure (Current & Planned)

The ELV Directive has been transposed into UK legislation in two parts. The End of Life Vehicles Regulations 2003 covered Articles 4, 5 (in part), 6, 8, 9 and Annexes I and II of the Directive. They introduced:

- Restrictions on the use of certain heavy metals in the manufacture of new vehicles;
- The need for a Certificate of Destruction, which triggers the removal of a vehicle from the national vehicle register;
- A requirement that certain components are marked to aid recovery and recycling, and that information is provided to facilitate dismantling;
- The establishment of adequate systems for the collection of ELVs, and site, storage and operating standards that must be met by businesses permitted to treat ELVs.
- A requirement that ELVs can only be scrapped ('treated') by authorised facilities, which must meet specified environmental treatment standards (including the need for depollution).

Following a consultation on UK implementation of Articles 5 and 7 of the Directive, the DTI issued the End of Life Vehicles Producer Responsibility Regulations 2005, which complete the transposition of the Directive in the UK. These Regulations deal with producers' obligations in respect of ELVs in the UK, the network of take-back and collection facilities to be made available, and the achievement of re-use and recovery targets. They specify a framework within which producers are to be responsible for take-back, treatment, re-use, recycling, recovery and disposal of vehicles. To discharge this obligation, they are required to contract with authorised treatment facilities (ATFs) and with the reprocessing and recycling industries. An ATF can accept any vehicle from a last holder/owner, but producers are only obligated for vehicles which they have declared (or are assigned) responsibility, which enter their network of contracted ATFs. Each producer's network is to be approved by the DTI to ensure adequacy and accessibility of ATFs to last holders/owners.

The DTI leads on the implementation of most aspects of the directive, while Defra leads on implementation of Article 6.

The UK has been late in introducing the systems required to meet the 2006 targets, as current levels of recycling, reuse and recovery are not accurately recorded and no monitoring system is yet in place. The Government considered three options, based on protocol (defining the processes and thus calculating recycling rates based on input tonnages), consignment notes to monitor waste shipments, and full recycling evidence (with tradable recycling certificates as for packaging), before opting for a system based on consignment notes. The DTI is confident that monitoring systems will be

established to enable recording against the 2006 targets. These will be based on Certificates of Destruction, using an average vehicle weight to estimate producers' responsibilities, and a system of waste transfer notes to assess practice.

Sources of ELV Arisings

Approximately 2 million end-of-life vehicles (ELVs) arise in the UK each year. There are two broad categories of ELVs; relatively new cars which result from accident write-offs, known as premature ELVs (PELVs) and cars which have reached the end of their life naturally or natural ELVs (NELVs). Natural ELVs often arise due to MOT failures and have an average life of around 12 to 13 years.

The CIWM has estimated that 221,000 vehicles were abandoned in 2002/03, typically resulting in a cost to the local authority of £360 per vehicle to arrange environmentally friendly disposal (CIWM, undated).

Defra (2005) has estimated that 1.8 million vehicles are scrapped in the UK each year, of which:

- Around 1.2 million go to vehicle dismantlers in the first instance
- The remaining 0.6 million go directly to scrapyards

According to Defra, treatment facilities in the UK have sufficient technology to treat undepolluted ELVs, as required by the Directive. Some of these already met the increased requirements of the directive before the regulations came into force, as these measures build on the requirement of the Waste Framework Directive which came into force in the UK in 1995.

According to the MVDA around 200,000 to 300,000 ELVs per year are accident damaged vehicles. The vast majority of these are disposed of as a result of insurance claims.

ELVs may enter the processing chain through four principal sources: private individuals; garages; insurance companies; and local authorities (abandoned vehicles). The MVDA estimates that around 70% of ELVs enter the processing chain via vehicle dismantlers; the rest are processed by garages and scrap metal dealers.

Estimates by the European Automobile Manufacturers Association (ACEA) suggest that the UK may have to deal with almost 30% of all ELV arisings in Europe, because other member states have active markets in the export of second hand cars, especially to Eastern Europe. It is likely that ELVs will be exported outside EU altogether once Directive takes force, i.e. exported from Poland and Czech Republic to non EU countries. The UK is unusual in Europe in having few exports of 2nd hand vehicles, because vehicles are right hand drive as well as the UK's island position.

Treatment Sector

DTI (2003) estimated that there are:

- 36 vehicle manufacturers selling in the UK

- 9 vehicle producers in the UK
- 7,000 vehicle component manufacturers selling in the UK, of which 90% are SMEs
- 2,500 dismantlers, salvage operators, scrapyards and secondary metal merchants currently dealing with ELVs, typically SMEs. A further 500-800 sites may be operating illegally (i.e. without a waste management licence or exemption)
- 37 shredding facilities in the UK, half of which are owned by two firms. Shredders tend to be large businesses because of the high capital costs involved.
- 1200 reprocessors and recyclers in the UK, not all of which deal with materials from ELVs.

There are currently around 37 shredders operating in the UK, served by a number of feeder scrapyards. The SMMT has estimated that around 250 feeder yards cover 95% of the population. Between 60-80% of the existing shredding capacity is with two shredders. The Trade and Industry Select Committee on ELVs raised concerns over the competitiveness of the shredding market with the DTI, which was aware of the issue and was taking advice from the OFT on the matter. The Committee recommended that the DTI continue to monitor the competitiveness of the shredding industry after the Directive has been implemented to ensure that the market is operating competitively (House of Commons Trade and Industry Select Committee, 2001).

Current Practice

Prior to the introduction of the Directive, few of its requirements were satisfied completely by the UK treatment sector. In particular, the average ELV was not depolluted before being shredded (House of Commons Trade and Industry Select Committee, 2001).

In 1997 the industry consortium ACORD signed a voluntary inter-sector agreement on the treatment of ELVs. The agreement contained a commitment to improve the recovery of material from ELVs to 85 per cent by 2002 and 95 per cent by 2015. It was recognised that a lot of effort would be needed to ensure that new processes were implemented to make recovery of non-metallic materials, and in some instances, the energy value contained in them, considerably more effective (SMMT, 2002).

There are no official estimates of ELV arisings in the UK. Industry data on arisings and current practice for the year 2000 has been provided by ACORD (2001). However, it is widely agreed that these figures are not 100% accurate and other sources provide slightly different estimates. ACORD estimated a total of 2.017m ELVs in 2000, of which 1.832m were cars and 0.185m vans. The average weight of a vehicle was just over one tonne, resulting in waste arisings totalling 2.1m tonnes (Table 1).

Table 1: Arisings and Treatment of ELVs

		1997	**2000**
Number of ELVs (units)	Cars	1,700,000	1,832,431
	Vans	200,000	184,706
	Total	1,900,000	2,017,137
Average weight (kg)		1025	1030
Weight of Vehicles (tonnes)		1,947,500	2,078,000
Weight of part exchanged core units	Engines/gearboxes	60,000	30,000
Total weight of waste material		2,007,500	2,108,000
Weight of parts re-used		207,000	240,000
Weight of metals recycled	Ferrous	1,200,000	1,290,000
	Non Ferrous Shredder	34,000	72,000
	Non Ferrous engines	n/a	20,000
	Non Ferrous dismantler	22,000	20,000
Weight of non-metals recycled	Tyres	8,000	4,000
	Fluids (inc fuel)	45,000	40,000
	Batteries (inc plastic)	10,000	10,000
	Plastics	1,000	1,000
	Glass (shredders)	500	3,000
		1,320,500	1,460,000
Total re-use and recycling	Tonnes	1,527,500	1,700,000
	%	76%	80%
Landfill	Tonnes	480,000	408,000
	%	24%	20%

Source: ACORD (2001)

According to ACORD's 2001 annual report, around 80% of this material is already recycled or recovered. This consists mainly of the ferrous and non-ferrous metals. However, in 2000 it was estimated that 3,000 tonnes of glass, 40,000 tonnes of vehicle fluids, 10,000 tonnes of batteries, 4,000 tonnes of tyres and 1,000 tonnes of automotive plastics were recycled from ELVs.

The composition of a car is changing, with the introduction of lighter, more fuel efficient materials such as plastics. ACORD has compiled data on the materials in ELVs. In 2000 the average weight of a car was 1142kg. The material breakdown of an average passenger car for 2000 is shown in Table 2.

