End of life tyres

A valuable resource with a wealth of potential

2006 Report

ETRMA
EUROPEAN TYRE & RUBBER manufacturers' association

About ETRMA

Formerly represented by BLIC, ETRMA is the Voice of European tyre and rubber manufacturers, representing 4100 companies in EU25, employing 360 000 individuals, with a turnover of the industry exceeding € 40 b.

In 1989, a Used Tyres Group dedicated to the management of end of life tyres was set up under the strategic guidance of the then "BLIC" Tyre Steering Committee. This Group is composed of experts from all tyre manufacturers producing in Europe, which are **Bridgestone Europe, Continental, Cooper Tires, Goodyear-Dunlop Tires Europe, Marangoni, Michelin, Nokian Tyres, Pirelli, and Vredestein**.

The Used Tyres group mission is to:

Promote the environmentally and economically sound management (elimination) and use of end-of-life tyres in those countries where tyres are still diverted to landfill, and proactively pursue Producer Responsibility with a dedicated financing scheme;

Provide the necessary assistance in EU Member States in achieving the provisions of landfill directive for end-of-life tyres by 2006, or earlier;

Promote the principle that end of life tyres are a resource that can be used in a wide array of applications;

Propose a "downstream management" for tyres coming from end-of-life vehicles;

Develop procedures to ensure that end-of-life tyres exported do not go into illegal reuse.

The activity of the Used Tyres Group covers all the Member States of the EU, plus Accession countries.

The European tyre industry is committed to assist in promoting environmentally and economically sound end-of-life management practices for its products. The industry continues to promote the development of appropriate markets for end-of-life tyres, provides technical and policy information regarding end-of-life tyres management, and advocates a legislative and regulatory framework that contributes to the achievement of these goals.

The Association undertakes action to host European, international and national conferences for authorities and advocates for sound EU programs to address end-of-life tyre issues.

It does not represent and does not have any vested interest in the processing of end-of-life tyres or in any product made from end-of-life tyres.

It promotes the principle that end of life tyres are a valuable resource with a wealth of potential.

This Edition is the first comprehensive reporting on end of life tyres management in Europe.

Table of content

This ETRMA report presents the situation of end-of-life tyres in the enlarged EU for 2004 and sets out to demonstrate the progress that has been made over the last decade by the European tyre manufacturers to address, in a responsible manner, the issues of end-of-life tyres.

Challenges for the EU

- No landfill option as from July 2006
- Guarantee an ecological treatment of the entire chain
- Promote efficient and sustainable economical solutions
- Solve the historic stockpile issue
- Control the exportation of end-of-life tyres to low-income countries

» Tremendous progress ... in the face of growing arisings

Increasing volumes to be treated worldwide

Over a billion tyres are sold worldwide each year and subsequently just as many fall into the category of end-of-life tyres. Despite an increase in the service life of tyres these volumes are constantly on the increase because of the growing number of vehicles and increasing traffic worldwide.

Recovery rates for 2004		
EU 15	2 788 000 metric tons	global recovery rate 85%
EU 25	3 213 000 metric tons	global recovery rate 80%
Japan	1 043 000 metric tons	global recovery rate 88%
US (2003)	3 750 000 tons	global recovery rate 90%

In 2004 the **enlarged Europe** was faced with the challenge of managing, in an environmentally sound manner, more than 3.2 million metric tons of used tyres. For the EU 15 the annual arisings have progressed from 2.10 million metric tons in 1994 to 2.7 million metric tons in 2004, representing an average annual increase of 2.6 %.
These are significant increases and it is therefore essential that we promote an efficient, sustainable and responsible attitude to the management of end-of-life tyres.
The estimated annual cost for the management of these arisings is at least 600 million euros. This is in fact a high cost for what is in reality a valuable resource of secondary raw materials or energy.

