The treatment of end-of-life vehicles in Spain and the trend over time

ENVIRONMENT

The industrial sector dealing with end-of-life vehicles (ELV) has developed almost beyond recognition in recent years after the new legislation introduced in Spain. In this short period of time it has made the huge leap from the old style scrapyards or breakers yards to the modern Authorised Treatment Facilities. This article gives a detailed account of the sector’s legislative framework, its current situation and future prospects, marked out by Directive 2000/53/EC. It aims to serve as a rallying cry for sector stakeholders, encouraging them to work towards strengthening this business line and turning it into a fully sustainable activity.

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Before the nineties, until the coming into force of the current end-of-life vehicles (ELV) legislation, unwanted vehicles were unceremoniously dumped by their owners in the old-style scrapyards. These were usually long-standing family businesses run on a low-tech basis with little staff. A few of the more expensive and easily sellable components were stripped off for resale as second-hand spare parts and the rest was sold off as scrap. More economic and managerial importance was usually given to the scrap-metal side of the business than the recycling of spare parts. So much so that the spare parts were sometimes stripped off in the scrapyard by the buyers themselves using their own tools. The rest was carted off to the shredder where the product demanded by the steel industry was obtained: scrap metal.

From the environmental point of view scrapyards did not extract hardly any potentially contaminating waste unless it proved profitable to do so, such as batteries for the value of the lead. Most of the oil and other fluids stayed with the vehicle remains. Neither did the shredders do anything to separate off the ferrous and non-ferrous metals, since the technology and costs at that time did not allow them to do so.

All this posed a serious problem, since this waste, light and heavy, had a high content of hazardous elements. Much of it also involved combustible and hence highly flammable products. It came as no surprise, therefore, when the government finally decided to step in to regulate and define legal aspects of this activity from the environmental point of view.

Legislative framework and its consequences

The advent of Directive 2000/53/EC brought about a sea change in ELV management across the board. The aim of this legislation was to cut down the environmental impact of ELVs, laying down...
rules for the correct environmental management thereof and also preventive measures to be taken into account in the vehicle design and construction phase. In other words vehicle manufacturers are brought into the legislation’s trawl.

Implementation of this Directive into Spain’s body of law spawned Real Decreto (Royal Decree) 1383/2002, which deals with the treatment and management of ELVs, establishing measures to prevent generation of vehicle waste and boost the efficacy of environmental protection throughout the whole useful life-cycle of vehicles.

The Real Decreto lays down preventive measures designed to reduce the use of hazardous substances in car manufacture, also encouraging the reuse, recycling and recovery of the various components to reduce any negative effects they may have on the environment.

Most important here are the measures impinging directly on the manufacturers themselves, obliging them to design and construct vehicles and their components in such a way as to facilitate subsequent dismantling, decontamination, recycling and recovery of ELVs.

In order to comply with their obligations under this Real Decreto, therefore, the development departments of new models, in liaison with their suppliers, are bound to take into account these considerations and use materials and employ processes that ensure proper treatment of vehicles at the end of their useful lives.

Legislation also states that component manufacturers should avoid elements considered to be hazardous: examples might be heavy metals such as mercury, cadmium and hexavalent chromium. ISO codes also have to be applied to facilitate identification of materials and components so that they can then be separated off for recycling.

Vehicle manufacturers are also encouraged to use parts made from recycled materials, thus favouring the development of markets and the companies making and marketing this material.

Reuse, recycling and recovery

The Real Decreto lays down clear reuse, recycling and recovery targets, defining these three concepts perfectly:

- **Reuse.** any operation by which components of end-of life vehicles are used for the same purpose for which they were conceived. For example the engine, if it still works properly and is undamaged, can be mounted in another similar vehicle.

- **Recycling.** The reprocessing in a production process of the ELV waste materials for the original purpose or for other purposes. If the engine of the previous example no longer works or is damaged, the material from which it is made could be recycled.

- **Recovery.** Any procedure allowing reuse of the resources contained in the ELV, including incineration thereof with energy recovery. Tyres are a good example.
Economic stakeholders, each within its own field of activity, are bound to meet the reuse, recycling and recovery targets. It was established that by 2006 they would reuse, recycle or recover at least 85% of the mean weight per vehicle and year of all ELVs generated; the 2015 target is 95%

As a previous step to the treatment of the ELV, the legislation calls for the vehicles to be decontaminated. This will be carried out in an Authorised Treatment Facility (ATF), where all vehicles will end up on becoming obsolete or reaching the end of their useful life.

ATFs are defined as authorised sites for carrying out any of the treatment operations on end-of-life vehicles; these sites must guarantee the decontamination, reuse, recycling and recovery of their component parts.