Table 2: Composition of an Average Car, 2000

Material	Average weight (kg)	% by weight
Ferrous metal	780	68.3
Heavy non-ferrous material	72	6.3
Light non-ferrous material	17	1.5
Electrical/electronic	8	0.7
Fluids	24	2.1
Plastics	104	9.1
Carpet	4	0.4
Process Polymers	12	1.1
Tyres	40	3.5
Glass	33	2.9
Battery	13	1.1
Other	17	1.5
Total	1142	100

Source: ACORD (2001)

TRL (2003) estimated ELV arisings of 1,983,340 tonnes in the UK in 2000, comprising:

- 68% (1,348,671 tonnes) ferrous metal
- 8% (158,667 tonnes) non-ferrous metal
- 10% (198,334 tonnes) plastics
- 2% (39,667 tonnes) rubber
- 3% (59,500 tonnes) glass
- 9% (178,501 tonnes) other.

Other sources suggest that ACORD figures need to be treated with some caution as they are estimates from a desk and consultation exercise rather than a full survey. The real figure for recycling, reuse and recovery is only now in 2005 likely to be approaching 80%. A DTI study involving shredder trials has concluded that metals constitute 75% of ELVs by weight and that 100% of these are recycled, leaving a further 10% of arisings to be recycled, reused or recovered to meet the 2006 target. Some recycling of other waste streams (oil, fuel, parts etc) takes place but this is considered to account for only up to 5% of the waste stream.

Thus current best estimates for 2005 are that rates of recycling, reuse and recovery are around, or just less than, 80%, comprising 75% metals recycling, 1-2% reuse of non metallic parts such as wing mirrors and seats, and 3-4% recycling of fluids, batteries and tyres.

2. Current Costs and Income

Unit Treatment Costs

One of the main impacts of the ELV Directive has resulted from the depollution of ELVs. The House of Commons Trade and Industry Select Committee (2001) concluded that there was some consensus that this would amount to around £40 per vehicle. The DTI consultation paper's draft regulatory impact assessment looked at the Dutch system for recycling where costs of treatment and recycling in 2000 were equivalent to around £50 per ELV.

Income from ELVs

There are two key components to the value of ELVs: whether they contain any usable parts that may be removed and sold for profit; and whether the metals they contain can be profitably recycled. In general, PELVs are used to provide spare parts for reuse, while NELVs only supply scrap metal.

Net income per ELV declined in the late 1990s due to a decline in the world steel price. The House of Commons Trade and Industry Select Committee (2002) reported that the market value of a NELV at the point of entry into the recycling chain was currently negligible, zero, or even negative, encouraging an increase in abandoned vehicles. The price of scrap metal dropped from around £35 per tonne in 1998 to around £10 per tonne in 2002. As a result, local authority figures suggested around 350,000 cars were dumped in 2000, a 4-5 fold increase on numbers recorded a few years previously (House of Commons Trade & Industry Select Committee, 2002).

More recent evidence suggests that increased steel prices, caused by growing global demand, have increased the value of end of life vehicles such that the treatment sector is now paying to take them once again.

PART B: TECHNICAL REVIEW

3. Changes To-date in the Design & Treatment of Vehicles & ELVs

Producers

Various industry initiatives are in place to promote the recycling of ELVs (DTI, 2002):

- The Automotive Consortium on Recycling and Disposal (ACORD) was established in 1991 to develop and implement a voluntary industry strategy to improve the management of ELVs. The ACORD agreement was signed in 1997 by industry and materials trade associations to improve the recycling and recovery of ELVs.

- The Consortium for Automotive Recycling (CARE) is a collaborative project involving the main UK motor manufacturers and importers and vehicle dismantlers. Its objective is to research and technically prove ELV materials re-use and recycling processes. CARE has undertaken a variety of projects including improving depollution techniques to increase recovery of oils and fluids; trials to collect, regrind and recycle polypropylene bumpers and analysis of shredder residues to determine contamination levels and potential processing necessary to convert it into a usable fuel. CARE sees its role in the next two years as to promote co-operation between manufacturers and the treatment sector to ensure that they work together towards the recycling targets.

- The International Dismantling Information System (IDIS) is a software tool developed by the major automotive manufacturers to make the recycling of ELVs more effective. The software contains information on the component parts of vehicle models, including how the parts are fixed, material, weight etc. The tool is designed to assist in the dismantling of vehicles and the subsequent recycling of ELV parts.

Changes introduced by producers pre-date the directive, as a result of the earlier voluntary initiative implemented by the industry (ACORD). Vehicle manufacturers have dedicated technical centres engaged in the research and development of new models. Their work is focused on ensuring vehicles meet future legislative requirements. As a consequence, improved recyclability and easier dismantling have been key objectives for some time, but these have also to be balanced by efforts to improve passenger and pedestrian safety, reduce emissions, improve fuel efficiency and continually improve quality and reliability. Design for recycling seeks to minimise the number of parts used and avoid the mixing of plastic parts in an assembly. Component attachment methods are designed to speed dismantling with pull out rivets replacing screws, where possible. The majority of ferrous and non-ferrous material used in vehicles has a high-recycled content. Vehicle component engineers are increasingly specifying plastic parts to have a post consumer recycled content. Engine compartment plastic, heating ducts and air intake grills are typical uses of recycled plastic. Examples include mud flaps that are made from recycled polypropylene and the soundproofing using recycled textiles. These and other applications are an increasing feature of new model programmes.

To aid recycling at end of life manufacturers have created dismantling manuals for all new cars and older models. These manuals provide a detailed depollution and dismantling process that describes the types and quantities by weight of fluids and materials to be removed and includes information on tools and methods. This dismantling information is also available in a CD-ROM package from The International Dismantling Information System (IDIS). Manufacturers from Europe, Japan, Korea and the US have created a database for the correct pre-treatment and dismantling of their past and current models. The dismantling manual describes the type of plastic used in the construction of a component. In conjunction with this all plastic parts over 100 gm in the vehicle have a material type code incorporated in the moulding tool. This mark is in accordance with international standards for plastic identification. This helps the

recognition and separation process and can allow for discreet material recovery streams at the dismantler (SMMT, 2002).

Most manufacturers are reluctant to talk about the costs of changes in vehicle design as this is commercially sensitive information. Restrictions on use of heavy metals introduced some one-off costs through changes in design and manufacturing processes, though ongoing costs are small. There was some concern that the Directive would result in unusable stocks of vehicle components which would need to be written off, though derogations have helped to reduce these.

IDIS involved some set up costs and typically requires each manufacturer to employ one member of staff charged with maintaining the software and distributing information.

The MVDA and BVSF believe the key to achieving the 2015 targets lies with the motor manufacturers to ensure the design and materials of vehicles facilitate the recycling process. However the MVDA also questioned the feasibility of these changes taking place by 2015. It was perceived as more likely that the process could take up to 25 years, allowing 10 years for the research, design and implementation of recycle-friendly design and materials, followed the expected average lifespan of an end of life vehicle of approximately 15 years.

Treatment Sector

The requirement for depollution of ELVs has imposed significant extra costs on the treatment sector, through:

- Provision of impermeable surfaces (where these do not exist or are inadequate)
- Provision of systems for the separate drainage and storage of fluids from ELVs
- Installation of new depollution rigs, and, on some sites, new buildings to house depollution equipment and permit operations in all weather conditions.

While there was initial concern about the lack of capacity for depollution and the level of investment required, the industry has responded to the need for authorisation and investment in depollution, and authorised treatment facilities are now listed on the Environment Agency website. There is sufficient treatment capacity in place to treat all of the ELVs arising in the UK, and treatment companies unwilling or unable to invest in such capacity have been forced to close. The BVSF represents over 85% of vehicle salvage companies in the UK and reports that most members have invested heavily in new premises, new impermeable surfaces and de-pollution equipment. The BVSF commented that the changes have made the industry far more professional, with ATFs now not dissimilar to vehicle assembly lines.

Re Use

TRL (2003) found that the most commonly reused items at dismantlers were:

- Wheels (steel/alloy)
- Engines

- Gearboxes
- Spare parts such as carburettors, alternators, starter motors, distributors, headlamps, quarter glass, brake discs and brake callipers
- Tyres
- Radiators
- Batteries
- Other spare parts depending on condition and marketability.