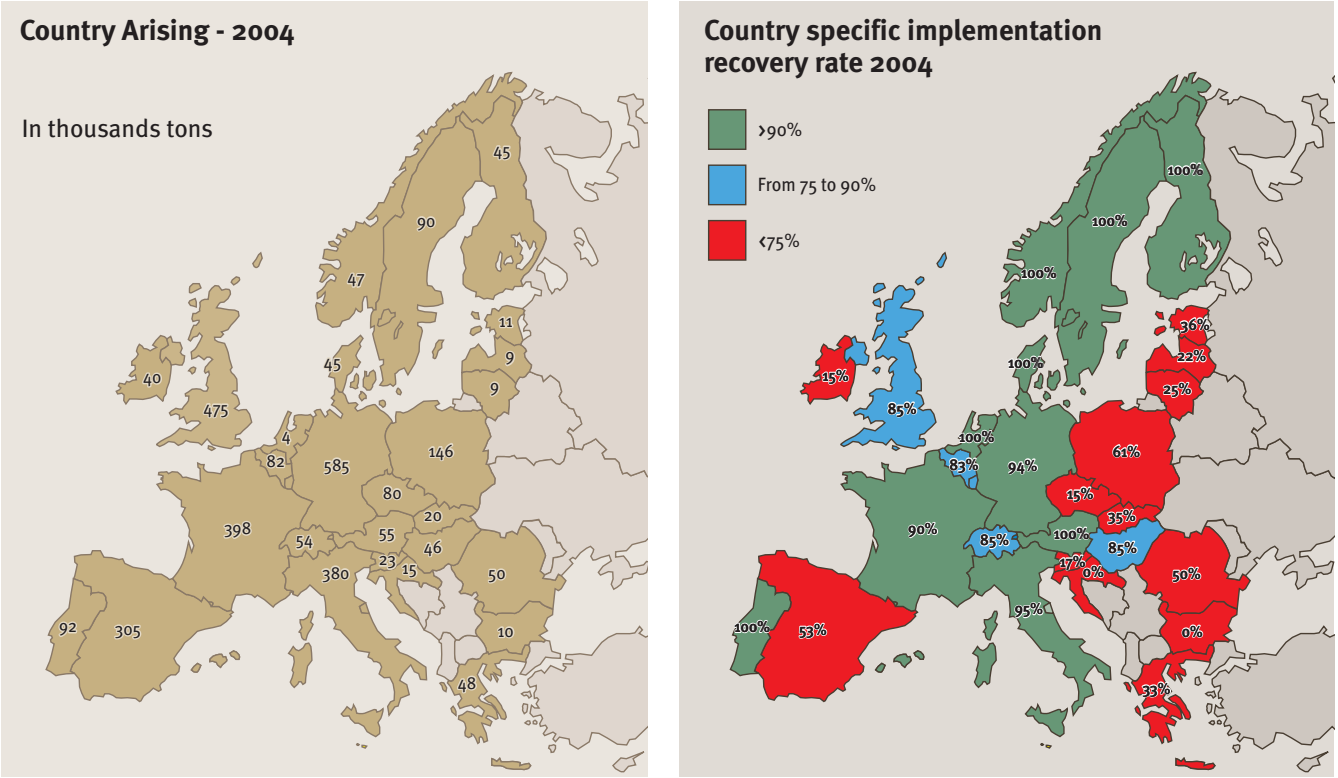
In addition the EU has millions of used tyres that have been illegally dumped or stockpiled. These historic stockpiles can, in some cases, pose a potential threat to human health (fire risk, haven for rodents or other pests such as mosquitoes....). The current estimate for these historic stockpiles throughout the enlarged EU stands at 5.5 million tons (1.73 times the 2004 annual arising).

Ultimately, the improved economic performance of the end-of-life tyre business should mitigate in favour of an earlier and more effective approach to tackling historic stockpiles.

The annual estimate for used tyres from end-of-life vehicles (ELV) amounts to 50 million tyres, which represents 10% of the annual arising.

Annual arisings and recovery rates by country

Not surprisingly the largest volumes of arisings are in the biggest countries (Germany, the UK, France, Italy and Spain) where the totals vary between 300 and 600 thousand metric tons per annum. All the other countries have arisings under 150 thousand metric tons per annum and at least six have 15 thousand tons or less.



In 2004 nine of the EU 25 countries recovered 90% and more of their annual arising. Six of the nine recovered 100% while a further three attained between 80% and 90%. The remaining countries were under 61% with seven still between 0% and 25%.

