

End-of-life Tyre REPORT 2015



EUROPEAN
TYRE & RUBBER
manufacturers'
association

ABOUT ETRMA

Established in 1959, ETRMA is devoted to advocating the interests of the tyre and rubber manufacturing industries with the European Union Institutions and other international organisations.

ETRMA contributes to ensuring the development, competitiveness and growth of the tyre and rubber industry in contributing to all the initiatives in favour of health, safety & environment protection, transport and road safety and access to third markets in coordination with the European public authorities. The Association represents 7,800 companies, which employ directly about 360,000 people in the EU. All together they generate a turnover exceeding € 72 billion. The product portfolio of ETRMA members is extensive ranging from tyres (all vehicle types), other automotive and construction rubber products to pharmaceutical, baby care, food contact applications, etc.

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.

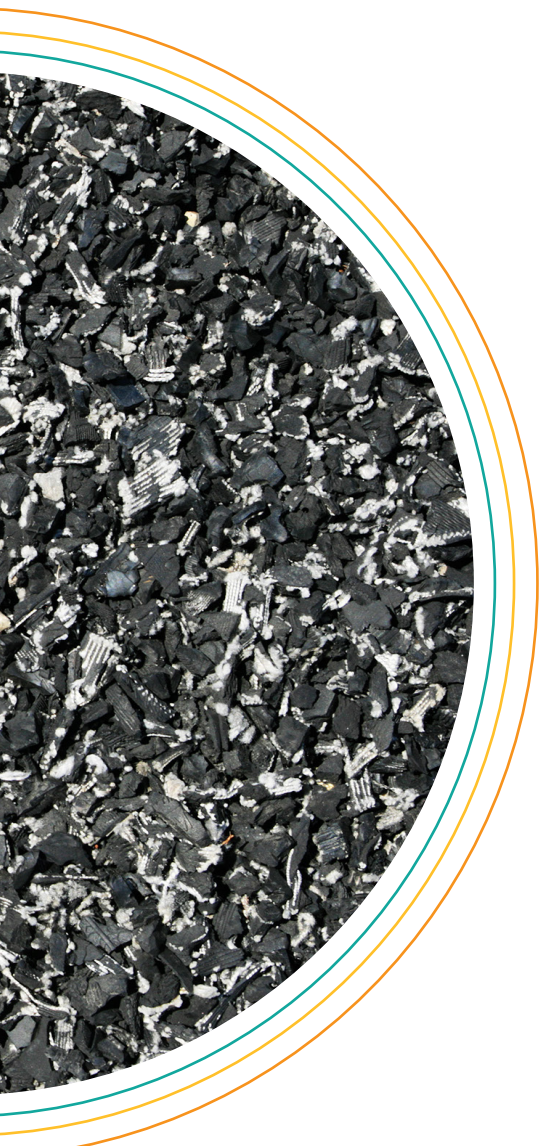
ETRMA undertakes action to host European, international and national conferences for authorities and advocates for sound EU programs to address end-of-life tyre issues.

ETRMA 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.





ETRMA promotes the principle that end-of-life tyres are a valuable resource with growing potential.

This edition is the 5th report on end-of-life tyres management in Europe published by ETRMA as part of the tyre manufacturers' continued commitment to promote the best available techniques for the effective recycling and recovery of end-of-life tyres.

MEMBERS



CORPORATE MEMBERS

 <p>www.vredestein.be</p>	 <p>www.conti-online.com</p>	 <p>www.bridgestone.eu</p>
 <p>www.coopertire.com</p>	 <p>www.goodyear.eu</p>	 <p>www.hankooktire.com</p>
 <p>www.michelin.com</p>	 <p>www.mitas-tyres.com</p>	 <p>www.nokiantyres.com</p>
 <p>www.pirelli.com</p>	 <p>www.trelleborg.com</p>	

NATIONAL ASSOCIATIONS

 <p>www.federplast.be</p>	 <p>www.kumiteollisuus.fi</p>	 <p>www.lecaoutchouc.com</p>
 <p>www.wdk.de</p>	 <p>www.federazionegommaplastica.it</p>	 <p>www.vereniging-nvr.nl</p>
 <p>www.consorciocaucho.es</p>		

AFFILIATED MEMBERS

 <p>www.brisa.com.tr</p>	 <p>www.btmauk.com</p>	 <p>www.hta.org.hu</p>
 <p>www.marangoni.com</p>	 <p>www.pzpo.org.pl</p>	

FOREWORD

This report into the End-of-life Tyre sector in Europe looks at the statistics and trends in the industry. The European tyre sector has moved towards a zero-waste scenario but some work remains to be done. The sector has performed well, and when compared to other waste streams, the tyre industry is both well managed and efficient in its recovery systems.

There has been a move towards an increased level of material recycling and the sector is evenly divided between recycling and energy recovery. This illustrates the balance required between the convenience of dealing with waste tyres through energy recovery – a quick and cost effective solution – and recycling solutions where the recovered materials may be used and reused.

The industry has many opportunities, in using ELTs for energy recovery in urban heating and energy plants, in using ELTs as fuel and material substitute in cement kilns, and even in steel mills to reduce the oxidation of scrap. For material recovery, there are many markets, some that may need a little help to assist them in opening up – such as rubberised asphalt, a key market for rubber powders, yet one that faces ongoing inertia across Europe despite its success elsewhere.

Additionally there are many projects looking into the use of rubber materials in rail transport, in moulded goods and in the automotive sector.

With this brief background set out, this report aims to look at a number of key areas of interest in the ELT sector and hopefully answer some questions about end-of-life tyres and generate a few more in the minds of the reader.

Mrs. Fazilet CINARALP
Secretary General



TABLE OF CONTENTS

	About ETRMA	2
	ETRMA members	3
	Foreword	4
01	INTRODUCTION ELT MANAGEMENT SCHEMES IN EUROPE	6
	1. Extended Producer Responsibility	7
	2. Liberal system (Free market)	9
	3. Government responsibility through a tax	9
02	USED TYRES STATISTICS	10
	The Evolution of ELT Arisings and Recovery	12
03	TYRES & THE CIRCULAR ECONOMY	16
04	ELT AS A RAW MATERIAL	18
05	DEVELOPMENT OF NEW END MARKETS FOR TYRE DERIVED MATERIALS	21
06	CHALLENGES TO THE RECYCLING OF ELT	28
	From R&D concept to commercial reality	28
	Tyre-to-tyre recycling	29
	Recovered Carbon Black	29
	Characterisation of ELT-Derived Raw Materials through Standardisation	30
	Conclusions	32
	Annexes	33

01

INTRODUCTION

END-OF-LIFE Tyre recycling is a global issue. What we do with end-of-life tyres (ELT) is both a challenge and an opportunity. The challenges come from many directions, not the least of which is the inertia in the recycling market. There is no shortage of ideas and projects that might utilise materials recycled from tyres, but the exploitation of those ideas is faced with uncertainty as to end markets and with obstacles to bring innovation into commercial success. And yet the ELT management schemes that have been implemented throughout Europe have pioneered ELT management best practices worldwide.

There are opportunities for those who have the finances and the political will: A case in point is the rubberised asphalt market which is underdeveloped in Europe. There are many other alternatives from street furniture, through to construction materials that have great potential.





The tyre recycling sector would indeed benefit from a more open consideration from governments through the encouragement of Green Public Procurement and the establishment of a recycled materials quota for public bodies. This could create new markets or even just create enough stability and credibility to allow operators to invest and develop materials and products to exploit those markets.