This eliminates the old-style scrap- or breakers-yards, which were granted a phase-in period for modifying their facilities, thereby producing changes in the working processes. All this involved a substantial change in the operational management of the business.

This represented a wholesale transformation not only in terms of the industrial activity itself but also administrative arrangements, since these authorised facilities now take on responsibility for officially taking the vehicles off the road (de-registration). They hence become a sort of “delegated office” of the various provincial traffic authorities.

But the most far-reaching change in the new ATFs was the modernisation of their equipment and plant to bring them into line with the specific legislation. This involves the implementation of appropriate systems for carrying out the necessary decontamination, reuse, recycling and recovery operations as well as the temporary storage of any potentially contaminating products. For example it is now obligatory to have specific contracts with authorised waste managers for subsequent removal and recycling as well as keeping a thoroughgoing record of the whole procedure.

The specific technical requisites for these facilities involve mainly the setting up, fitting out and use of the following areas:

- Appropriate covered areas to suit the number of vehicles to be decontaminated, with impermeable flooring and spillage-collection and degreasing and decanting equipment.
- Covered areas with impermeable flooring for storing the contaminated components removed from the vehicles, especially oil-contaminated spare parts.
- Suitable containers for storing batteries with electrolyte neutralisation in situ or in a nearby site in case of accident.
- Suitable storage tanks for segregated storage of ELV fluids, i.e., fuel, engine oil, gearbox oil, transmission oil, hydraulic oil, cooling fluids, antifreeze, brake fluids, battery acid, air-conditioning system fluids and any other vehicle fluid.
- Equipment for the collection and treatment of water, including rainwater in uncovered areas, all of which has to be duly treated before discharge in compliance with environmental and health regulations laid down at the various government levels.
- Appropriate areas for storing used tyres, including fire protection measures and the prevention of risks deriving from excessive stockpiling.

The processes are also defined, comprising of the following phases:
• **Reception.** This is the phase where the owner hands over the vehicle and the corresponding documents for processing its de-registration and removal from the road.

• **Decontamination.** This is the process in which the components involving hazardous waste are removed from the vehicle; i.e., oil, brake fluid, antifreeze, fuel, filters, batteries, etc.

• **Dismantling of components for reuse.** This involves the operations of recovering all elements that might be reused subsequently and also the identification, storage and marketing thereof. This phase also involves segregation of other items for their recycling and recovery, such as glass, tyres, etc.

• **Waste management.** This phase is based on the use of suitable processes for storing the waste generated in the vehicle handover to authorised managers for reuse, recycling and recovery purposes.

The various regional governments and the regional environment ministries are empowered to check compliance with all these requirements and the corresponding documentation, pursuant to the Real Decreto, and also to grant, where appropriate, the licence to run an ATF or authorised waste management facility.

**Current Situation**

This legislation has been enforceable since 2004, while the next year, 2005, saw the coming into force of European Decision 2005/293/EC on the monitoring of the reuse/recovery targets for end-of-life vehicle targets to be met by member states, as well as the deadlines and formats for submitting the corresponding reports.

By now the regional environmental ministries have built up a set of relevant data on this activity. Tapping into this store of information, we can therefore find out what this legislation led to and how much it has achieved, as well as its influence on sustainable development in its three fundamental aspects: ecological, economic and social.

Analysis of the economic and social aspects is very revealing, but this calls for a more in-depth study that goes beyond the remit of this report.

As for the ecological aspect, an account is given below of vehicle recovery percentages, the number of vehicles dealt with, components stripped off, parts reused, materials recycled and energy recovery.

**Manufacturers are bound to design vehicles in such a way as to favour dismantling, decontamination, reuse and recovery of the ELVs**

**End-of-life vehicle recovery percentage**

The Spanish Association for the Environmental Treatment of End-of-Life Vehicles (Asociación Española para el Tratamiento Medioambiental de los Vehículos Fuera de Uso: SIGRAUTO), comprising 455 ATFs and founded by the Spanish Association of Automobile Recycling and Breakers Yards (Asociación Española de Desguazadores y Reciclaje del Automóvil: AEDRA), the National Association of Importers of Automobiles, Lorries, Buses and Motorcycles (Asociación Nacional de Importadores de Automóviles, Camiones, Autobuses y Motocicletas: ANIACAM),
the National Association of Automobile and Lorry Manufacturers (Asociación Nacional de Fabricantes de Automóviles y Camiones: ANFAC) and the Spanish Recovery Federation (Federación Española de la Recuperación: FER), conducted a 2010 study to ascertain the level of recovery of end-of-life vehicles in Spain, doing so by monitoring the various stages in the treatment chain.