Countries where a producer responsibility system has been operating for over 10 years. (eg Nordic countries) have recovery rates of 100% and stockpiles have been eliminated.

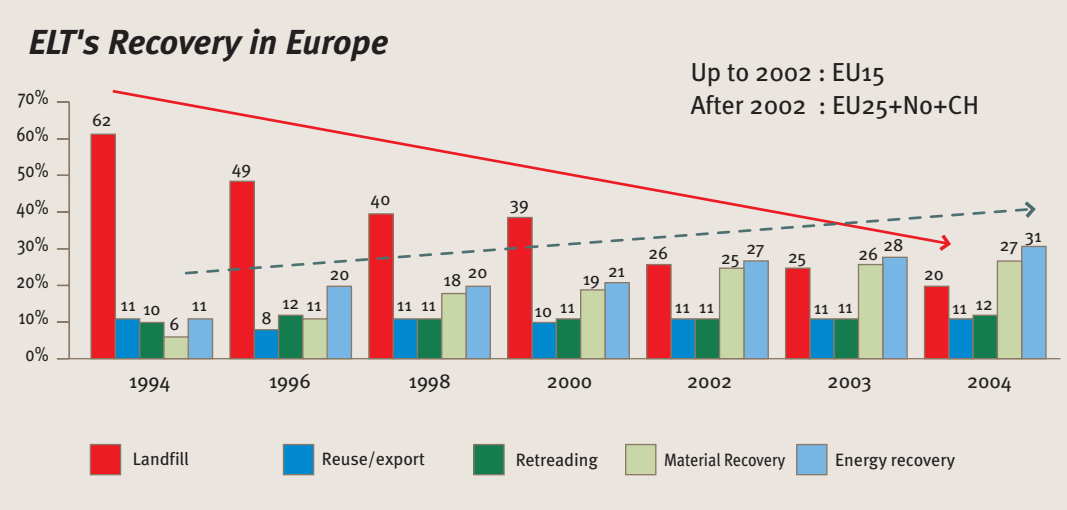
Despite the heterogeneous nature of these rates, in 2004 the EU 25 had an average recovery rate of 80% while the figure for the EU 15 was 85%, which is quite favourable when compared with recovery rate of other sectors (in 2002 aluminium 84%, paper and cardboard 56%[1] ...).

[1] Source : Inventory of existing information on recycling of selected waste materials, European Environment Agency, August 2004

A turnaround in market trends over the last decade

Over the past decade from 1994 to 2004 there has been a dramatic turnaround in the trend with a decline from 62% landfilling in 1994 to 20% in 2004, while energy recovery, recycling and retreading has risen from 27% in 1994 to 70% in 2004. The major markets in 2004 were energy recovery 31% and recycling 27%.

At present landfilling still accounts for 20% but the prospects are that this will decline as countries improve their end-of-life tyre management systems to be in compliance with the Landfill Directive and as they actively seek new and innovative ways to expand treatment capacity.



>> Thanks to a proactive industry

Anticipating regulations

Despite a still quite heterogeneous situation in Europe the remarkable progress that has been achieved is due largely to the proactive attitude of the profession. Even prior to the passing of the Directive on the Landfill of Waste 1999 the industry had been active in taking action to organise the different players in the recovery chain (see in the Annex) with the creation of national associations or consortia.

The national associations, voluntary consortia, joint companies and boards that were set up jointly by tyre producers/importers to take responsibility for end-of-life tyres are financed in different manners according to the legal system prevalent in the country and these organisations in turn organise and manage the end-of-life recovery chain in different ways (see page 10).

By professionalising the service providers – collectors, sorters and reprocessors – the goal is to significantly improve the recovery rate and traceability and develop applications with added value which utilise the full potential of the properties of rubber.

Promoting producer responsibility

The given volumes and recovery rates on the previous maps above would appear to demonstrate that producer responsibility achieves more robust results than the purely market driven approach as well as the ultimate objective of 100% recovery whereby not only the annual arisings are recovered but the historic stockpiles are also progressively eliminated.