A larger proportion of parts from premature ELVs than natural ELVs are reused. TRL's study of dismantlers estimated that these proportions are 47% by weight for PELVs and 9% by weight for NELVs.

Shredding and Landfill

ELVs are shredded (often in combination with other sources of metals) and fragments sorted into ferrous metal, non-ferrous metal and shredder residue. A shredder is able to recover the majority of the metal content (ferrous and non-ferrous) of a vehicle by its magnetic and density properties. The non-metallic fraction (shredder residue) is not currently recycled in the UK, and comprises materials such as plastic, foam, glass, rubber and textiles. This is currently landfilled. Up until January 2002, before undepolluted vehicles were classified as special waste, many of the ELVs entering shredding facilities contained significant quantities of potential environmental pollutants. These included materials such as used lead acid batteries, lubricating oils, brake fluid, coolant, fuel and tyres. However, shredding facilities are now demanding that depollution activities are carried out before vehicles will be accepted for shredding (unless facilities are available to depollute vehicles on site, TRL, 2003).

BMRA estimates are that 1.8m tonnes of ELVs are processed by UK shredders, producing 1.3m tonnes of ferrous product (72%), 72,000 tonnes of non-ferrous product (4%) and 428,000 tonnes of shredder residue (24%)(TRL, 2003).

4. Technical Options for Increasing Rates of Re-Use, Recycling and Recovery

ACORD (2001) estimated rates of reuse and recycling at 80% in 2000, while TRL (2003) estimated them at 76.9%. This suggests a need for an additional 5-8% of ELV arisings to be recycled or re-used by 2006 compared to 2000 levels, to meet the needs of the Directive.

TRL (2003) has provided summary estimates of current arisings, reuse and recycling rates as follows (Table 3).

Table 3: Estimated Arisings and Treatment of Different Fractions, 2000

Material/component stream	Estimated % material composition of an ELV*	Estimated current recycling, reuse and recovery as % of the total tonnage of ELV arisings in 2000	Estimated current recycling, reuse and recovery as % of estimated individual material arisings in 2000
Components sold for reuse (including reuse of tyres)	n/a	6.69%	n.a
Ferrous Metal	68%	63.73%	93.7%
Non Ferrous Metal	8%	4.22%	52.7%
Plastics and Process Polymers	10%	0.10%	1.0%
Tyres (excluding reuse)	3%	1.63%	54.3%
Glass	3%	0.10%	<3.3%
Batteries	1%	n/a	n.a.
Fluids	2%	0.40%	20.0%
Textiles	1%	~0%	~0%
Rubber	2%	~0%	~0%
Other	2%	Unknown	Unknown
Total	**100%**	**76.87%**	

Source: TRL (2003)

ACORD estimates are generally considered generous and it is widely felt that current rates are only now approaching 80%, suggesting a need for a significant step up to meet 85% target in 2006.

Current practice and options for different components (from Waste Online, 2004; DTI, 2002; Cleaner Vehicles Task Force, 2000) can be summarised as follows.

Metals

At least 98% of metals are recycled. Shredding facilities process large tonnages of loose light steel, including crushed ELVs but also white goods and other metal-rich products. The main output is shredded steel for use in the steel industry.

The material content of vehicles has changed considerably in the past 20 years, and the metal content has declined as a result, as manufacturers aim to reduce the weight of vehicles to decrease fuel consumption. Traditional metals have therefore been replaced by plastics, or lighter metals such aluminium, where possible, to reduce the overall weight. As a result the proportion of metals included in the total vehicle weight has fallen, a trend that is likely to continue. This highlights the importance of looking at the ways and means of recycling the more difficult components such as glass and plastics in order to continue to increase the recycled and recovered weights to reach ELV targets.

Plastics

The % of weight of ELVs accounted for by plastics is increasing, and is now approximately 11%, as car manufacturers continue to design lightweight vehicles to improve fuel efficiency. There are currently very low rates of recycling due to wide variety of polymer types used, and increasing recycling rates is a priority if targets are to be met. Identification by marking components at production stage is helpful in facilitating recycling, though studies suggest that most progress will be needed at the post shredder rather than dismantling stage.

The majority of plastic material from an ELV arises at the shredder as shredder fluff. Once part of this mixture it is very difficult to extract the plastic for recycling, however the removal of plastic components from ELVs prior to shredding is labour intensive and, therefore, costly. It is estimated that 195,000 tonnes of plastics originating from ELVs was sent to landfill in 2002 (Plastics Reprocessing Validation Exercise, Prove, Jan 2005).

Plastic recycling is affected by a number of factors (DTI factsheet on Plastics). Essentially it is dependent on the plastic waste arisings being clean, segregated by polymer type and in relatively high volumes to allow recyclate to compete with virgin polymer.

Recycling plastics includes:

- Regrinding and reprocessing plastics for reuse as 100% recycled grade, or in blends with virgin plastics
- Recycling bumper material into new bumpers, mountings, fascias and carriers;
- Recycling battery cases for new batteries, crates and land drainage systems (Cleaner Vehicles Task Force, 2000).

One of the few plastic parts currently recovered from ELVs is battery cases, accounting for 5,000 of 14,000 tonnes of automotive plastics recycling in 1998.

The most common plastics types used in the automotive industry are polypropylene (PP), polyethylene (PE), polyurethane (PU) and polyvinylchloride (PVC). PP accounts for approximately 41% of all car plastics (common in bumpers, wheel arch liners and dashboards), and like PE and PU (most common in seat foam) it is easily recycled and viable markets for PP, PE and PU from non-automotive sources already exist. PVC makes up about 12% of the plastics content of an average 1990s vehicle. PVC is relatively difficult to recycle, and there are currently no large-scale recycling schemes

operating for post-consumer PVC. Alternative disposal methods such as incineration have raised a number of environmental concerns including dioxin emission during incineration and the use of phthalate plasticisers, which are thought to be disrupters of hormone systems. Nevertheless, this is likely to change due to proposals for a European Directive on the disposal of PVC and car manufacturers are currently looking for alternatives to PVC.

The 'Prove' project, initiated by the CARE Group together with the Automotive Recycling Task Force of the British Plastics Federation, has demonstrated that recyclate from post consumer sources could be recycled into a specified engineering grade plastic which could be used to manufacture new components. However supplying components produced from recyclate to the automotive industry would involve extensive testing to ensure compliance to a specified standard. This process would be expensive and is likely to be a key barrier to widespread acceptance. This testing could feasibly be reduced if there was confidence that the recycled plastics did not contain high, or variable, levels of heavy metal contamination, and also if a shortened test protocol could be developed based on key performance indicators.

A research project undertaken by Prove aimed to test the feasibility of dismantling plastic components from vehicles prior to shredding, whilst testing the plastics for contamination. The report did not include the removal of bumpers as this has been covered in a separate CARE study, 'Plastic Bumper Recycling Report 2004'. The CARE bumper report suggests that recycling ELV bumpers is only just viable. Given that the bumper is the single largest plastic component on a vehicle and is easily removable, and is still only just economically viable, it is doubtful that the recycling of other plastic components, which will inevitably be smaller and take longer to remove, will be feasible.

The Prove research tested a sample of 20 vehicles all manufactured in 1990, to match the current average ELV age of 14 years. The vehicles were selected from the most popular new car registrations for 1990. The average plastic yield rate per car was 2.6kg, as material was only removed if that material was readily available and could be removed within a reasonable period of time (approximately 10 minutes per vehicle). This yield rate of 0.26kg per minute, equates to £384 per tonne (assuming a labour cost of £6 per hour and excluding transportation costs). The report states that recovery of the next 2.5kg of plastic would be likely to take twice as long and equate to a cost of £700 per tonne. In many cases, the time taken to extract appreciable quantities of material prevent this from being an economically viable activity for the dismantling industry (JEMA, 2005).

The Prove report suggests that plastic recyclate obtained from ELVs has the potential to be used as a feedstock for incorporation into recycled grade material for automotive or non-automotive uses. However the recyclate could not be used at a 100% level because of inconsistent processability and metal contamination.