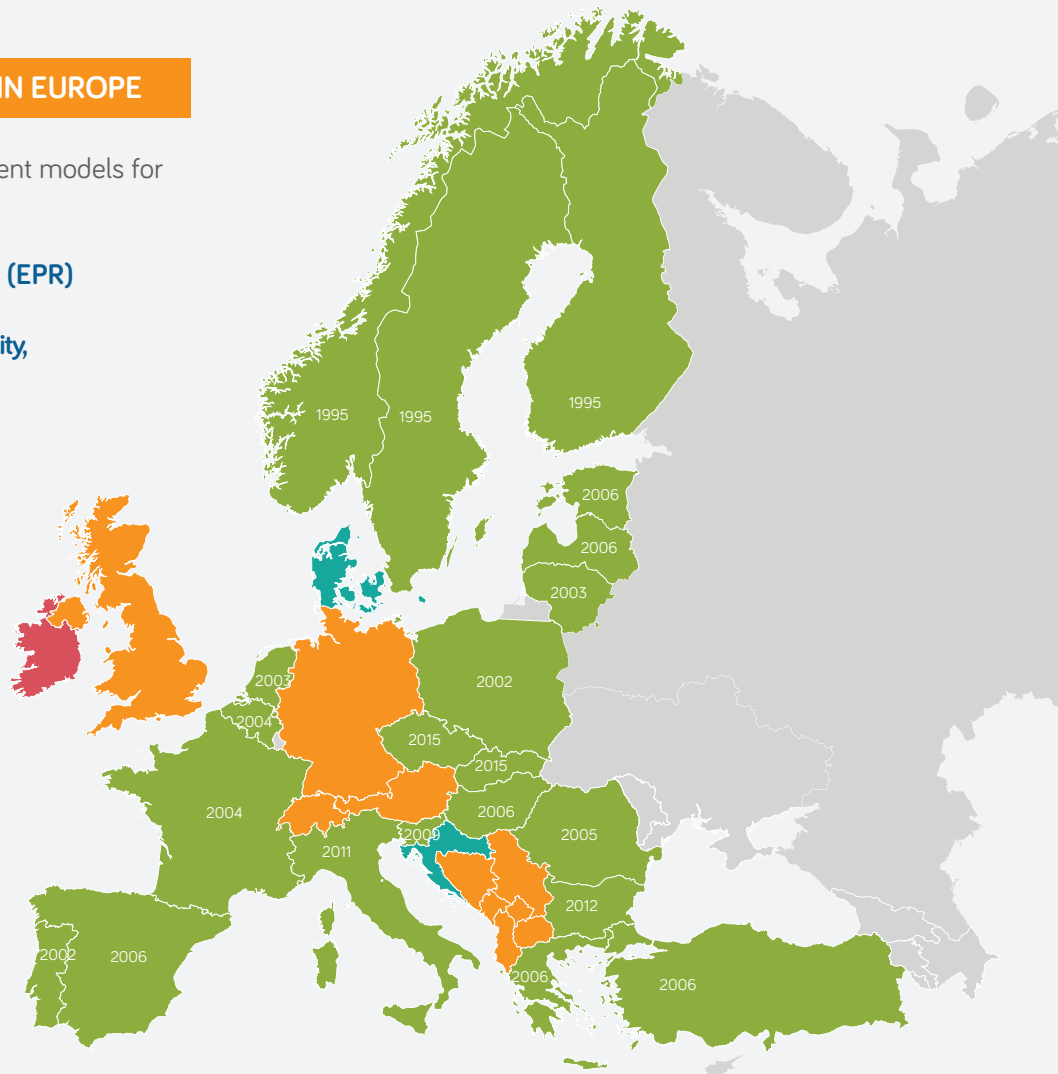
Governments also need to look at aligning their policies to ensure that recycling in a circular economy is possible. Specifications need to be attainable and well assessed. For example, restrictions on any

ELT MANAGEMENT SCHEMES IN EUROPE

Today within the EU there are 3 different models for managing ELTs:

- 1 - Extended Producer Responsibility (EPR)
- 2 - Liberal system (Free market)
- 3 - Tax system (Government responsibility, financed through a tax)

-  Liberal System (Free Market)
-  Government Responsibility financed through a tax
-  Producer Responsibility
-  Law under revision



chemicals can have a knock on effect in the absence of proper risk assessment, which rightfully takes into account the risk for human health and environment but also the benefits of recycling materials. Therefore, some mechanism has to be put in place by the legislator to balance the equation and avoid closing off existing and future routes to recycling.

1.- Extended Producer Responsibility

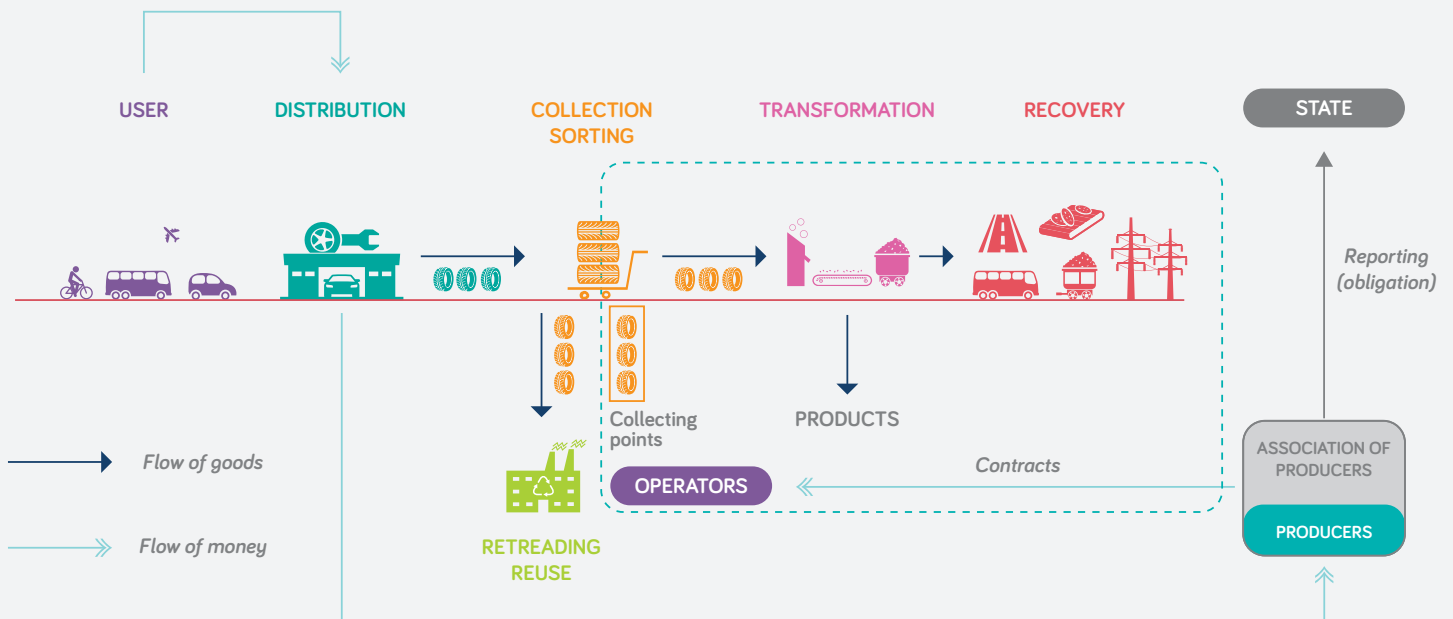
Extended producer responsibility means the producer's full or partial operational and/or

financial responsibility for a product extended to the post-consumer state of a product's life cycle.

In other words, under that system, the original manufacturer has a duty of care to ensure that the waste from the products it has created is disposed of responsibly, in an environmentally sound manner. This makes the producer responsible for the waste that the consumer generates.

The law defines the legal framework and assigns the responsibility to the producers (tyre

PRODUCER RESPONSIBILITY SCHEME



manufacturers and importers) to organise the management of ELTs.

This Extended Producer Responsibility is followed through in various ways from a single ELT management company dealing with ELT collection and treatment in a country (such as in Portugal, the Netherlands or Sweden), through multiple ELT management companies (such as in Italy, France or Spain) or through individual producer responsibility (in Hungary).

These companies are mandated by law to collect and organise the treatment of an equivalent amount of the volumes of tyres sold individually or collectively by affiliated companies on the same year or the year

before. The process is financed through an environmental contribution charged upfront by ELT companies to its affiliated tyre manufacturers and importers on tyre sales. The fee is passed on by producers and distributors throughout the value chain to the end user. For the end user, this system guarantees transparency of costs through a visible contribution, clearly indicated on the invoices.

A reporting obligation of the ELT management companies towards the national authorities provides a good example of clear and reliable traceability.