The tyre's intrinsic quality gives added value (to all recovery applications)

The tyre is a complex and high-tech safety product representing a century of manufacturing innovation, which is still on-going. The tyre comprises many materials, the very best the metallurgical, textile and chemical industries can produce. There is no room for even the slightest defect and it is an extremely complex process to develop and manufacture the product.
From a materials point of view, the tyre is a mixture of synthetic and natural rubber, to which are added a range of specific substances to ensure performance, durability and safety. These include mineral oil, reinforcing fillers (carbon black and silica) and vulcanising agents (sulphur) which act as catalysts to accelerate the vulcanization process.

These characteristics contribute in many ways to enabling the development of a variety of recovery routes.

ENERGY RECOVERY (TYRE DERIVED FUEL)

With a calorific value equivalent to that of good quality coal, end-of-life tyres are used as an alternative to fossil fuels. The increase in the price of oil and the necessity to preserve resources could favour the development of this type of application.

Some equivalences		
1 metric ton of tyres	=	1 metric ton of good quality coal
coal	=	750 kg of fuel
Calorific power/value of a tyre		
1 passenger car tyre	=	7.6 litres of fuel

Combustion industries are currently facing a number of significant issues with the spike in energy costs and the constraints imposed by the introduction of air emission standards. In both these cases this could create opportunities for TDF. (NB: the use of TDF is a low-cost NOx reduction option.)

In the US a system of standards has been created for TDF (ASTM). The improvement in the quality, consistency and supply chain for TDF will enhance its chances of being seen as a valid alternative fuel for the larger customers. One of the ETRMA's current projects is to support the elaboration of a set of standards for cuts, shreds and chips.

Cement kilns - Currently in Europe whole or shredded tyres as a supplementary fuel provide some of the energy requirements of the cement industry. The cement sector requires 30 million tons of fuel equivalent per annum and the total annual arising of tyres is 3 million metric tons! Even if all Europe's end-of-life tyres were sent to cement kilns they would only represent 10% of the total amount of fuel required by the cement industry. Even if for technical reasons, TDF should not exceed 20%, this still leaves great leeway for this market sector.

The cement sector is the main application for energy recovery and new kilns are increasingly equipped to use end-of-life tyres as supplementary fuel, and still be in compliance with the atmospheric emission standards due to come into force in 2008.

Thermal power stations - This particular application is underdeveloped in the EU but much more widespread in the US.

Pulp and paper mills - Again the elevated cost of energy could create openings for TDF in this sector. At present this application is not developed in Europe but it is quite common in the US (at the end of 2003, 17 pulp and paper mills were consuming 26 million scrap tyres[2]).

Market outlook for TDF - The various market segments face different challenges and the rising cost of energy will no doubt remain a critical factor and stimulate market growth for TDF as an alternative fuel.

[2] Source : US Scrap Tire Markets 2003 Edition, Rubber Manufacturers Association, July 2004

MATERIAL RECOVERY

Civil engineering applications - These applications are the main recovery route for whole tyres. The applications vary from coastal protection, erosion barriers, artificial reefs, breakwaters, avalanche shelters, slope stabilisation, road embankments and landfill construction operations, sound barriers, insulation.

This market is for the moment confined to single projects and therefore fairly small scale. It is an application which is under-utilised and could represent a significant growth area for end-of-life tyres.

Shredded tyres - Whole tyres are mechanically sheared into shreds ranging in size from 25-300mm.
Tyre Derived Aggregate (TDA) is used as foundation for roads and railways, as a draining material replacement for sand and gravels, landfill construction, subgrad fill and embankments; backfill for walls and bridges and subgrad insulation for roads.

Advantages of Tyre derived Aggregate
Tyre derived aggregate is lighter by 30-50%; drains 10% better than well graded soil; provides 8 times better insulation than gravel.

Crumb and powdered rubber - After the removal of the steel and fabric components the remaining rubber is reduced to granular rubber.
Applications include moulded rubber products such as wheels for caddies, dustbins, wheelbarrows and lawnmowers, urban furniture and sign posts.