A University of Brighton research report, Diversion from Landfill: Mechanical Recycling of Plastics from Materials Recovery Facilities and from Shredder Residue, by Hooper, Potter and Singh (2001), found that by using a simple sink/float technique it was possible to separate the vast majority of plastics from shredder residue, "a highly complicated mixture of materials". The research found the resin appeared ideal for reclamation and was of sufficient quality to potentially become another "high-end" product, such as an automotive component. This approach could assist vehicle

manufacturers in meeting their voluntary agreement to incorporate a minimum of 25% recycled plastic back into new vehicles.

If the recycling of plastic components from ELVs is to succeed, it is important to establish a collection system for ELV material, to collect material dismantled prior to shredding or after the ELV has been shredded. The dismantling of plastic components prior to shredding is likely to be labour intensive and costly in terms of logistics due to the number of Authorised Treatment Facilities. The collection of shredder fluff would improve the logistics expense (due to the smaller number of shredding sites in the UK) but this approach would have to overcome the problems of removing plastics from the shredder fluff and also segment the plastics according to plastic type.

The Prove report suggests that to ensure a higher viable volume of plastic recyclate is suitable for use, it might be that the plastic should be used for non-automotive industries where specifications are less onerous. Plastic materials meeting automotive specifications can command a high price but do have to undergo rigorous testing which can take up to 12 months.

However an independent poll commissioned by Prove in 2003, suggested that only a third of automotive companies were aware that sufficient volumes of plastics could be sourced from ELVs and only a quarter were aware that recycled plastics could be cheaper than virgin material.

Recoup (2002) has published data on the main car parts using plastics, types of plastics used and weight in average car.

Technologies designed to separate plastics from shredder residue have been developed, or are being researched by:

- Galloo Plastics, linked to Galloo metals, the Belgian/French shredder operator
- SALYP, a Belgium based company
- University of Delft, the Netherlands
- MBA Polymers, USA
- University of Brighton.

Emphasis has been put on extraction of polypropylene, as this is the largest fraction of automotive plastics. These do not yet work commercially – the only commercially viable uses for plastics relate to those separated during the dismantling process.

Most recycled plastics are used for low value applications e.g. plastic lumber, outdoor furniture, plant pots, but research by University of Brighton and others is investigating higher value uses e.g. in automotive sector.

Work on bumper recycling by Brighton University for CARE has investigated ways of increasing the quality of the plastic product by minimising the degree of treatment that bumpers receive (as the more the waste stream is treated, the more its quality declines). While the quality of the recycled product is not sufficient to allow it to be

used in cars, it is suitable for use in trays used in warehouses and production lines in the automotive sector, and can be cost competitive with reground material.

Fluids

Increasing amounts of waste oil are being recovered and recycled, but less than a third of waste oil produced by the DIY motorist is recycled. Much of the waste oil collected for recovery in the UK is processed (by removing excess water and filtering out particulates) and used as a fuel burnt in heavy industry and power stations. However, stricter emissions controls could restrict this – the preferred option is therefore refining for use as a lubricant, though this does not currently occur on large scale in UK. Oil filters can retain large amounts of waste oil – this can be recovered using special filter presses prior to recycling.

Catalytic converters

Catalytic converters are made up of a stainless steel box housing a catalyst containing ceramic or metallic substrates, with active coatings of alumina, ceria and other oxides, and combinations of precious metals – platinum, palladium and rhodium. An industry has grown around the need to remove catalytic converters from ELVs, separate the catalytic element and remove the precious metals. In the US, catalysts have been used for 25 years and recovered platinum now accounts for over one third of the platinum used in new catalysts. In the UK, catalytic converters have been used in all petrol cars since 1993, so increasing numbers of catalytic converters are being recycled. Platinum, rhodium and palladium can be recovered for reuse, and there is a good market for this. The ceramic casing can be recovered as a powder for refining. Steel from the exhaust can also be recycled.

Batteries

Recycling rates exceed 90% through an established system for collection and recovery. However, some scrap cars still contain batteries when shredded. The average car battery weighs 13.5kg and contains 8.6kg lead, 3.8kg sulphuric acid and 0.7kg polypropylene. Incorrect disposal is an environmental hazard, and incineration leads to release of lead into the air.

Secondary Restraint Systems (airbags and seatbelt pretensioners)

Airbags became standard in vehicles only in 1993. They do not contain high value materials, and recycling is not a viable option; re-use is currently not an option due to high product specifications and specialist installation procedures.

Glass

Around 3% of the weight of an ELV is glass, in the form of laminated and toughened safety glass. Estimated arisings have been put at around 55,000 tonnes by several studies, most of which is landfilled. Two types of glass are used – toughened and laminated. Toughened glass is easy to remove from vehicles after shattering. Laminated glass does not shatter and needs to be removed manually, which is time consuming. The UK currently recycles some vehicle glass, although the majority of ELV glass is sent to landfill. Dismantlers do not generally remove glass from ELVs prior to being sent to shredders as the removal of the glass is time-consuming and the

value of glass waste is relatively low. According to a recent report by CARE the value of glass from one ELV is around £0.48. In order to cover current costs 15 vehicles/hour would need to be processed, which is not feasible using current methods.

Pilkington Glass told the House of Commons Trade and Industry Select Committee that 1.8 million cars could theoretically yield around 54,000 tonnes of used glass or 'cullet'. This potential raw material feedstock will have to compete with virgin raw materials that cost around £35 per tonne, and existing cullet that costs around £30 per tonne. The calculated costs for producing ELV cullet would be between £215 and £233 per tonne.

The ease of removing the glass at the dismantling stage is dependent upon the method of sealing the glass in place during manufacture. The use of rubber seals makes the glass removal process comparatively easy compared to the direct bonding method. In the case of rubber seals the whole window can be removed, but the more common 'direct bonding' process means the most effective method of removal is to cut a disc of largest possible size from the window, therefore leaving a significant proportion of glass in place. There can also be problems removing glass from door windows due to the locking mechanisms. As a result, CARE studies have estimated that a realistic figure for the amount of glass that can be recovered is 19,000 tonnes per annum.

The removal of bonded glass takes an average of 5 minutes per vehicle, according to CARE, at a cost of between £2.50 and £3.50. The current market price for cullet ranges from £5 per tonne to £45 per tonne depending on quality, making recycling economically infeasible at present. CARE data suggests that the cost of glass removal is at least £102 per tonne, and could be as high as £389 per tonne. The lower figure is based on the lowest dismantling cost of £2.50 per vehicle and the maximum potential stream of 52,000 tonnes, and excludes secondary costs of transportation and reprocessing. The higher price of £389 per tonne is based on the higher dismantling cost of £3.50 per vehicle and the minimum potential stream of 19,000 tonnes of glass cullet per annum. The inclusion of transport and processing costs would increase these costs further.

There are two routes for recycled ELV glass – primary, glass-making markets and secondary markets. The main sectors in the primary markets are container, flat and fibre glass manufacture. The container sector is probably the only sector that consumes a significant proportion of the total possible and this is primarily due to the green glass making industry, (whilst there is still room for improvement in the amber and clear glass making sectors). The other glass sectors are severely limited by quality specifications and as such tend to source recyclate from downstream processing rather than post-consumer supplies but continually aim to increase this where possible. These sectors consume an estimated 727,000 tonnes of waste glass per annum, at an average estimated price of £25 per tonne (CARE figures).

The main secondary market for the re-use of glass cullet is the aggregates industry. There is significant potential for the aggregates sector to consume far more of the UK's waste glass stream than it does at present. Glass can be used in road construction, as a concrete additive, in decorative applications, and potentially as a replacement for sand used in sports turf applications and golf courses (these sand replacement uses could potentially consume more than 500,000 tonnes per annum). The aggregates industry currently uses 150,000 tonnes of glass cullet per annum, but CARE estimates

potential volume could exceed 1 million tonnes per annum. The market price is low at between £5 and £10 per tonne, and an Aggregates Tax of £1.60 per tonne was introduced in 2002 to encourage the use of recycled materials. However low-grade (often contaminated) glass cullet is reported by CARE as being able to compete with these prices. This glass must be very finely ground and crushed to avoid the silica reacting with the alkali in the cement.