This study works from the data obtained from over 1100 vehicles dealt with by ten ATF s spread throughout Spain, plus eight shredders and four media separation plants working with them.

Extrapolation of the results of this study to all the vehicles dealt with shows that the recovery levels laid down in the legislation are currently being met in Spain and stakeholders are currently working towards the 2015 goal of 95%. The results of this analysis show that the current recovery figure is 86.529%. It also shows that Spain is perhaps the country where most progress has been made in this field and it now ranks among the vanguard countries in the management of end-of-life vehicles. This reflects the effort made by the automobile sector to reach the objectives set by the legislation.

According to these figures, only a little over 13% of vehicle weight ends up in the landfill site; in another four years this figure has to be less than 5%. The important thing now, therefore, is to determine how to make up the remaining gap for full compliance with the legislation and continue to make progress in terms of reusing the recovered items.

The study shows that the standardised recovery levels are likely to be met only when all stakeholders, i.e., ATF s, shredders and media separation plants, intervene in all stages of the treatment chain in a coordinated way.

Other studies of the various products and components show the following percentage breakdowns of the total ELV waste dealt with:

- 68% is made up by ferrous metals, which are 100% reusable or recyclable.
- 7% is made up by non ferrous metals, also 100% reusable or recyclable.
- 4% are tyres, which can be reused, recycled or recovered.
- 3% is glass, which can be reused or recycled.
- 1.3% is made up by textiles (non metallic part and reused components).
- 1.2% is made up by fluids, which are reusable, recyclable and recoverable for energy purposes.
- 1% is made up by plastic and rubber, which may also be reused, recycled and recovered for energy purposes.
- The rest of the material, just over 13%, is currently the subject of R&D initiatives to develop new systems and determine the best recovery procedures (industrial processes and economic environments).

Trend of the vehicles dealt with in Spain over recent years

Since implementation of this legislation we have been able to compare the number of official de-registrations (at least in the case of cars) with the number of vehicles dealt with. The attached table, based on figures taken from the website of the Spanish Road-Traffic Authority (DGT in Spanish initials), shows the number of cars dealt with in Spain each year, in the period 2005-2010, since implementation of the legislation. This reflects marked year to year variation.
In 2005 almost 900,000 cars were taken off the road, 8% more than in the previous year.

In 2006 a total of 910,727 cars were dealt with, 2.8% more than the previous year. In 2007, however, there was a 2.6% fall in the number of vehicles dealt with.

In 2008 the figure plunged to 734,638 cars dealt with, representing a 17.2% fall. This fall can be partly be put down to the fact that vehicle owners began to hang onto their vehicles longer at the start of the economic downturn we are still suffering from.

In 2009, as a result of the Plan 2000E, offering trade-in rebates for cars over 10 years old or with over 250,000 kilometres on the clock, 937,297 cars were treated, the highest figure in the whole period, with a 27.6% increase on the previous year.

2010 saw an 18.8% fall on the previous year, attributable partly to the end of the discount scheme and, again, to the drawing out of the vehicle’s useful life in the lingering downturn.

Table 1. Car de-registration figures according to D.G.T figures.

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Cars De-registered</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>886,395</td>
</tr>
<tr>
<td>2006</td>
<td>910,727</td>
</tr>
<tr>
<td>2007</td>
<td>734,638</td>
</tr>
<tr>
<td>2008</td>
<td>887,395</td>
</tr>
<tr>
<td>2009</td>
<td>937,297</td>
</tr>
<tr>
<td>2010</td>
<td>761,267</td>
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</tbody>
</table>

Although, logically, there are as yet no complete figures for 2011, the first quarter’s figures are down by about 25%, suggesting that there will be a significant fall this year in the number of vehicles taken off the road.

**The second life of automobiles**

Nearly 5,200,000 cars have been treated by ATFs since implementation of the legislation. Their components will be given a second life, either as reused elements fulfilling their original function, as recycled elements or as recovered energy.

According to the abovementioned percentages an estimate can be made of the amounts of material obtained since implementation of the legislation.

**Ferrous Metal:**

Mainly steel and iron for resmelting, generally known as scrap metal. It is obtained by shredding in specific plants where the vehicles arrive in crushed half-metre cubes from the ATFs themselves or an authorised manager. After decontamination, the parts that can be reused are then separated off.
It is estimated that in the period 2005-2010 about 1,500,000 tons of this material was obtained from recycled cars, this then being sent on directly to the steel plants for recycling.