Crumb and powdered rubber are also to be found as flooring for playgrounds and sports stadiums, as shock absorbing mats for schools and stables, as paving blocks or tiles for patios and swimming pool surrounds as well as roofing materials.
A promising use of crumb rubber is in the construction of artificial turf for example in football fields. Rubber modified asphalt takes advantage of the elasticity and noise absorbing characteristics of the rubber. Although this increases the life span of the road surface, reduces the noise pollution and increases safety in wet road conditions it is still relatively underutilised in this area despite its many advantages.

Electric Arc Furnaces - 2004 saw the emergence in Europe of an important new market for end of life tyres (ELTs) in steelworks equipped with electric arc furnaces. This application was validated for industrial use in France and more than 7,000 metric tons of end-of-life tyres were used as a substi-

tute for anthracite and scrap metal. This is a promising first and encouraging as the application uses both the carbon and steel content of the tyres. This application is already under development in the US and will most certainly follow a similar trend in Europe in the years to come.

LME conducted experiments in an electric arc furnace during 2002 to check the feasibility of using ELTs during the process of making steel. Emissions on the casting floor (impact on health) and at the chimneystack (impact on the environment) were evaluated and best operating practices were elaborated. The findings demonstrated that an electric arc furnace could consume 1% (10,000 metric tons) of used tyres as an alternative for anthracite per million metric tons of steel produced.

Emerging opportunities

Pyrolysis / Thermolysis - Thermal treatment technologies – pyroylsis, thermolysis and gasification – are some of the emerging solutions for recovering value from end-of-life tyres.

Tyre pyrolysis involves the thermal decomposition of end-of-life tyres into intermediate substances such as gas, oil and char. The economic viability of this alternative route for high temperature resource recovery from tyres is hampered by the fact that the prices obtained for the by-products often fail to justify the process costs.
Under current market conditions the economic viability of these options has yet to be proved (there are few or no large-scale plants currently in operation) but they have the merit to offer scope for increasing recycling rates.

>> The current situation

Regulatory framework and other constraints

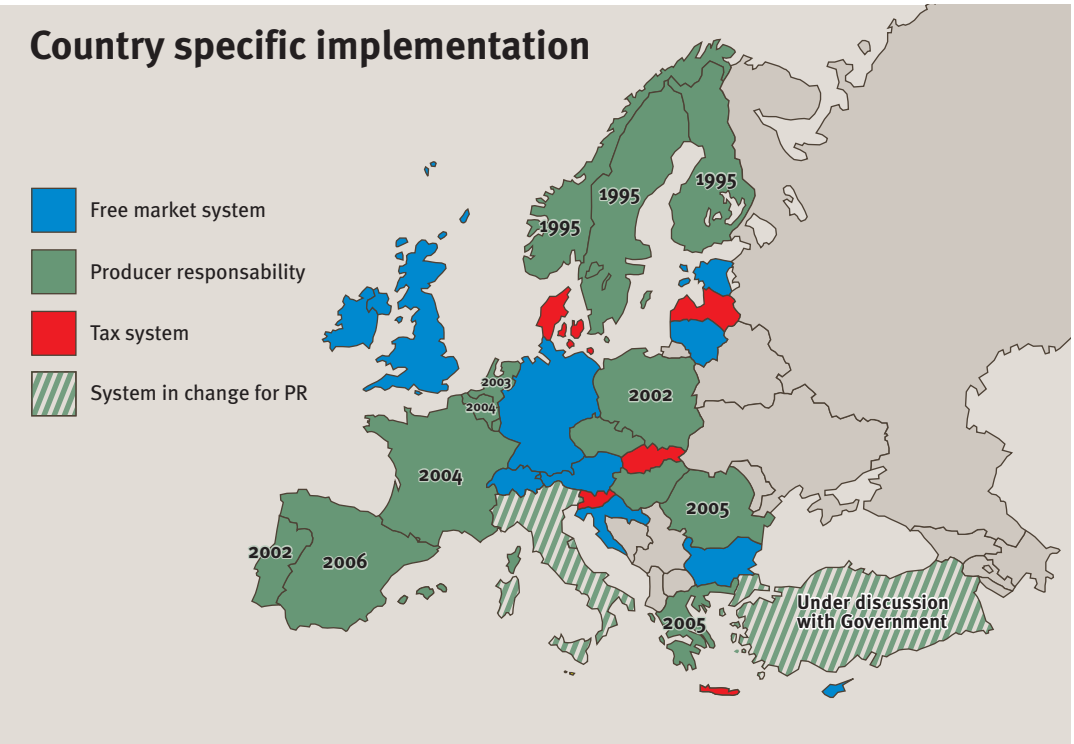
What are the issues facing the tyre industry in the realm of end-of-life tyres? EU Member States now have to be in compliance with EU legislation and have transposed into local legislation this EU Directive. Tyre manufacturers are also facing growing environmental pressure from the general public and other stakeholders concerning illegal dumping and historic stockpiles.