The filtration of water for drinking and waste water purification currently only consumes a few hundred tonnes of glass cullet per annum but has potential to use much greater volumes as a replacement for sand, ranging from 175,000 to 220,000 tonnes per annum (CARE figures). CARE reports that high specification glass cullet could compete with the current market prices of sand for filtration of between £50 and £125 per tonne, although there are concerns over the silica content of glass.

Glass cullet can also be used as a substitute for a variety of abrasives, including blast abrasives, bonded abrasives and frictionaters. At present only 3,500 tonnes of glass cullet are consumed in this market per annum due to insufficient supplies of competitively priced glass. However potential volumes are estimated at between 10,000 and 50,000 tonnes per annum (CARE figures) despite the fact that the abrasives market is in decline.

There is significant future potential from the brick and ceramics industries to use glass as a fluxing agent to bind with clay in the production of bricks and ceramics due to the sodium oxide found in most glass. The UK ceramics market has the potential to use 20,000 tonnes of waste glass per annum, in addition to volumes that could potentially be used in the brick making industry. It is not clear whether this would be cost effective as CARE estimate the benchmark cost of glass to be £16 per tonne, and the glass would be required to be fairly good quality compared to the aggregates industry for example. However energy consumption by brick manufacturers is of particular importance due to the Climate Change Levy. The inclusion of 5% glass has potential cost savings and the benchmark cost for glass could rise to £32/tonne and this price would allow glass cullet to be cost competitive with virgin materials. In the ceramics industry glass would have to compete with the traditional materials, which cost around £70 per tonne.

There are also a range of niche markets and potential markets for waste glass which include paint filler, zeolites, foam glass and glass tiles. Potential volumes are often small in comparison with those described above but the market price of the glass is often significantly higher, in industries producing high value products but also using lower quality cullet. Many industries are remain undeveloped in the UK, and others have significant potential for growth, such as the paint filler market which is only small at present, whilst the use of waste glass in zeolites is currently in the development stage, and there are currently no UK producers of foam glass at present with the main market players in North America and Europe.

The foam glass market is ideally suited to consume contaminated glass which would include glass from ELV sources and has great potential. It is estimated that a 1% penetration into the UK market would allow this industry to consume 50,000 tonnes of waste glass per annum. There has been increasing research on the feasibility of penetration of the foam glass market into the UK and there is significant potential for this to occur in the near future although currently there is no manufacture in the UK as the cost of setting up a facility is too high.

Problems associated with glass re-processing include the contamination from other waste sources such as plastics, stones, metals, ceramics, and different coloured glass. Contaminated glass is useless in many glass industries and businesses are concerned about wasted costs in purchasing glass at risk of contamination. The greater the degree of breakage the more difficult it is to assess the degree of contamination within the waste stream, which highlights the importance of removing glass from ELVs without causing breakage.

If the above prices for glass cullet are infeasible, it might be necessary to look towards alternative technologies in order to reduce the cost of glass removal. Assuming a market price of £45 per tonne, these new technologies would have to reduce the cost of glass removal to £1.10, based on the potential stream of 52,000 tonnes per annum, to become economically feasible, according to CARE. This would require glass removal costs to fall to below half their current level and is the best case scenario. Assuming the realistic potential stream of 19,000 tonnes per annum, the cost of glass removal would have to fall to £0.40 per vehicle. These necessary reductions in cost are so significant that it is questionable that removal at the dismantling stage will ever be viable.

The costs of removal could be reduced by taking steps in the manufacturing stage to ease the removal of glass at the end-of-life stage. Directly bonded glass is currently adding time to the glass removal process, and making this process less efficient due to the large proportion of glass left attached to the vehicle and not recycled. Using a different method of attaching glass to the vehicle would not only reduce costs of removal but also increase the potential tonnages of glass available.

Tyres

Around 3.5%, or 40kg, of the weight of an average ELV is tyres. According to 1999 statistics, around 55,000 tonnes of tyres arise from ELVs. Most waste tyres come from cars in use rather than ELVs, as each car uses an average of 17 tyres in its lifetime. Simply because the vehicle is an ELV does not mean that the tyres are worn out. Around 40% of ELV tyres are generally reused, mainly as part worn tyres, but also as retreads, although the market for retreads has suffered in recent years. The majority (60%) of ELV waste tyres are still sent to landfill. The Landfill Directive requires the UK to ban the landfilling of virtually all tyres by 2006.

Options are:

- Re-use – limited by legal standards on tread
- Re-use for landfill engineering – whole tyres can be used in construction of landfill sites, and are exempt from landfill tax. This use increased by 20% between 1998 and 1999.
- Recycling through re-treading. Manufacturing a re-tread car tyre takes 4.5 gallons less oil than a new tyre. Car tyres can be re-treaded once. However, despite improved quality, the market is declining. The EU Retreaders Manufacturers Association (RMA) are trying to promote greater use of retreads, and there is an EU target of 25%.

- Recycling through grinding. An estimated 83,000 tonnes of tyre were granulated in 1999. Crumb is used in sports and play surfaces, brake linings, landscaping mulch, carpet underlay, absorbents for wastes and shoe soles, and in rubberised asphalt for roads. Some crumb is also used in tyre manufacture, along with virgin rubber – this is less than 5% but increasing, and Pirelli has plans to achieve 20% crumb content by 2006.

- Other recycling techniques exist, including through cryogenic fragmentation, de-vulcanisation, microwave technology – these are subject to continuing development.

- Energy recovery – tyres have a high calorific value 20% greater than coal, which can be harnessed for energy recovery through burning, pyrolysis, or incineration in cement kilns (which can save 40% of NOx emissions compared to coal). Pyrolysis is expanding with new plant coming on line. Burning tyres in cement kilns has been identified by the Used Tyre Working Group as key to meeting 100% recovery targets but there are concerns about air pollutants, including dioxins and particulates. In 1993 the first tyre fired power station was commissioned in Wolverhampton, but has been hampered by financial and technical problems. In 2000 two cement kilns were authorised to burn tyres and three are undergoing trials (2000).

- Other uses – 20,000 tonnes of tyres are used in a variety of other uses (e.g. boat and dock fenders, crash barriers etc) and 10,000 tonnes are exported.

- Landfill – causes problems such as ground shift and fires (resulting in air emissions), also risk of leaching of chemicals.

Tyres should all be reused/recovered/recycled by 2006 because of a ban on landfill. Thus 100% recovery for 2006 is the baseline.

Seat Foam

Relatively easily extracted and can be recycled but light and bulky and therefore relatively expensive to store and transport.

Recovery

Energy recovery currently plays a minor role in the disposal of ELVs but is widely seen as having an important future role, especially in meeting the 2015 targets. ACORD (2001) estimated that there is potential for around 100,000 tonnes of ASR to go for incineration with energy recovery, but that the UK is disadvantaged in that there is current spare incineration capacity of only 5,000 tonnes. Recovery of oil from engines and gearboxes already takes place, for use in power stations as a fuel enhancer. Tyres are now increasingly burned in cement kilns, and this accounts for approximately 25-30% of tyre arisings. The MVDA claim that the estimated capacity of the cement kiln industry is sufficient for all waste tyres in the UK, while the SMMT suggests that tyres could make up much of the 5% allowed to be recovered in 2006. Public opposition to new incinerators means that use of waste streams as “fuel” in power stations, cement

kilns and blast furnaces may be more likely. Spare MSW incineration capacity is limited, and burning significant quantities of ASR would be subject to completion of successful trials.

If 10% of UK ELV waste was disposed through incineration with energy recovery, this would amount to around 200,000 tonnes – this might be achieved through one dedicated facility. However, energy recovery from ASR is complicated by the mixture of materials contained within the ASR, and the fact that vehicles that have not been de-polluted properly are still going through shredders, resulting in pollutants in ASR.

The VW Scicon process involves a large proportion of output going to blast furnaces as a calorific enhancer. A number of operators in the UK are looking at the possibility of operating VW Scicon plant under licence (VW would licence in the UK rather than running plant themselves).