**Non ferrous metal:**
This is also obtained from the shredding process, mainly made up by aluminium and copper, which are sent on to specific plants for recycling. Metal of this type is currently being more widely used in automobiles, mainly aluminium, of which about 95% is recovered. Seventy percent of the aluminium used in automobile manufacture comes from the resmelting of this metal from other automobiles, closing the recycling circle almost completely.

**Tyres:**
It is estimated that about 210,000 tons of tyres were generated by end-of-life vehicles in the period 2006-2010. Tyres are governed by a different regulation, according to whether they come from ATFs or repair garages. In both cases, however, depending on the state of the tyre itself, we can speak of its reuse, recycling and recovery. This may well be one of the vehicle components with most applications nowadays:

- 43% of used tyres are recycled, converting them into new products, after separation of their rubber and steel component (they can be used for athletics tracks, road tarmac, artificial-grass sports fields, insulation or rubber for new formulations).
- Chopped tyres have a calorific value very close to coal, so 41% of them are transformed into energy for industry (energy recovery), providing a considerable energy saving.
- The most environmentally friendly option is without doubt reuse, which accounts for about 16% of used tyres. This lengthens their life and reduces the manufacture of new tyres.

**Glass:**
ELV glass comes from the laminated windows, generally the front windscreen, and from the side windows, generally of tempered glass.

Laminated windscreens are usually rejected by the glass recycling industry since they are built up from two sheets of annealed glass joined by a paper-thin film of polyvinyl butyral, which is a highly elastic and flexible polymer used to give the windscreen the specific elastic properties for type approval. But this polymer poses a recycling problem; as a plastic material it does not mix well in the glass crushing and fusion process and acts as a contaminant in the final mixture. Several research projects are currently underway, generally conducted by the research departments of different universities, to separate it off and thereby boost the recyclability of vehicle glass. This separation is technically possible, while the polyvinyl itself would be recovered and used for making insulation. The challenge, however, lies in finding profitable processes for establishing industries of this type.

It is estimated that the total amount of recyclable and reusable ELV glass adds up to about 150,000 tons. The glass for recycling comes from the shredding plants and has to be separated off from the other components of the process. This material, until such time as a cleaner alternative becomes available with the successful implementation of a polyvinyl butyral separation process in the future, is recycled for construction, insulation, asphalt and glass of lower quality.

**Plastic:**
Plastic accounts for 1% of vehicle weight. In the period 2006-2010 about 50,000 tons was obtained in all, taking in the three
recovery possibilities: it can be used in another vehicle – car bumpers, for example, are habitually marketed in ATFs; it can be recycled, since it is perfectly identified in the vehicle and this favours a fundamental phase in this process: its classification; and it has energy recovery possibilities, since it is used in incineration with energy recovery on the strength of its high calorific power.

**Textile, fibre and foams:**
This type of material is also called light fraction waste or “fluff”. It is currently the subject of an industrial research project to increase its recycling possibilities and avoid sending it to the landfill site, where almost all of it ends up at present. Technical tests are currently underway for the energy recovery of this light fraction in cement plants as an alternative fuel.

**By 2015 95% of the vehicle weight will be reused, recycled or recovered for energy generation**

**Other components:**
It should not be forgotten that there are also other important ELV components with many subsequent applications:

- Fuel, which can be reused as such. When unmixed it can be used as a component of organic cleansing solvents.
- Antifreeze, which may be used as a new antifreeze fluid once purified.
- Batteries, dealt with by specific environmental regulation; the main by-product is lead. Real Decreto 106/2008 on accumulators and the environmental management of their waste tries to minimise the risks deriving from this waste and promote correct management. To this end the legislation lays it down that they have to be dealt with by accredited managers of batteries, lead and acid (both collection centres and temporary storage facilities). At present about 97% in weight is recycled in up-and-running recovery plants. There is now a well-developed recycling
market that buys from the authorised managers, thereby practically closing the cycle; almost all the lead obtained is turned back into automotive lead-acid batteries.

- Used oil, whose environmental management has also been regulated in Spain, via Real Decreto 679/2006, which lays down the specific criteria for forestalling any environmental impact and also the correct used-oil management procedure. This procedure is based on a collection obligation and regeneration as the preferred treatment option, overriding any other form of recycling and energy recovery.
- Catalytic converters are easily recoverable items and are mainly used for obtaining semiprecious materials with a high economic value such as palladium, platinum and rhodium.

**Integrated Management Systems**

The Waste Act 10/98 (*Ley de Residuos*) laid down the obligation of drawing up specific plans for treating waste of all types together with a series of environmental objectives. This law gave rise to various national plans and regional regulations and, pursuant thereto, another series of initiatives which have brought in waste treatment according to clear environmental measures.