On the whole, tyre manufacturers have demonstrated a clear preference for this system and have taken the necessary steps to implement it. EPR is today the most widespread system in Europe with 21 countries (most of EU28 countries + Norway and Turkey) having adopted a legal framework assigning the responsibility to the producers (tyre manufacturers and importers) to organise the management chain of ELTs.

2. Liberal system (Free market)

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 the legislation. This may be backed up by voluntary cooperation between companies to promote best practice.

Free market systems operate a.o. in Austria, Switzerland, Germany and the UK. The UK operates a “managed free market” system as ELT collectors and treatment operators have to report to national authorities.

3. Government responsibility through a tax

The last model for managing ELTs is the tax system, applied in Denmark and Croatia. Under the tax system, each country is responsible for the management of ELTs. It is financed by a tax levied on tyre producers and subsequently passed on to the consumer.

In whichever market, the tyre companies are willing to ensure that their End-of-life tyre arisings are accounted for and dealt with in an environmentally sound way. The producer is responsible for ensuring that his products have a suitable recycling and recovery route.

The challenge is to collect and recover all tyres and prevent them from going to illegal landfill, or to manage their export to ensure that their destination is acceptable to European requirements i.e. that they are being treated in equivalent environmental conditions as in Europe and fulfil the legal prescriptions of the EU Waste Shipment Directive. In Europe, the various management schemes have a duty to ensure the required environmental standards are met and all do their utmost to ensure compliance. However, when not managed by ELT management companies, ELTs leaving EU borders may not be fully traceable as to their final destination. This is a weakness that will need to be addressed by a global response to tyre recycling.

The opportunity lies in the resources released by ELT recycling, whether in terms of energy or material recovery. Tyres create opportunities to find new markets for new materials and new products. Some of the opportunities are small, local solutions, others are high volume, high value solutions and others fall anywhere in between.

02

USED TYRES STATISTICS

The calculation of national used tyres (UT) and ELT statistics is a complex exercise and mainly deals with estimating national tyre arisings (i.e. the quantity of Used Tyres and ELTs arising in a specific geographic market available for collection and subsequent recovery) and tyre treatments (quantity of used tyres reused or ELTs sent to material and energy recovery).

The calculation of annual tyre arisings and treatments is based on data collected by ETRMA for 31 countries, including EU28, plus Norway, Switzerland and Turkey. The data is the most accurate available and not only comes from the main ELT management company (such as Aliapur, Signus, Ecopneus), but also from annual reports released by other ELT management companies such as FRP, TNU, EcoTyre as well as – when available – national statistics reported by public authorities so that as wide a range of arising and treatment data as is possible, is collected.

For the 2 main countries operating under free market, (UK and Germany) data are based on the audited arisings recorded by the UK UTWG (Used Tyres Working Group¹) and German arisings and treatments are compiled by GAVS (Gesellschaft für Altgummi Verwertungs Systeme mbH), a WdK study company.

It is important to understand the applied methodology of accounting.

¹ Formed in 1995 to act as a link between industry and Government on used tyre recovery issues.

ETRMA assumptions are:

☸ tyre sell-in figures are equivalent to tyre sell-out figures i.e. that the effect of storing new tyres in the global tyre supply chain is unaccounted for: all tyre sales are considered sold to end consumers

☸ one sale equals one tyre arising. This means for example that the total amount of tyres sold on a specific market is equal to an equal amount of used tyres dismantled from vehicles (1:1 correlation).

N.B. This is generally the case except for winter tyres.

National UT arisings comprise:

☸ UTs arising from the sales of new tyres on the replacement market

☸ UTs arising from retreading activity

☸ UTs arising from imported second-hand tyres²

The total UT arising is expressed as UT weight (i.e. new tyre weight minus wear loss). The arisings figures normally exclude

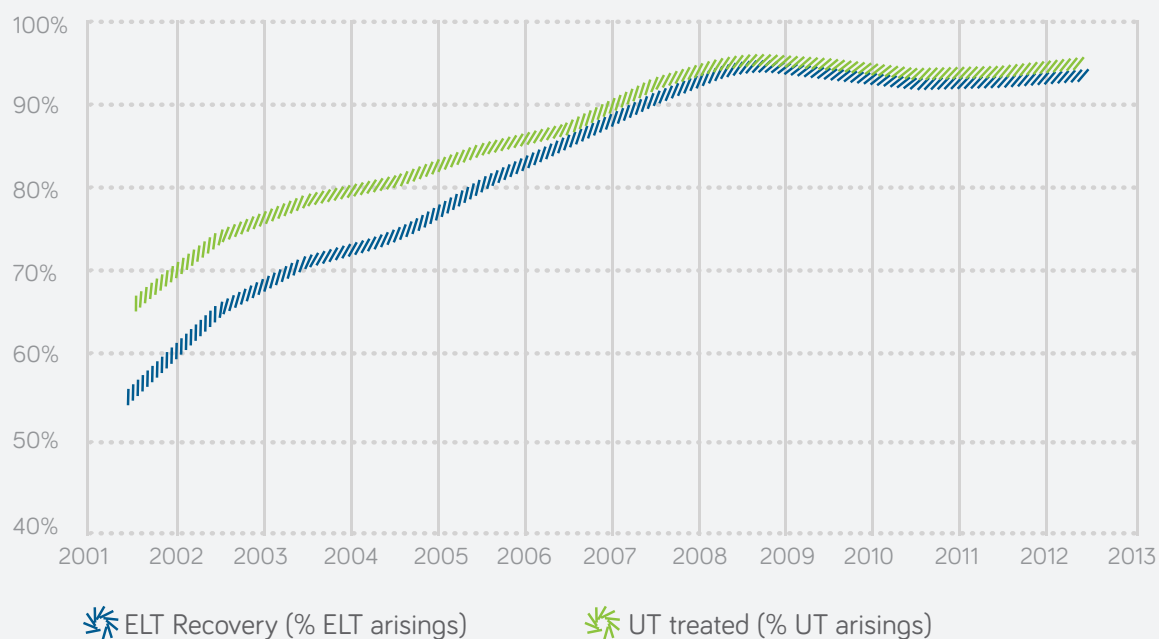
the recovery of ELTs from end-of-life vehicles, historical stockpiles and “free riders” from tyre replacement activity.

Pooled together, this data represents the most accurate tyre arising data for Europe. Details are reported in Annex I.

In 2013, the EU Used Tyres Arisings were estimated at 3.6 million tonnes, of which after sorting, an estimated 2.7 million tonnes of ELTs were recovered and recycled, which represents a treatment rate of 96%. This is a commendable result compared to other waste streams in Europe.



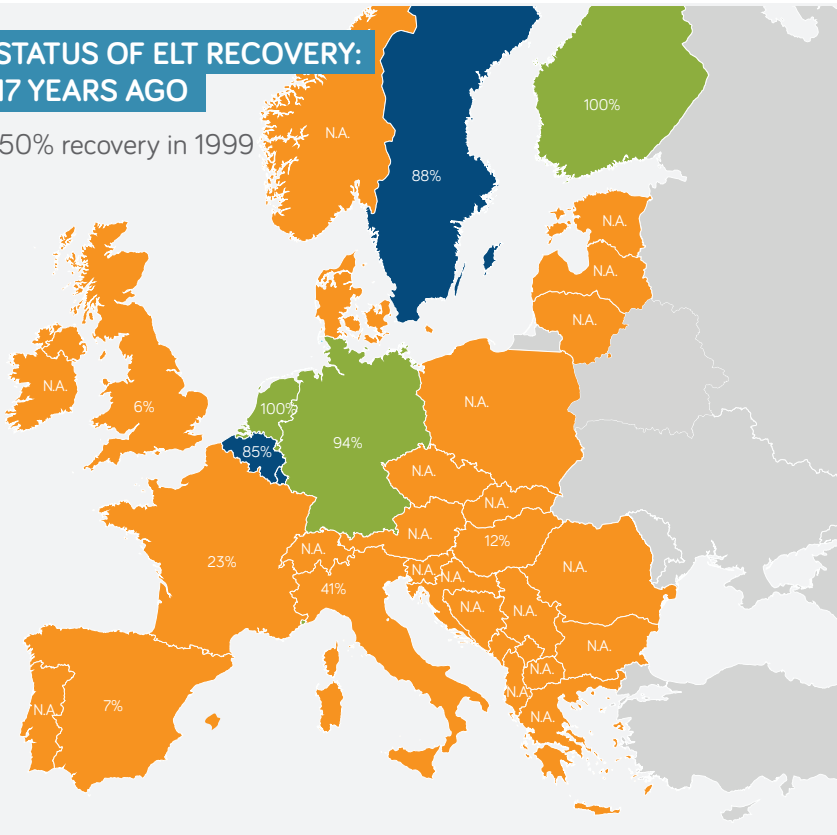
ELT RECOVERY vs UT TREATED OVER THE LAST 10 YEARS



²Second hand tyres are often unaccounted for in UT arisings since the second hand tyre market is a “grey” market.