PART C: MARKET & ECONOMIC ASSESSMENT

5. Overview of Vehicle and Recycling Markets

Vehicle Market

Most of the vehicle manufacturers have contracted to one of two treatment consortia – 'cartakeback.com' and 'autogreen'. Both have been created recently, specifically to deal with the issue of free vehicle take-back. One has been set-up by vehicle shredder companies, the other by vehicle dismantlers, and their approach to recovery of material from ELVs is likely to vary accordingly. The DTI therefore expects a roughly equal split in the recovery of parts and material through dismantling and the treatment of shredder residue.

Cartakeback.com is being led by the shredder companies and reports being "created especially to deal with this new government legislation in its entirety. This includes the initial de-pollution and parts recovery process carried out by dedicated businesses through its national network of ATFs, the lawful disposal of the resultant waste materials through structured relationships with professional companies in the recycling sector and recovery of recyclable materials through its links with UK Shredders Ltd" (Source: www.cartakeback.com). The majority of manufacturers have signed up with cartakeback including Ford, Peugeot, Citroen, MG Rover, Renault, Nissan, Fiat, Hyundai, and Colt.

Autogreen is being led by vehicle dismantlers and initially has 50 approved treatment facilities, with this number increasing to ensure nationwide service for final owners (Source: www.autogreen.org). Vauxhall and Saab have signed an ELV contract with autogreen.

Free car take back is not operating yet, but everything is being put into place to meet the new legislation. Dismantlers are also currently negotiating and signing contracts with these service providers in order to ensure they have a supply of vehicles to dismantle once the new legislation comes into force.

Motor manufacturers will not be paying a fee per vehicle for the car take-back service. Manufacturers have instead individually negotiated a single one-off membership charge fee, or annual charge, with the car take back service providers.

Techniques exist for separation of ASR – e.g. through simple flotation methods to remove plastics and rubber. These are not currently commercially viable otherwise they would take place already, and they are at least as costly as landfill.

Dismantling is likely to focus on the largest non metallic items including bumpers and dashboards, which are largely plastic.

Recycling Market

The current market price for scrap steel is £80 per tonne, which is relatively high and has been stable for the last year. This is a typically volatile market, but has been buoyed by strong demand from India and China for metal exports.

This high price is believed to be supporting the changes to the industry as a result of the Directive, but many are concerned by the potential problems should the price of scrap metal fall again. The new legislation, including free take back, should ensure that the last owner of an ELV has no incentive to abandon his/her ELV instead of using the correct channels for disposal. It is also hoped that improved traceability of vehicles should ease the abandoned vehicle problem.

A study of shredders indicated that the aluminium content of the material they handle has a significant impact on their profitability. Scrap aluminium is worth up to 10 times more than scrap steel and ELVs currently make up between 30 and 50 per cent of shredder feed. The shredding industry is also able to commercially handle ELVs hulks sold on by dismantlers. (SMMT, 2002)

The market for re-treading tyres is in decline due to cheap tyre imports (Cleaner Vehicles taskforce, 2000).

Markets for recycled materials are often an obstacle for achieving higher recycling rates. For example, projects sponsored by CARE demonstrate that it is technically feasible to produce high quality carbon black through pyrolysis of tyres, which would normally have a healthy end market. However, buyers are reluctant to pay near market prices for materials that are recycled (CARE, 2005).

Contracting arrangements between manufacturers and treatment facilities enables them to agree a contract involving overall rates of recycling. If treatment facilities were allowed to cherry pick waste streams they would recycle only those that are profitable; agreeing an overall contract allows for some degree of cross subsidy.

6. Economic Benefits To-date

The main economic benefit identified in the UK is that free take-back is expected to reduce the problem and costs of vehicle abandonment, once introduced in 2007. However, there has been concern about the costs of abandoned vehicles in the interim period, given the effects of higher treatment standards on the costs of dealing with ELVs.

Marginal Cost Assessment

Costs of implementing the directive comprise various elements:

- The cost of changes in vehicle design;

- The cost of improved deregistration procedures;
- The cost of improved technical standards in the treatment sector
- The cost of meeting higher recycling targets.

Vehicle Design

The RIA for the 2003 Regulations (DTI, 2003) quotes one industry estimate that the Directive could involve one-off costs of up to £500m for vehicle manufacturers in the UK, as a result of the need for re-engineering and re-tooling to meet heavy metals restrictions, equivalent to an annualised cost of £60 million. The RIA asserted that these estimates need to be put in context, since development, engineering and tooling costs involved in the production of a new vehicle can exceed this figure. In terms of running costs, the RIA stated that the industry view is that the heavy metals restrictions are unlikely to produce significant differences in costs from current levels, but that there may be some increase in costs *if* substitutes for the restricted metals raise energy costs or increase depreciation of machinery.

The Directive's requirements to mark certain components, and to provide dismantling information, are not considered onerous compared to current practice and are not expected to lead to any significant increase in costs. The RIA estimated that the administrative requirements relating to dismantling information could lead to an extra man year of work each year at each of 36 vehicle manufacturers, at a total cost of £1.5 million per year.

Certificates of Destruction and other Admin Costs

The cost of issuing a CoD was put at £3-£5 per vehicle in the first RIA. Based on 2 million vehicles being scrapped each year, the total cost of issuing CoDs was put at £6-10m p.a., plus investments in IT of up to £0.5 million (annualised).

The RIA of the 2005 Regulations estimated an average of 10 minutes to issue a CoD for a ELV. Cost estimates were based on average wage rates, with a factor of 30% added to include non wage costs, giving a figure of £14.70 per hour or £2.45 per ELV.

The DVLA has estimated an extra annual cost of £40,000 to operate the CoD system. Costs to DTI of meeting Vehicle Certification Agency (VCA) costs of enforcing Articles 4, 8 and 9 are put at £50-100k per annum.

TRL Ltd (2003) in a report for Defra estimated the cost of a system of evidence notes for monitoring compliance with the Directive. The initial first year set up costs were estimated at £8.0 million, followed by annual administrative costs estimated to average £9.4m p.a.

Free Take-back of Vehicles

The costs to manufacturers of free take-back of vehicles manufactured between 2002 and 2006 was estimated in the RIA as £300,000 per annum. This is based on estimates of the number of vehicles involved in accidents each year, at an assumed average cost of £50 per vehicle, on the assumption that accident vehicles have zero value. However, the RIA also quoted estimates from the salvage industry that few if

any post 2002 vehicles will have no or negative value. This is because post 2002 vehicles can command significantly higher scrap values than older vehicles, because of the quantities of non ferrous metals (e.g. catalytic converters and aluminium) they contain.

Motor manufacturers expressed concern about the impacts of free take-back on their profitability, in evidence to the House of Commons Select Committee. MG Rover estimated that up to £500 would need to be added to the new car price for the UK market and Toyota estimated that it could inherit a potential liability of around £70 million. Of particular concern to motor manufacturers is the obligation to book one off reserves to cover a pre-assumed cost of disposing of the entire 'historic car parc.' Both Ford and MG Rover claimed that this could threaten their solvency (House of Commons Trade and Industry Select Committee, 2001).

Improved Treatment Standards

At the time that the legislation was first announced, the treatment sector expressed concern about the high costs and levels of investment involved. For example, the BMRA told the House of Commons Select Committee (2001) that it would cost around £100,000 for a "twin rig, a state of the art depollution rig" for shredders, at a total cost of about £240,000 for the building, the storage of liquids, petroleum licences, changes in working plans and licences. Charles Trent Ltd (2001) in a memorandum to the Trade & Industry Select Committee estimated the total fixed costs of a range of different scenarios at between £420m and £907m.

The DTI's RIA (2003) estimated the annualised costs of these investments at between £50m and £109m over ten years. The RIA noted, however, that these figures need to be treated with caution because:

- The higher end figures are based on top of the range depollution rig technology, whereas cheaper equipment is available
- Higher end figures assume the whole site is concreted, which is not a requirement of the legislation;
- Much of this work should already have been undertaken to comply with existing waste management legislation and health and safety standards
- Estimates are based on all existing operators investing to meet the new standards, which is unlikely to happen in practice.

Based on different assumptions (costs split evenly between depollution rigs and impermeable surfaces, only 50% of businesses invest to meet new standards, 950 sites with waste management licences meet or are close to requirements of directive), the initial RIA estimated indicative annualised costs in the region of £20-41m.