For all these reasons it is in the interests of the tyre industry to continue being proactive and take responsibility collectively for end-of-life tyres.

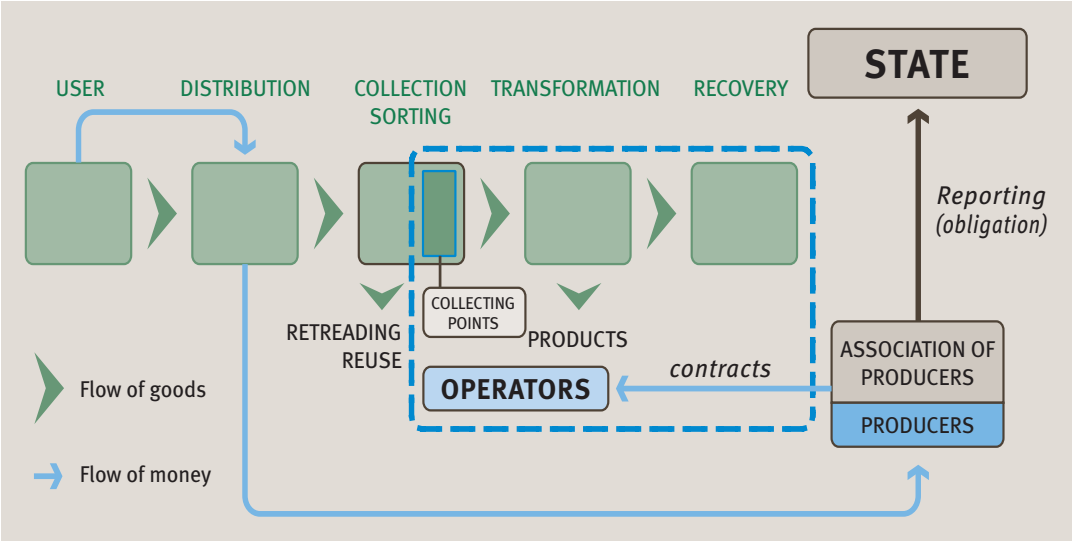
Although all the EU Member States have to implement the same Directive they are free to manage it in different ways. Today within the EU there are three different legal systems for managing the issue of end-of-life tyres:

- Producer responsibility
- Tax system
- Free market system

Some countries are currently in the process of moving from one system to another one. For example Spain passed a decree in December 2005 to change from a free market situation to a producer responsibility approach under the aegis of the national association Signus Ecovalor.



Producer responsibility



The law defines the legal framework and assigns the responsibility to the producers (manufacturers and importers) for organizing and processing end-of-life tyres. In this system the producer is responsible for the end-of-life tyre. A national operating company or consortium is created and the producers contribute to a common fund which covers the cost of collecting, recycling and recovery. The mem-

bers of the national associations and consortia usually include the national manufacturers and the main importers.
For example in Finland, Nokian is the national tyre manufacturer and Bridgestone, Continental, Goodyear, Michelin and Pirelli are the importers.

This system appears to be the most suitable and robust for addressing and resolving end-of-tyre arisings, in a sustainable manner for the long term, and to achieve a 100% recovery rate, in the most economical way. On the whole the tyre manufacturers have demonstrated a clear preference for this system and have deployed determination and commitment to take this route. For the end user, this system guarantees transparency of costs through a visible contribution, clearly indicated on the invoices.