**STATUS OF ELT RECOVERY:
17 YEARS AGO**

-50% recovery in 1999

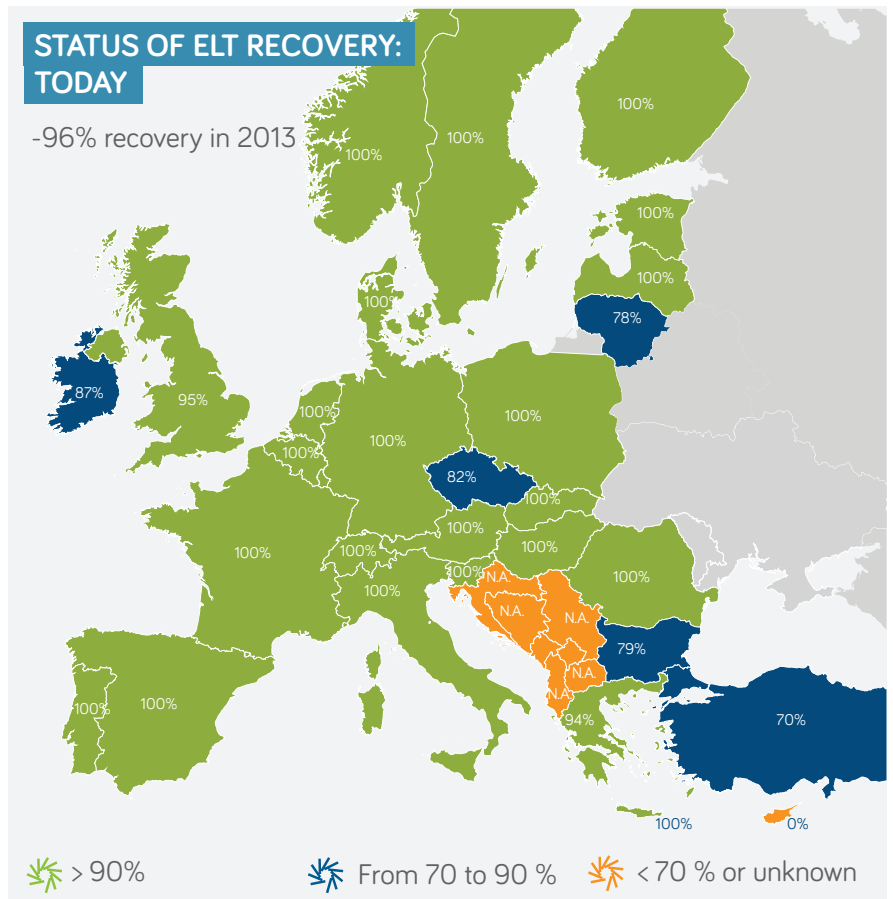


The Evolution of ELT Arisings and Recovery

The nature of ELT arisings is such that it reflects the development of the automotive market and the global economy. Europe has taken a lead in dealing with ELT arisings, and since 1994, where no structured management plans were in place, a growing number of European states has seen the development of some form of Producer responsibility scheme.

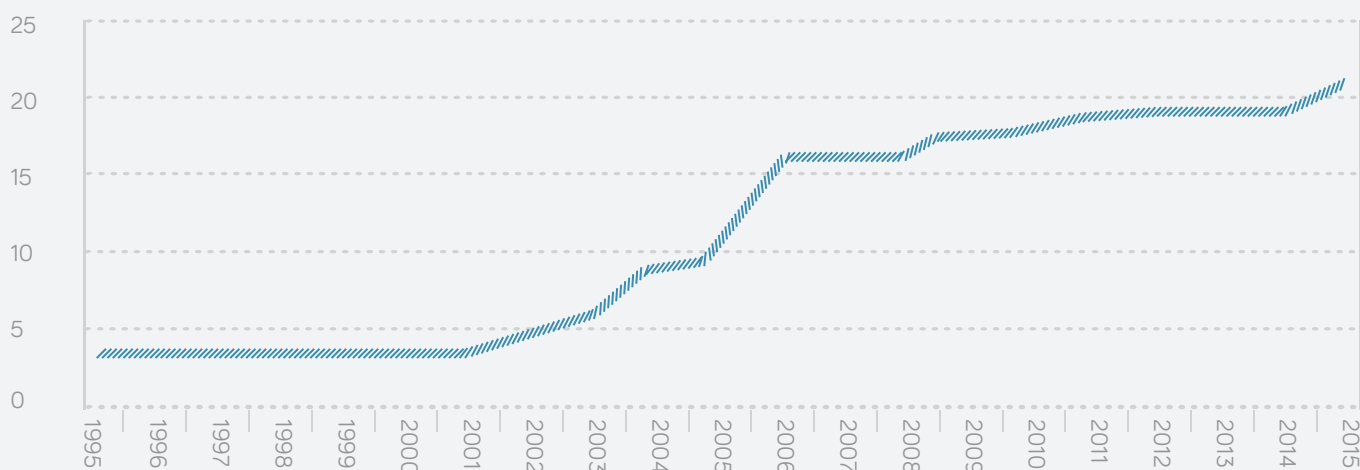
**STATUS OF ELT RECOVERY:
TODAY**

-96% recovery in 2013



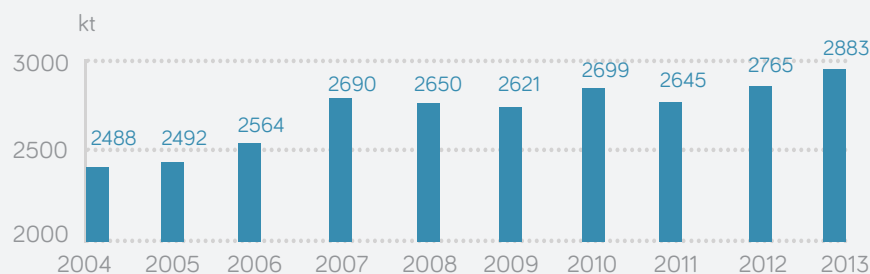
COUNTRY EPR EVOLUTION CHART

Cumulative number of countries with EPR



Over the intervening period, Europe has expanded and, as it has grown, the perimeter of consolidation also evolved over time along with the widening of Europe and the increasing number of countries with national ELT regulations. In 1994 only eight countries out of EU15 were involved in the analysis, by 2013, 27 Member States plus Norway, Switzerland and Turkey were now included in the ETRMA tyre arisings perimeter. So, by 2013 figures are much more inclusive and representative.