In practice, levels of investment have varied among different treatment operators, depending on the scale of operations and whether their sites were concreted before the Directive. Highest costs have fallen on sites which needed to be concreted and to install buildings and more extensive depollution rigs; some operators have spent much less, for example by purchasing mobile depollution equipment.

The BVSF has estimated that a typical ATF has had to invest approximately £40,000 to £50,000, as an absolute minimum, to adhere to the new legislation. Although the

legislation does not state that new equipment is necessary, there is a belief throughout the industry that it cannot be done properly without heavy investment. One vehicle dismantler has already invested between £7-800,000 on infrastructure and equipment, including new 'de-pollution' equipment, laying concrete, and introducing interceptors for environmentally safe drainage, across their four ATFs. However these are large sites, handling a total of 12-15,000 ELVs per annum. Another vehicle dismantler has invested over £250,000, incorporating 4 de-pollution rigs and a large vehicle crusher. They now have the capacity to process more than 200 ELVs per day.

Another large vehicle dismantler reported investing heavily in de-pollution equipment and infrastructure to meet the requirements of the ELV Directive. The dismantler, one of the major players in the UK, has been working closely with ACORD and CARE to research the de-pollution and recycling of materials from ELVs. The dismantler reports being very proactive in terms of environmental considerations, they had begun resurfacing their ATFs with concrete 20 years ago. They have been preparing for these changes to their industry for many years and have been aware of the ELV issue for many years, since ACORD first highlighted the issue in 1992.

They reported that good de-pollution equipment has only been available since 1999, and they (together with another large UK dismantler) brought the first SEDA de-pollution equipment to the UK, and now have 11 of the machines. These machines cost £90,000, or £150,000 including delivery, installation, etc. Concrete resurfacing costs approximately £30 per square metre (£120,000 per acre). The dismantler reported having invested a total of £3 million in the last two years.

The dismantling businesses/organisations interviewed do not expect the Directive to necessitate any further investment, once ATFs have invested in impermeable surfaces and de-pollution equipment. Any further changes are likely to involve vehicle manufacturers and the shredding companies. The MVDA commented that it would be impossible to sustain the dismantling industry if further demands are placed upon dismantling businesses.

The RIA put costs of waste management licensing at £600/site (to obtain licence) plus £400/site/yr inspection costs. If 50% of registered exempt vehicles applied for licences to continue to treat ELVs, this would result in additional annual costs of £350k per annum.

The 2005 RIA estimated that it would take an average of one hour labour to depollute an ELV, including neutralisation of airbags and draining fluids from air conditioning systems.

The new equipment is no more labour intensive than previously, according to dismantlers and trade organisations, so this has had no impact on labour costs. However the increased processing of ELVs, such as issuing CoDs, has had a large impact on labour, and the large dismantler interviewed reported having to add 2 full-time members of staff simply to administer ELVs, while another dismantler estimated the additional labour time at approximately 30 minutes per ELV.

Re-use, Recycling and Recovery

Meeting the 2006 Targets

It is widely assumed that 75% of vehicle weight is already recycled. Steps have already been taken to increase this recycled percentage through de-pollution, battery removal, fluid removal. De-pollution is reported by dismantlers as adding between 3% and 5% of the vehicle weight towards the recycling, reuse and recovery targets, through the removal of batteries, tyres and fluids before shredding.

The BVSF suggest that intensive de-pollution and dismantling will increase recycling rates to between 80% and 82%, leaving the problem of securing the final 3%-5%, thought likely to be achieved from separation and recycling of shredder residue.

The SMMT are less confident about achieving the 2006 targets. Metals are already being recycled and even if all tyres were to be incinerated in cement kilns, this would still only reach 78%, leaving a large proportion unaccounted for. The SMMT appreciated that de-pollution would add further to this total but were concerned where the remainder was going to come from.

De-pollution has assisted the recycling, reuse and recovery rates in the following ways:

- Engine oil is drained. This is usually started first because this process is the longest and can take 15 to 20 minutes.
- Oil filters are also removed and an 'oil filter crusher' is used to recover the oil residue - usually about 250ml of oil.
- Gearbox lubricant is drained under vacuum using specialist equipment.
- Fuel, brake fluid, coolant and windscreen wash fluids are all recovered separately using vacuum and then stored. All the above fluids are drained non-destructively, when the component containing the fluid is suitable for re-sale.
- Batteries are removed and tested. Batteries are then recharged, cleaned and resold if suitable, or are sent away for specialist recycling.
- Tyres are removed and assessed. Where possible they are sold as 'part-worn' tyres. Where re-use is not safe or possible, the tyres are removed using a wheel crusher (a quick tyre removal tool)
- Lead wheel balancing weights are removed for recycling.
- CFCs are recovered from air-conditioning systems, since it is illegal to dispose of these materials improperly.
- Secondary restraint systems (airbags and seat belt pretensioners) are deployed for the safety of the dismantlers.
- Components such as radiators, engines, gearboxes suitable for re-sale and re-use are removed and sold as spare parts by the dismantler.
- Once all of the above have been removed, dismantlers will proceed to remove unwanted radiators, engines, gearboxes, carburettors, starter motors and alternators (assuming they have the necessary tools) to be sent to specialist reprocessors for metal recovery.

- The remainder of the ELV then goes through a baling machine (again assuming the dismantler has the necessary machinery) before being sent on to a shredder.

The dismantling businesses and organisations see any further increase in the recycling, reuse and recovery rates as a post-shredder issue because the separation of any further materials from an ELV is uneconomic prior to shredding due to the scale of the labour and transportation costs. The interviewed dismantlers did not expect to remove any further materials from ELVs prior to shredding because it is not economically viable, although they could do it if they were getting paid to do so.

Interviewees were generally confident of the shredders' ability to secure the final 5% (or so) of vehicle weight from recycling/reusing/recovering ASR. The materials expected to make up the remainder of the 2006 target of 85%, are the rigid plastics such as polypropalene (e.g. bumpers), rubber, and seat foam. These materials are reported as easy to recover from well shredded ASR and the technology already exists to remove these materials from the ASR. However, capacity is understood not yet to be in place in the UK to achieve this, and the shredders' investment plans continue to be subject to commercial secrecy.

The MVDA emphasised the importance of keeping individual materials separate in order to assist recycling. One of the big challenges is the separation of materials when, for example, plastics and metals are glued together, such as steel brackets incorporated within bumpers.

The SMMT believe more attention should be paid to separating ASR and recycling more non-ferrous materials. However the SMMT was concerned that the economics for recycling plastics do not stack up against the low price of virgin plastics.

Tyres do not presently go to incinerators for energy recovery, but are used in cement kilns. The MVDA claim that there is sufficient capacity in cement kilns to deal with all waste tyres in the UK. ELVs make up a relatively small proportion of the total waste vehicle tyres, with the majority coming from dedicated tyre replacement companies (ATS, Kwik Fit, etc).

Glass, however, is likely to be a more complicated issue. It has been reported that there is no evidence to suggest that glass can be recovered from the ASR. Pre-shredder glass removal is also unlikely because the labour and transportation costs would make the process uneconomic, and health and safety issues would also act as a barrier.

Meeting 2015 targets

There is more doubt in the industry about the feasibility of achieving the 2015 targets. The BVSF believe this to be achievable if the manufacturers do what they have said they will and make vehicles more recyclable. However, 2015 is too soon for manufacturers to research and implement new materials and practices, and for the vehicles to reach ELV status. Assuming the current ELV lifespan of approximately 13 years, the ELVs of 2015 have already been manufactured, so any changes introduced by manufacturers will not have a significant impact on ELVs for another 13 or so years from introduction.

The SMMT stated that the 2015 targets are simply not going to be viable without a huge investment in post-shredder technology to separate materials for recycling but also for preparing the ASR for incineration. This huge investment was reported by the SMMT as not likely to proceed until waste procedures are confirmed and in place.

It was not possible to obtain costs of increasing rates of recycling/reuse/recovery because this is seen as a post-shredder issue and the shredder companies are currently reviewing these costs and are not prepared to release this information at the moment because it would have commercial implications for the shredders. Dismantlers share the responsibility of ensuring their ELVs meet the Directive targets with the shredders and manufacturers, and dismantlers are currently waiting for these recycling cost estimates from the shredders before they can negotiate charges for their ELVs with the shredder companies.