Countries: Belgium, Czech Republic, Finland, France, Greece, Hungary, Norway, Netherlands, Poland, Portugal, Romania, Spain, Sweden.

Tax system

With the tax system each country is responsible for the recovery and recycling of the end-of-life tyres and this is financed by a tax levied on (tyre) production and subsequently passed on to the customer. This is an intermediate system whereby the producers pay a tax to the State, which is responsible overall for the organisation and remunerates the operators in the recovery chain.

Countries: Denmark, Latvia, Slovak Republic.

Free market system

Under this system the legislation sets the objectives to be met but does not designate those responsible. In this way all the operators in the recovery chain contract under free market conditions and act in compliance with legislation. This may be backed up by voluntary cooperation between companies to promote best practices.

Countries: Austria, Germany, Ireland, Switzerland, United Kingdom.

Barriers and constraints

The new enlarged EU has created a single market with freedom of movement for goods, persons and capital. Used tyres are considered as goods and some flows have been identified within the single market. These flows can have significant impacts on recovery rates when the movement occurs between two countries with different legal frameworks and management systems.

The fact that end-of-life tyres are classified as waste undoubtedly creates hurdles for the development of certain markets. According to the application this classification can create difficulties concerning permits, emissions, transportation and incineration. Even for use in civil engineering applications this denomination raises problems of perception in the minds of the general public.

With the EU Directive which bans landfilling of whole (2003) and shredded (2006) tyres, it is clear that the retreading, recycling, and energy recovery capacities for tyres will have to greatly increase.

The setting of specific recycling targets within overall recovery goals in certain countries will kill the competition between the various options and thus artificially increase the gate fees to be paid to the reprocessors.

The use of end-of-life tyres as "silage clamps" is a drawback as it is highly unlikely that these tyres will ever re-enter the recovery chain and the risk is that they will end up being burned for an application that has no potential.

The very properties which contribute to the tyre's performances – strength, durability and safety – often frustrate attempts to recycle end-of-life tyres.

Shredding, crumbing or thermal processes have relatively high operational costs and the sale of the by-products (crumbs, textiles and steel) does not always offset the initial cost, creating a need for gate fees to the granulating industry.

Funding research and development

In France Aliapur has set itself the target of devoting up to 10% of its annual budget to R&D.
The British government has allocated 1.5 million pounds per year for a three year plan to develop markets for ELTs. These 'WRAP' include monies develop existing and new processes for all aspects of end-of-life tyre recovery and recycling.
In Norway 3 million euros have been provided by the national government, national association and EU through the LIFE programme (1.5 million euros).

A lack of viable markets, materials recovery operations and good networks of tyre collectors as well as increased regulations at all levels, could all continue to hamper further market development.

>> There is still room for improvement

The efficient and cost-effective management of end-of-life tyres as a valuable and versatile resource with a high potential still has a long way to go. Many countries have successfully achieved a managed transition away from landfilling, but evolving market trends and regulations make the market an uncertain one.

In the case of natural rubber the tyre industry uses 70% of all natural rubber produced worldwide (source: CPN 01/01/2004) and estimates for the next 30 years predict that consumption will double. It is therefore critical to manage this source of secondary raw material in a sustainable way and all applications that recycle or recover rubber will help to preserve this valuable resource.

It is important to achieve a more sustainable change in our capacity to handle end-of-life tyres to avoid greater regulation. Extensive research into technologies for managing end-of-life tyres is crucial as is the monitoring of technologies and products entering the demonstration phase or full commercialisation. The role and commitment of the national consortium / management associations to drive the search for new and innovative initiatives and strategies to address the end-of-life tyre issues is crucial

The establishment of industry standards under the aegis of CEN could go a considerable way to increasing the credibility of end-of-life tyre applications.

Ever spiralling energy costs could have a positive impact on the end-of-life market, especially in the tyre derived fuel sector. But it could also have a detrimental effect on possible new market openings by squeezing the available supply of end-of-life tyres.