EVOLUTION OF EU ELT ARISING



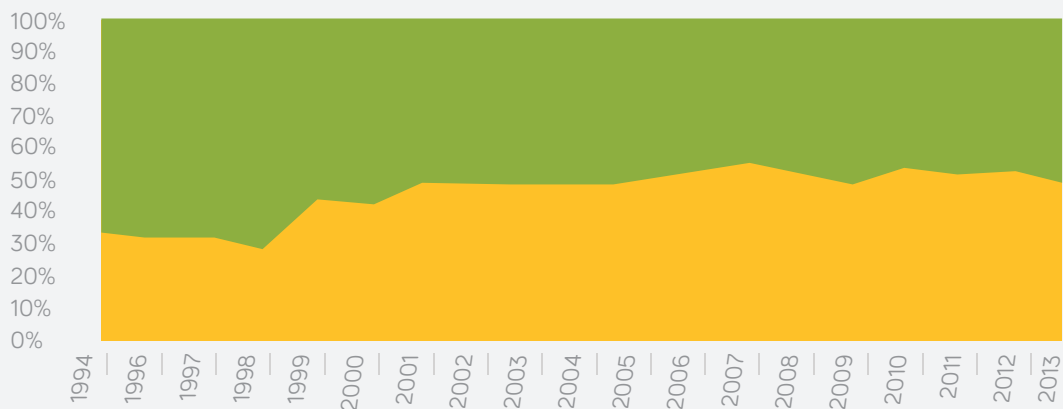
Since 2004 there has been an overall growth in tyre arisings from 2.48 million tonnes to 2.64 million tonnes in 2011 (EU27, Norway & Switzerland). The ELT arisings jumped to 2.76 million tonnes in 2012 and 2.88 million tonnes in 2013 (previous perimeter + Turkey). The rise has not been constant and reflects the economic crisis and its impact on transport and the economy. However, the trend is upwards and it is likely to remain so as the transport and automotive market in Eastern European markets continues to develop and mature. Even in the mature markets of Western Europe, the automotive market continues to expand and there is no sign of it coming to a plateau. Despite

traffic congestion, motoring costs and the environmental issues, the population of Europe continues to invest in and rely on personal transport.

As the retail economies grow, the transport sector servicing those economies also grows. The result is an inevitable ongoing increase in ELT arisings.

EVOLUTION OF ELT RECOVERY

 Material recovery
  Energy recovery



The uses that ELT are put to have changed since 1994. The ELT recovery recorded showed 32% used for material recovery, and 68% sent for energy recovery. By 2007 this had changed to 54% to material recovery and 46% to energy recovery. By 2013 the situation had swung slightly in favour of energy recovery, 48% material and 52% energy recovery. Between 2007 and 2013 it appears that a balance has been found that sees a roughly 50/50 mix in use between materials recovery and energy recovery.

The tyre industry has one legislation driven target with regard to ELTs: to prevent them from going to landfill. The single highest volume and quickest route to recovery of tyres was to use them for their energy and cement kilns, as the main user for tyre derived fuel (TDF).

The reality is that markets for recycled rubber materials have been slow to develop and without the arrival of alternative large scale processes that consume or reuse tyre derived materials, TDF risks becoming the largest single route to deal with ELT.

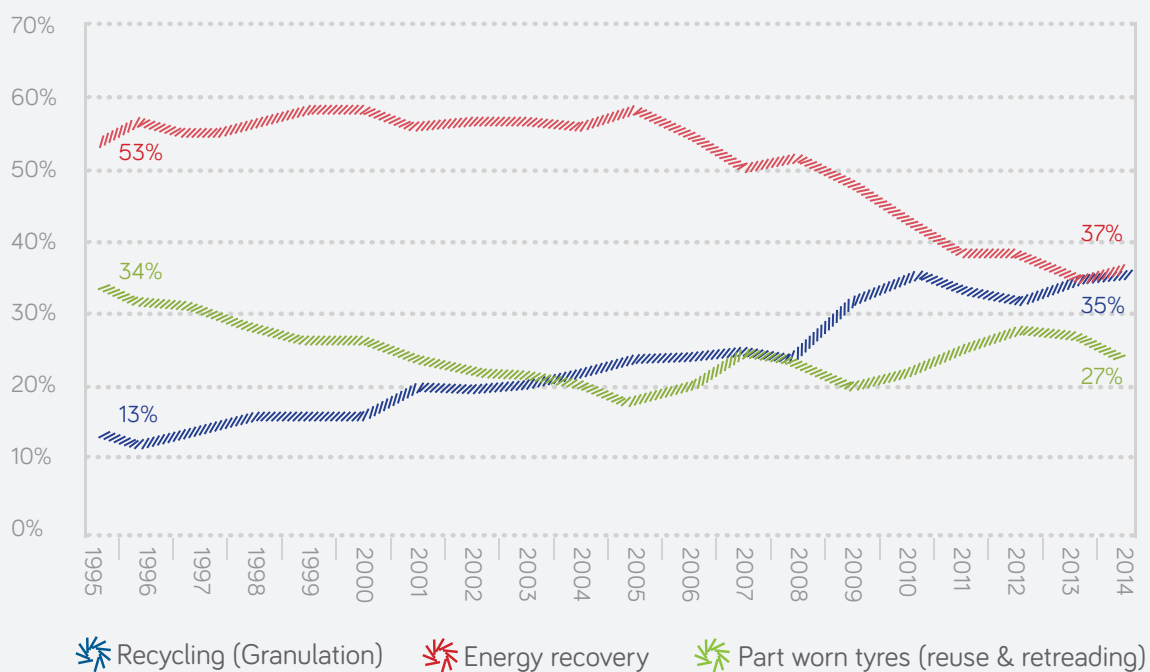
It is clear that there are benefits to the use of TDF. It is in plentiful supply, it has a cost benefit advantage, it replaces fossil fuels and it is thermally efficient. It is also the cheapest processing option for the size reduction plants which lack motivation to invest in further material recycling when there are higher costs involved and the alternative markets are not yet proven.

An examination of the market in Germany exemplifies the situation, showing the huge disparity between material and energy recovery in 1995 and today's market where there is near parity between materials and energy recovery, with energy recovery almost entirely being accounted for by cement kilns.

The same chart shows a stagnation of retreading in Germany, with volumes of retreading and reuse in 2013 at roughly the same levels as they were in 1995. Retreading in Germany, according to the BRV, the body representing independent retreaders in Germany, is facing unprecedented competition from low priced new tyre imports and there has been consolidation within the sector with retreaders leaving the market, or being taken over by competitors.



EVOLUTION OF TYRE TREATMENT ROUTES - GERMANY





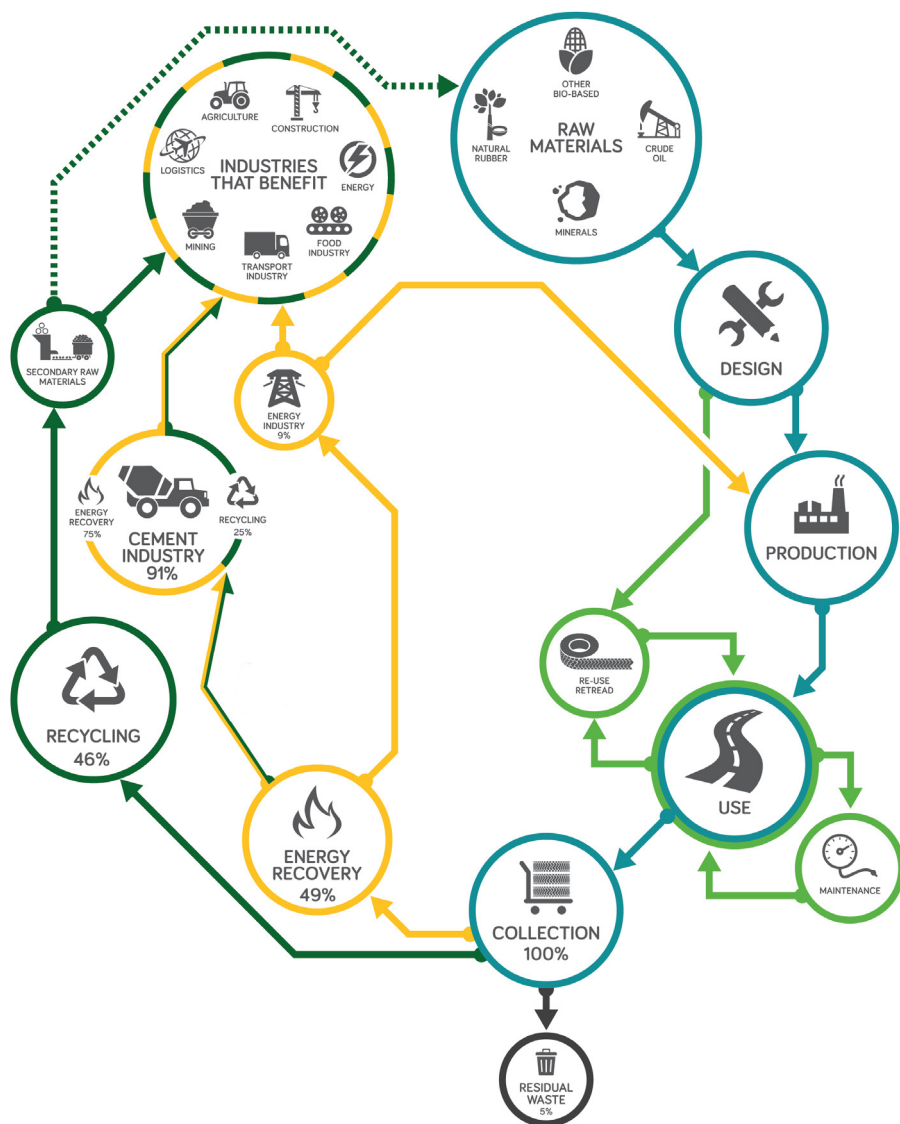
03

TYRES AND THE CIRCULAR ECONOMY

In history, there have always been elements of re-use, and some industries/crafts have always reused raw materials. In fact, up until the industrial revolution re-use until the point of no return was probably the norm. Wood, stone, metal, clothing etc., were all reused until they had no value or use left.