This law is based on the «polluter pays» principle, making the initial marketer of the item in question responsible for paying the waste management costs. It also allows for the possibility of setting up Integrated Management Systems as a procedure whereby manufacturers, importers and distributors can commit themselves to compliance with the environmental obligations generated by the product in question during the post consumer phase.

There are currently three integrated management systems in Spain’s automobile sector. Two of them take in the treatment of end-of-life tyres (SIGNUS and TNU) and the third is for the treatment of used oil (SIGAUS).

SIGRAUTO is not an integrated management system as such. It is born by agreement of the associations representing the main stakeholders in the ELV treatment chain, setting up a permanent forum in which manufacturers and importers, shredders and breakers yards can analyse the problems involved in the treatment of these vehicles and seek the best solutions. The association aims to provide its associates with the wherewithal for meeting their new environmental ELV-treatment obligations.

**Socio-economic conclusions and future prospects**

The industrial ELV treatment sector was once totally unregulated. In recent years, however, under the aegis of greater government involvement and new legislation, the situation has changed completely and there is now systematic encouragement of second or third stage use of automobile components and materials.

This new legal framework has brought in far-reaching changes in this sector and there will surely be a need for more in the future. It is the regional authorities that are responsible for the surveillance, control and enforcement of good practices in the new processes.

Future prospects are bound up with proper enforcement of Directive 2000/53/EC, which lays it down that by 2015 only 5% of ELV weight should be sent to a landfill site.
The factors likely to determine the future development and trend of this sector include participation and liaison of all stakeholders involved in these materials:

- The main onus falls on manufacturers, who are now bound to use recyclable materials in vehicle construction and identify them (as with the plastic components) to make it easier to pinpoint hazardous substances and classify the rest in the dismantling process at the end of the vehicle’s useful life. Another factor that has to be taken into account is the current race to reduce vehicle weight in an attempt to comply with established emission levels.

- ATFs are bound to work towards a more professional procedure and optimise their own processes to improve and increase recovery of the various materials and the marketing profitability of the reusable components.

- Shredders have to develop within clear objectives of nurturing post-shredder technologies, seeking investments and developing viable and profitable uses of this technology.

- Government authorities, which have played a key role in the development of this sector over recent years, are now bound to ensure specifically that manufacturers, ATFs and shredders all meet the set objectives, monitoring and enforcing compliance therewith. In particular the government should continue to promote the development of waste collection and transport processes to recycling centres, the creation and maintenance of efficient integrated management systems, the creation of firms trading in this area and the drawing up and publication of reports on the recovery targets met.

From now until the 2015 deadline we therefore need to make further progress on the following crucial fronts:

- Improving the capacity of classifying and separating materials to cheapen the whole process.
- Increasing the capacity of obtaining non-metallic, rubber, glass and plastic materials.
- Increasing the level of energy recovery from the materials.
- Increasing the use of easily recyclable materials such as aluminium in vehicle construction processes.
- Increasing the value of the materials and products recovered.
- Creating the appropriate economic infrastructure for boosting recovery rates.
- Establishing the suitable infrastructure for facilitating the collection, transport and delivery of material to the appropriate centres.
- Encouraging the use of recovered products by dint of improving the sector’s environmental image and making it more professional in its procedures

A great challenge for 2015: development, implementation and maintenance of measures to favour the development of this business line, already interesting in its own right as an industrial activity but even more as a key factor in sustainable development, a principle that now needs to be applied across the board to all the economic activities of any society.

NOMENCLATURE(Spanish initials in each case)

SIGRAUTO. Spanish Association for the Environmental Treatment of End-of-Life Vehicles.
AEDRA. Spanish Association of Automobile Recycling and Breakers Yards.
ANFAC. National Association of Manufacturers of Automobiles, Lorries, Buses and Motorcycles.
ANICAM. National Association of Importers of Automobiles, Lorries, Buses and Motorcycles.
CESVIMAP. MAPFRE Road Safety and Experimentation Centre.
CESVIRECAMBIOS. CESVIMAP Authorised Treatment Facility (ATF).
FER. Spanish Recovery Federation.
SIGNUS. Integrated Management System for Used Tyres.
TNU. Integrated Management System for the Treatment of Used Tyres.
SIGAUS. Integrated Management System for Used Oil.

REFERENCIAS DE SITIOS WEB

aedra.org
anfac.com
aniacam.com
cesvimap.com
cesvimap.com
cesvirecambios.com
fundacionfitsa.org
recuperacion.org
sigaus.es
sigrauto.com
tnu.es