In conclusion we recognise that while there are difficulties, the industry is well capable of tackling them

Brussels, March 21 2006

Annexes I and II :

Annex I

	Ktons (Estimates)	UT	Part-worn tyres			ELT Recovery		Landfill & Unknown	UT Treated %
		Arising	Reuse	Export	Retreading	Material	Energy recovery		
EU 15	Austria	55	-	-	4	16	35	-	100%
	Belgium / Lux	82	-	2	3	28	35	14	83%
	Denmark	45	1	-	5	38	1	-	100%
	Finland	45	-	-	10	35	-	-	100%
	France	398	20	20	55	157	106	40	90%
	Germany	585	15	38	60	124	310	38	94%
	Greece	48	1	-	2	5	8	32	33%
	Italy	380	30	50	50	83	148	19	95%
	NL (PC only)	47	-	13	-	13	21	-	100%
	Portugal	92	1	15	16	26	34	-	100%
	Spain	305	10	20	37	42	52	144	53%
	Sweden	90	1	7	16	32	34	-	100%
	UK	475	32	34	55	212	72	70	85%
	Ireland	40	1	1	1	3	-	34	15%
	Norway	47	-	1	7	23	16	-	100%
	Switzerland	54	1	13	7	-	25	8	85%
	Subtotal	**2 788**	**113**	**214**	**328**	**837**	**897**	**399**	**85%**
		100%	**4%**	**8%**	**12%**	**30%**	**32%**	**14%**	**85%**

Annex II

	Ktons (Estimates)	UT	Part-worn tyres			ELT		Landfill & Unknown	UT Treated %
		Arising	Reuse	Export	Retreading	Material	Energy recovery		
Enlargement	Bulgaria	10						10	0%
	Cyprus	5						5	0%
	Croatia	15						15	0%
	Czech Rep	80			12			68	15%
	Estonia	11			2	2		7	36%
	Hungary	46			5	18	16	7	85%
	Latvia	9			2			7	22%
	Lithuania	9			2			7	22%
	Malta	1						1	0%
	Poland	146	1	1	21	10	56	57	61%
	Romania	50			5	10	10	25	50%
	Slovakia Rep	20				5	2	**13***	35%
	Slovenia	23			4			19	17%
	Subtotal	**425**		**1**	**53**	**45**	**84**	**241**	**43%**
		100%	**0%**	**0%**	**12%**	**11%**	**20%**	**57%**	**43%**
	Total Europe	**3 213**	**113**	**215**	**381**	**882**	**981**	**640**	**80%**
		100%	**4%**	**7%**	**12%**	**27%**	**31%**	**20%**	**80%**

* Collected and stored to be treated

Major legislation review impacting tyre recycling

1975 **Directive on Waste** 75/442/EEC ; 91/156EC
End of life tyres are classified as « non hazardous waste ».

1993 **Regulation on supervision and control of trans-border shipment of waste**
259/93/EEC

1999 **Directive on the Landfill of Waste 1999/31/EC** (26.04.1999)
- Ban on used tyres (whole tyres) in landfill starting July 2003
- Ban on shredded tyres in landfill starting July 2006.

1999 **Basel Convention Technical Guidelines on Hazardous Wastes:**
Identification and Management of Used Tyres (SBC NO. 99/008 October 1999).

2000 **European Waste List** 2000/532/EC and amendments

2000 **Directive on Incineration of Waste** 2000/76/EC (04.12.2000)
- Fixes emission standards for all cement kilns starting in 2002
- Older cement kilns prohibited from burning end-of-life tyres after 2008

2000 **Directive on End of Life Vehicles (ELV)** 2000/53/EC (18.09.2000)
- 85% of scrap cars to be recovered starting 2006
- tyres to be dismantled from vehicles increasing ELT arising by 10%.

2006 Landfill ban as from July 2006

List of the Operating companies with a shared management of the major tyre manufacturers

1994 SDAB, Sweden
1995 ND, Norway ; SRO, Finland
1998 RECYTYRE, Belgium
2002 ALIAPUR, France ; CUO, Poland ; Valorpneu, Portugal
2004 BEM, Netherlands ; EcoAnvelope, Romania ; Eco Elastika, Greece ; GME Hungary
2005 Signus Ecovalor, Spain

Photographics sources: **ELTs operating companies**

http://www.etrma.org/public/activitieseofltelts.htm

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