Then came the industrial revolution and we discovered that we could make many things quickly and cheaply and we became an increasingly throwaway society. Our latter day waste heap and landfills will one day become mines for resources such as rubber, plastics and other long lived materials.

Surfing on that trend and faced with scarcity of resources, in particular in Europe, which is import dependent not only on raw materials such as minerals but also rubber, the European Commission adopted in December 2015 a long-awaited Circular Economy Package. It includes revised legislative proposals on waste to stimulate Europe's transition towards a circular economy which will boost global competitiveness, foster sustainable economic growth and generate new jobs. The Circular Economy Package consists of an EU Action Plan for the Circular Economy that establishes a concrete and ambitious programme of action, with measures covering the whole cycle: from production and consumption to waste management and the market for secondary raw materials.



wear and handling performance. Commercial Vehicle and OTR tyres will be regrooved and retreaded as often as the manufacturer recommends. All this serves to extend the life of the tyre and mitigates the demand on natural resources.

Until 2003, ELTs were allowed to landfill, which was, with a few exceptions (bicycle and tyres beyond 1.4m diameter), definitely outlawed in 2006 also for shredded tyres by the Landfill Directive (Council Directive 1999/31/EC). Today, legislation has driven the tyre sector towards recovery and recycling. With collection rates in much of Europe at 100% of arisings, the tyre industry is halfway to a circular economy, for collection is half the battle.

Of that 100% collection figure there is an estimated 5% considered as residual waste, with unknown recovery routes. The balance goes largely to energy recovery (49%) and recycling (46%). 91% of tyres that go to energy recovery are used in the cement kilns. Of these, 25% is still being recycled in the clinker. The remaining 9% of tyres going to energy production feeds the energy industry with power.

The proposed actions will contribute to “closing the loop” of product lifecycles through greater recycling and re-use, and bring benefits for both the environment and the economy. It is an economic model that is being adopted globally. The design process needs to take into account the plan to recycle. It is important that all new products can, wherever possible be reused, recycled and recovered, and that the product resulting from this cycle can face the same requirement, to reuse, recycle and recover.

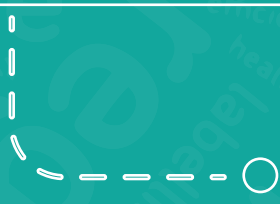
Tyres are an example of a market sector where the circular economy can be easy to exemplify: they are a clearly identifiable product, designed to last and their collection is distinct from all other waste streams.

For tyres, the Circular Economy starts at the design stage. The raw materials are considered and how they can best be used to produce a recyclable product. Tyres are designed for use, and some - the retreadable tyres for aircraft, truck and Off-The-Road (OTR) markets - are designed to be reconditioned.

It is during the use phase that the circular economy comes into play: to extend their life, tyres need to be maintained and technology is helping by ensuring the correct pressures and loadings, reminding about wheel position rotations. Tyre pressure monitoring is now mandatory on all new cars sold in Europe, the future will bring more digital input into tyre maintenance, possibly even monitoring

Recycled tyres become secondary raw materials that go into new products. Cement and steel produced using TDF also go into new products, all of which become recyclable themselves. As a result, the tyre circular economy is open and ELTs become an enabler for several other industries (from agriculture to mining, from construction to the food industry).

Achieving a “closed loop tyre-to-tyre recycling”, with materials recovered from tyres going back into tyres, is not yet within reach due to tyre high safety and environmental performance and technological constraints.



04

ELT AS A RAW MATERIAL

ELT cannot be considered as a simple waste to be disposed of and they are, in fact, a resource of renewable materials and energy. Tyres are made from a range of constituent components; rubbers, steel, and textiles. The types of rubbers vary with the type of tyre and the compounds used, and the ratio of steel may vary from one tyre type to another, and textiles are generally only used in passenger car and light truck tyres today.

To give an introduction to the potential tyre derived materials (TDM), the main components of tyres are briefly described.

Rubber

A tyre may contain more than one compound and more than one type of rubber. For example, on a car tyre there will be a sidewall rubber, a casing rubber and a top tread rubber, all adding different elements to the performance of the tyre. As can be seen from the chart in the next page the detailed composition of a tyre is very complex and any rubber recovered from a tyre may contain an amalgam of different compounds, and yet this material presents homogeneous properties when adequately sampled.

Separating and devulcanising these compounds to recover them is a difficult, if not impossible task. So, the rubber in recycled tyres is often treated as a complex resource and recycled in its entirety as shred, crumb, granulate or powder. Each of these stages of size reduction has its own

INGREDIENTS	CAR TYRE	TRUCK TYRE	OTR TYRE
Rubber/ Elastomers ¹	47%	45%	47%
Carbon Black ²	21.5%	22%	22%
Metal	16.5%	25%	12%
Textile	5.5%	0%	10%
Zinc Oxide	1%	2%	2%
Sulphur	1%	1%	1%
Additives	7.5%	5%	6%
Carbon based materials Total	74%	67%	76%

Source: WRAP (UK)

1.) Truck & OTR (off-the-road) tyres contain higher proportions of natural rubber than passenger car tyres.

2.) Silica replaces part of the carbon black in certain types of tyres.

characterisations and properties and one style of size reduction will create an end product with different properties to that created by another system.

Two of the key differences are in granulates and powders produced by ambient or cryogenic size reduction. In the former, ambient shredding and granulation produces a tearing effect that leaves a coarse surface area. The greater the surface area of the granulate or powder produced by ambient processes, the more surface active the product becomes and it has properties that give it greater binding potential in new mixes, either in rubber, or in elastomer mixes for remoulding.

Cryogenic size reduction usually requires an initial ambient shred to downsize the tyre, the shred is then fed into a hammer mill in a very low temperature nitrogen atmosphere and the tyre is literally smashed into granulate or powder. The form of the product by this method is “cuboid”, it has flat surfaces and a low surface activity ratio. However, it is said to be physically easier to create microscopic powders by cryogenic size reduction and its proponents claim that by making the powders finer, they create a similar surface area per weight compared to ambient grinding. Therefore, cryogenic powders can then be used in new compounds and

other processes such as rubberised asphalt. It is easier to generate high volumes of ELT rubber powders with cryogenic processes compared to ambient size reduction.

For granulates (>0.8mm), the specific surface area is comparable with both processes. For powders (<0.8mm), the specific surface area is higher with ambient size reduction (at the same granulometry).

Of course, by processing the whole tyre, the end product will contain Butyl dispersed through the material. This can have an impact upon the use of the material in rubber compounding or in subsequent pyrolysis operations.

Some operations recycling rubber will only accept rubber buffing from the tread, and sidewall of tyres. These buffing come largely from the retread sector and are the main supply feedstock for the reclaim sector. In Europe this is limited to the Rubber Resources operation in Maastricht. Some pyrolysis operations are now also only focusing on tread rubber in order to limit the variables in their process. In those cases their output is derived exclusively from the pyrolysis of car tyre treads.



Steel

The steel element recovered from all tyres is of an extremely high quality and is, when clean, in demand by the steel industry as scrap feedstock for the production of new steel.