Costs of Meeting Targets

The RIA for the 2005 Regulations estimated the costs of achieving the 85% target compared to estimates of 76-77% prior to the Directive, i.e. the costs of recycling, re-use or recovery of a further 8-9% of ELV arisings.

The RIA assumed that ELV arisings would continue to increase, with the number of ELVs increasing by 24% between 2000 and 2006 and 28% between 2000 and 2015. The average weight per vehicle was expected to increase by 5% to 2006 and 11% to 2015, suggesting an overall increase in ELV arisings of 30% by 2006 and 43% by 2015.

The assessment was based on a series of assumptions about increased recycling rates for:

- Fuel, oil, coolant, brake fluid and other fluids;
- Batteries, based on an assumption that an additional 30% of batteries could be recycled with an average weight of 12kg
- Tyres – based on an assumption that the remaining 80% of tyres can be recycled at a cost of 75p per tyre and an average weight of 6.5kg/tyre
- Glass – based on an assumption that glass can be recycled in aggregate at a cost of £27 per tonne, and that it takes an additional 15 minutes to remove the glass and bumpers from an ELV. Inclusion of labour costs for dismantling increases the cost of glass recycling to more than £100 per tonne.
- Plastic bumpers – based on an average weight of 5-6kg per bumper and an average cost of recycling of £1 per bumper
- Plastics and rubber – based on an assumption that these can be recycled at £150/tonne.

It was also estimated that the cost of a plant for separation of ELV materials from shredder residues would be between £2m and £5m, and that four such plants might be installed in the UK (equivalent to number of heavy media separation plants).

It was assumed that much of the requirement for the higher 95% target would be met through energy recovery, which might cost £90/tonne compared to current landfill costs of £50/tonne. Only a small proportion of ELVs are currently recovered, mainly through the use of tyres in cement kilns and waste oil as an industrial fuel, and increasing the

rate of recovery is therefore seen by the industry as a cost effective option (albeit one that involves significant capital costs and is likely to face resistance from local communities).

Based on these assumptions, the present value of costs in 2007 (85% target) were put at £16-£22m, while those in 2015 (85% target) were put at £28-£37m (95%) target. The annualised value of the total costs of Article 7 between 2005 and 2025 was put at £29-40m. The net cost of meeting the 95% target compared to the 85% target was estimated at £14-17m in 2015.

CARE commented that meeting the 95% target will require a step change in practice. Only a certain amount can be achieved by increasing rates of dismantling, as increased labour costs and limited markets for parts and materials limit the degree to which reuse and recycling of particular components and fractions can take place. As a result, separation of shredder residue is likely to be the way forward.

Abandoned Vehicles

Costs of dealing with abandoned vehicles are likely to increase before 2007. Estimates vary, but RIA and T&I Select Committee have suggested that number could increase by 150,000 to 500,000 per year.

Total Costs

The RIA of the 2003 regulations estimated total costs of implementing regulations as £88-113m per annum, comprising:

- Design requirements - £60m
- Information requirements - £1.5m
- CoD requirements - £6.5m to £10.5m
- Free take-back of post 2002 vehicles - £0.3m
- Site requirements for storage and treatment – £20-41m
- Enforcement and monitoring costs - £0.4-0.5m.

The RIA of the 2005 regulations puts the estimated total costs at £67m to £82m per year, annualised, between 2005 and 2025, comprising:

- Article 5 (CoDs and treatment) - £38m to £42m;
- Article 7 (recycling) - £29m to £40m.

This compares to quantifiable annualised benefits (reduced costs of landfill and car crime) of £35-40m per year.

Landfill Costs

The current cost of landfill of ASR is approximately £15-£20 per tonne plus the current Landfill Tax of £18. The total current cost of landfilling ASR is therefore approximately £35-£40. In Budget 2004 the Government announced that the standard rate of Landfill

Tax would increase by £3 per tonne to £18 per tonne in 2005-06, and by at least £3 per tonne in the years thereafter, on the way to a medium to long term rate of £35 per tonne.

Therefore assuming the actual cost of landfill remains the same, and the rate of Landfill Tax increases in line with Government projections, the total cost of landfilling ASR is expected to increase to, at least £50-£55 in the medium to long term.

7. Wider Economic Impacts

The RIA (DTI, 2003) considered that regulations would not have any significant impact on competition for any of the business sectors affected, and not present any particular barrier to entry or exit for new or incumbent firms in either vehicle or ELV markets.

PART D: ENVIRONMENTAL ASSESSMENT

8. Environmental Benefits To-Date

The RIA of the 2003 Regulations (DTI, 2003) identified the following expected benefits:

- Reduced risks of potential negative impacts on human health and the environment from certain heavy metals. Main benefit is avoidance of potential damage from heavy metals leaching from landfilled waste. However, benefits are uncertain given the difficulty of isolating the source of heavy metals (since ASR likely to be disposed of with other wastes), while impacts depend on extent of contamination, degree of exposure and response to exposure. Quantification is therefore very difficult but there is some benefit from avoidance of risk.

- Article 4 also brings economic benefits through avoidance of costs of removal of hazardous substances from ELVs in future, though these are highly uncertain

- Reduced risks of potential negative impacts on human health and the environment from the disposal of materials from ELVs (through treatment requirements)

- Reduced risks of certain types of car crime and fraud and a more effective system of vehicle registration (through CoDs). CoDs are one of a package of measures to tackle car crime that the Home Office has estimated could bring economic benefits of up to £200 million per year.

- Free take-back should help to facilitate more environmentally sound disposal of ELVs

- Enforcement of licensing and treatment standards, and introduction of CoDs, should help to prevent operation of illegal treatment facilities, of which there are believed to be between 500 and 800 in the UK. This should help to raise environmental standards.

The RIA of the 2005 regulations identified the following benefits from higher recycling rates and the introduction of producer responsibility:

- Reductions in landfill (estimated at £14-£18m per year, annualised benefits 2007 to 2025, based on reduced landfill costs)

- Reductions in hazardous waste entering landfill (due to depollution)
- Reduced CO_2 emissions (due to reduced production of new materials)
- Positive contributions to sustainable development and resource productivity
- Positive contribution to measures tackling car crime (through CoDs, estimated at £21m annualised 2007-2025).

The environmental benefits of materials recycling also include reduced use of non renewable resources such as metals and plastics. Metals produce a variety of environmental impacts through mining, the energy used in smelting and refining, and resultant emissions and waste. Plastics give rise to environmental impacts in oil extraction, transport and refining.

Using recycled metals consumes less energy and water and causes less air pollution than smelting processes. Recycled steel uses 62-74% less energy and 40% less water, and reduces air pollution by 86% and water pollution by 76% (Cleaner Vehicles Task Force, 2000).

Car manufacturers reports a conflict between development of lighter weight cars and meeting ELV recycling targets. Reducing CO_2 emissions (and meeting CO_2 targets) is an immediate priority and is leading to greater use of plastics and carbon fibre, which are more difficult to recycle. As 80% of the energy consumed by a vehicle is in its use, there is a strong case for focusing attention on fuel efficient design. VW commented that the industry is therefore concentrating on improving fuel efficiency in vehicle design; however, at some point before 2015 there will be a need to increase rates of recycling of the new materials introduced, to meet ELV targets.

It has been estimated that a car weighing 1.3 tonnes consumes an extra 1000 litres of fuel during its life than a car weighing 1.1 tonnes. The British Plastics Federation estimates that 105kg of plastics, used as a replacement for metals, in a car weighing 1000kg, could make a possible fuel saving of up to 7.5% (Recoup, 2002)

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Consultees

Contact was made with the following organisations, by telephone or face to face, of whom just over 50% provided information. The majority of motor manufacturers declined to provide information and referred us to the Society of Motor Manufacturers and Traders.

British Vehicle Salvage Federation

BMW UK

CARE Group

Charles Trent Ltd

Department of Trade and Industry

Doncaster Motor Spares

EMR

Ford UK

GW & G Bridges (Dismantler)

Motor Vehicle Dismantlers' Association

Peugeot

Renault

SIMS Group

Society of Motor Manufacturers and Traders

Universal Salvage

Vauxhall

VW