The shredding processes are all designed to strip steel from the rubber and the more efficient the process is at removing the steel the cleaner the rubber will be, so the higher its value will be. Conversely, the same can be said of the steel and some of the more successful shredder manufacturers have approached the challenge of tyre shredding from the viewpoint of also recovering clean steel wire.

The lower the level of contamination of the steel, the higher the value. Operations with a high volume of throughput can generate a steel stockpile. This needs to be kept dry and clean as steel rusts quickly in the open air, greatly reducing its value.

Some processors have invested in hammer mills and will process all steel immediately prior to baling and dispatch so that they can supply clean steel to the end market.

Clean steel wire is also important to the concrete industry and tyre wire is now in growing demand for concrete reinforcement. An EU funded project (TWINCLETOES) is an example of how this use is being commercialised. Here clean tyre wire is used to reinforce concrete, specifically for large areas of flooring where it replaces specially manufactured “needles” as reinforcement.

Textile

The textile element of car tyres, and previously of bias belted tyres has always been a challenge for the tyre recycler. It is a hazard in the workplace if not managed as it creates a build up of dust and fibre on and in machinery and in the atmosphere:



this can result in all sorts of problems from housekeeping issues through to potential health issues for operators. Plants with suitable dust extraction systems can clean the workplace atmosphere, minimising any risk to staff, and minimising the risk of fire through heat build up in contaminated bearings and work areas. There have always been questions about what to do with the textile, which is often contaminated with rubber fragments. Whilst quality shredding and hammer mills can produce clean steel, they cannot do the same for textile. However, as new insulation products are developed and accepted by national building standards agencies throughout Europe, the demand for recovered textile has increased. Textile fibres can also be used as a source of energy and can be pyrolysed to recover materials. There is also ongoing research into the use of textiles from tyres for use as reinforcement in concrete.

05

DEVELOPMENT OF NEW END MARKETS FOR TYRE DERIVED MATERIALS

Over recent years, significant investment has been made by ELT management companies and recyclers in terms of R&D to develop new end markets. A discussion of few of most promising and yet not fully exploited applications is presented here below.

The presentation slide shown gives an idea of the extent of the current markets for ELT materials and energy. It shows the environmental benefits, which are often somewhat esoteric to comprehend, but to the left it shows the substitution rates in the current main outlets for ELT – a more tangible way of considering alternative uses.

Rubber in Concrete

Already the essential element in concrete – cement is a key market for TDF, but the potential to use tyre derived materials (TDM) in concrete applications is huge and there are various research projects and some active commercial applications already, and this market is sure to grow.

TDM in concrete is in some ways an obvious market. However, it is a market that requires considerable research and development in

MAIN END-USE APPLICATIONS



ELT-derived products substitute conventional fuels and raw materials



ELT recovery method	Substitution rate for an equivalent service and the same life span <i>1 tonne of ELT replaces</i>
Retention basins	1.95 t of blocks of concrete or 0.3 t of blocks of polyethylene
Infiltration basins	6 t of gravel
Moulded objects	1 t of virgin polyurethane
Synthetic turfs	0.5 t of virgin EPDM and 2 t of chalk
Equestrian floors	44 t of sand
Cement works	0.7 t of coke and 0.29 t of coal
Urban heating	1.15 t of coal
Steelworks	0.59 t of anthracite and 0.16 t of scrap metal
Foundry	(1000 t of scrap metals + 9.5 t of coke + 1 t of ELT) replaces (1002 t of scrap metals + 10 t of coke)

Source: ALIAPUR 2010 LCA

Demonstrated environmental benefits

Environmental review	Synthetic turf	Moulded objects	Cement works	Steel works	Urban heating	Equestrian floor
Indicators						
Emissions of greenhouse gas of fossil origin (direct, 100 years) (in kg eq. CO₂)	- 3,217	-2,703	-1,466	-627	-1,275	-342

Source: ALIAPUR 2010 LCA

terms of materials and products, and then in gaining government and market acceptance for use in construction (as cement-based mortars and concretes).

The aim of rubber incorporation is to both lighten the concrete and increase its performances (increased resistance to cracking and the capacity for deformation of these materials). The tests carried out by Aliapur with the LMDC laboratory in Toulouse and the Eiffage company not only showed a clear improvement in the resistance to cracking in the laboratory, but above all on test slabs placed outdoors and subjected to the vagaries of the climate. Adding granulate obtained from ELT provides the concrete with

increased durability, and a greater aptitude for absorbing mechanical vibrations, with no implementation difficulties.

There are also tests being undertaken to examine the use of rubberised concrete as an earthquake protection tool.

The concrete market across Europe is huge, with a volume in excess of 39.4M m³ of concrete being produced in the 16 European countries represented at the European Ready Mixed Concrete Organisation (ERMCO), plus Norway, Switzerland, Israel and Turkey (2013), and even a small percentage of rubber included in cement and concrete

would represent a considerable market for TDM. At this stage the volume of TDM used in concrete production is not recorded by ERMCO.

Rubberised Asphalt

A proven use for TDM in many parts of the world, this is a technology that is being tested in many European countries, but so far there has been no widespread adoption of rubberised asphalt. The argument for rubberised asphalt is strong as roads built with “modified asphalts” with rubber powder have many demonstrated advantages:

- ④ high durability of the pavement and exceptional resistance to aging, with international experiences of lifetimes up to three times longer than those of traditional asphalt;
- ④ consequent significant containment of maintenance interventions and costs;
- ④ appreciable reduction in noise;
- ④ excellent drainage in wet weather, with a strong improvement in visibility;
- ④ excellent response in case of sudden braking;
- ④ use of a resource deriving from the recycling of decommissioned tyres, an operation with an important environmental value.

Retention basin	Infiltration basin	Foundry	Asphalt Rubber
-448	-11	-1,193	- 1,585

Ecopneus-sponsored noise measurements on a stretch of rubberised asphalt in Bolzano, Italy, showed a 3-5dB reduction in road noise: enough to satisfy the expectations of local residents, as 3dB is equivalent to a noise reduction by 50%. Further calculations by the local government of Bolzano on the equivalent costs of rubberised asphalt compared to noise reduction barriers showed

that rubberised asphalt was particularly competitive in cost terms. In Italy the drive for noise reduction in transport is considered an opportunity for the tyre recycling sector to promote rubberised asphalt.

Some facts & figures

Spain has some 1170km of rubberised asphalt road surfaces, 360km by the “dry process” and 860km by the “wet process”, whilst Portugal had been successfully improving its roads with rubberised asphalt until the economic crisis stopped almost all public works. Portugal counts some 700km of rubberised asphalt road surfaces.

Europe has an estimated 5.3 million km of road network of which around 1.3% are motorways (Source: European Road Federation), most of which are paved and will at some point need repair or resurfacing. In addition, there are some countries in Europe, such as Estonia, Greece, Hungary and others that have many kilometres of unpaved roadways. The precedent set in the UK, Germany and France is that the majority of these roadways can and will be surfaced at some point in the future.



Bitumen binder used in producing asphalt for road surfacing can contain between 5 and 25 per cent of rubber powder, the mix depends upon the specification and the type of process used. 277M tonnes of asphalt bitumen were produced in Europe in 2013 (EAPA - European Asphalt Pavement Association). If all of that asphalt bitumen were to include a minimum of 5 per cent tyre rubber powder, the market potential would be 13.8M tonnes. The reality is that if even just a 10th of that production were to include rubber powder, then the market would still be almost 1.4M tonnes per annum. The potential of the bitumen sector is enormous. However, tyre rubber is late into the competition and there are already other modifiers available to the bitumen manufacturers, and of all asphalt road surfaces replaced in Europe every year, 99 per cent are already recycled, including the bitumen binder already incorporated in the road surface.

Resulting Rubber Modified Bitumen	Original Bitumen	Rubber Content (%)	Polymer Content	Temp. (°C)	Stirring Degrees	Digestion Time (min)
BC 35/50	B 50/70	10	-	185	Medium	60
BC 50/70	B 70/100	10	-	185	Medium	60
PMB 45/80-60 C	B110/120	4.0 - 5.0	2.5 - 3	185	High	60
PMB 45/80-65 C	B110/120	4.0 - 5.0	3.0 - 4.0	185	High	60
BMAVC-1	B C 35/50	22	-		Medium	60
BMAVC-1b	B C 50/70	22	-	195	Medium	60
BMAVC-3	B110/120	4.0 - 5.0	3.5 - 4.5	185	High	60

Source: Signus

The actual volume of rubber used in rubberised asphalt depends upon the specification, but varies from 4% to 22% by volume.

Nonetheless, rubberised asphalt is a market that has potential for growth, both in the replacement and repair of existing roadways and in the surfacing of currently unsurfaced roads and the creation of new highways. Currently, in Italy, this only constitutes 1% of the market. And in many other European countries its use is still negligible but growth can be accelerated if supported by incentives such as Green Public Procurement

The automotive industry is a huge consumer of rubber, not just in terms of tyres, but in seals, gaskets, mountings and other components. So, it is reasonable to expect that the automotive sector could be a large consumer of recycled rubber materials.

However, there is a reluctance by automotive manufacturers to specify recycled rubber content in original rubber products such as mountings, gaskets etc, unless that rubber comes from a closed loop manufacturing process, i.e. waste webbing from a gasket production being recycled into that same production line. The argument against such use is that the recycled rubber does not have the same properties as the original and reduces performance. Until that issue

is addressed simply reincorporating recycled rubber into rubber products for the automotive sector is going to be a challenge.

However, there are a lot of vehicle components that require the use of polymers to create plastic trays, mouldings, and so on. Here, the blending of recycled rubber material with polymers and elastomers can create new, mouldable materials that are in high demand by the automotive industry, and in fact they can be used to create improved performance products due to increased flexibility – for example.

Sweden's Ecorub is one company pioneering the use of tyres and polymers/elastomers to produce everything from painted coatings to automotive components. The commercialisation of the Ecorub plant came about as a direct result of contracts to supply both Ford and General Motors in the USA with polymer materials containing recycled TDM.

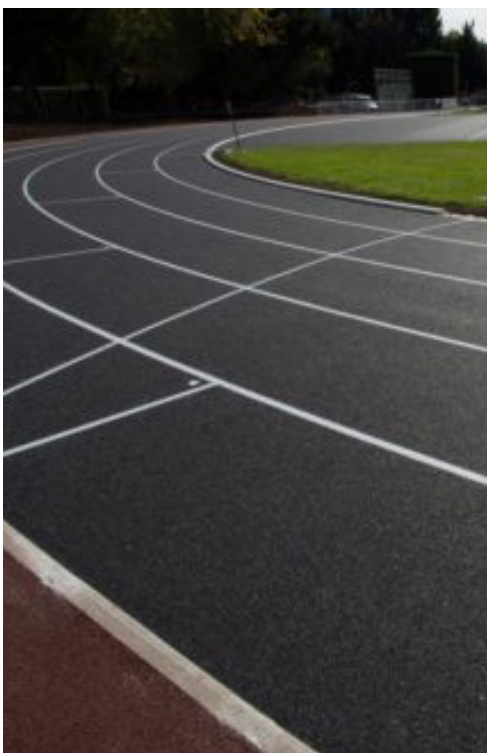
This is an avenue that is in complete compliance with the EU ELV Directive recycling requirements for the automotive manufacturers to incorporate an increased level of recyclates in their vehicles.

Athletic tracks – 100% made of ELT

Aliapur and Technisol, a manufacturer of sports surfaces, have developed an innovative concept for the surface of athletic tracks 100% manufactured from end-of-life tyres that would satisfy the expectations of the athletes doing disciplines in a stadium: shock absorption, deformation (flexibility) and slide (grip). This surface is made from granulates obtained from end-of-life tyres and a binding agent, polyurethane. This mission required 18 months of work, from the preliminary studies to the final design.

Once validated in the laboratory, this decidedly ecological sports surface was chosen by ASM Omnisports (Clermont-Ferrand) for its new athletics track at the Gauthière stadium, funded by Michelin. The track was installed during the autumn of 2012. The track laid is composed of a 400 m circuit with 5 lanes, 6 straight sprint lanes, a semi-circle for the high jump area as well as run-up track for the long jump and triple jump. The total surface area is 3,800 m². To make the 16 mm-thick surface, 40 tonnes of granulate from 9,000 passenger vehicle tyres were required.

End-of-life tyre granulates contain more than 50 % of high quality elastomers – particularly “NR”, natural rubber, and synthetic rubber of the “SBR” and “BR” types – whilst EPDM granulates only contain 20 % of elastomers. By restoring all the bounce and shock absorbance qualities from the tyres it is made from, tyre granulate is, by nature, perfectly suited to the criteria predefined for the track. The prototype track made for ASM Omnisports thus demonstrates that the exclusive use of end-of-life tyre granulate makes it

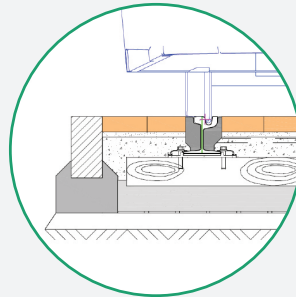
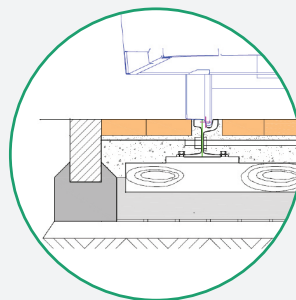


Source: Aliapur

NOISE MITIGATION AND ANTI-VIBRATION SOLUTIONS

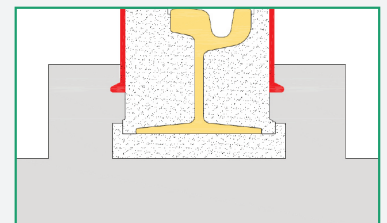
Vulblokken uit gerecycleerd rubber

- 1998: eerste keer geplaatst
- Zwaardere trams - Luchtgeluid
- Bredere tramwielen
- 3 dB(A)



Jaquette uit gerecycleerd rubber

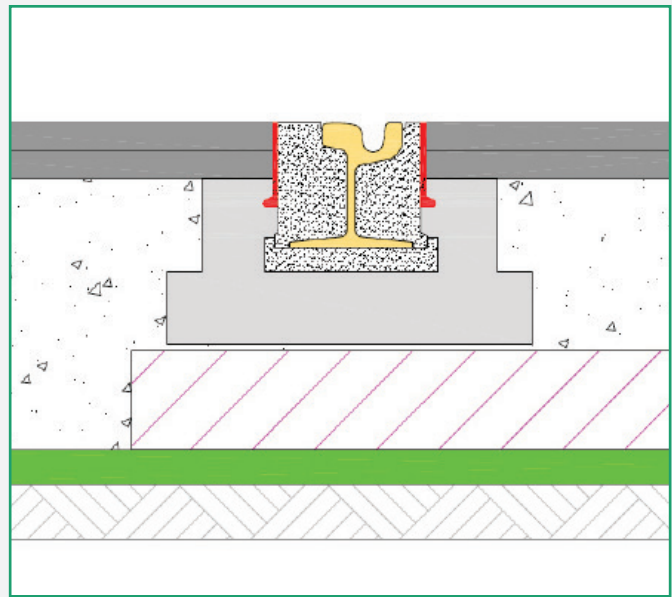
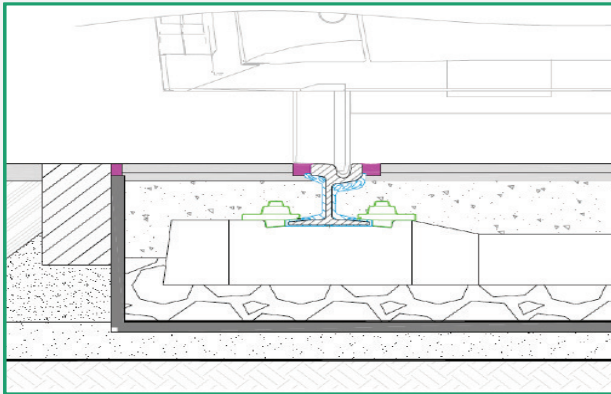
- 2000: eerste keer geplaatst
- Trillingen tot – 5 dB



Source: STIB /MIVB

Trillingsdempende matten uit gerecycleerd rubber

- 2003: eerste keer geplaatst
- 2004 Conventie MIVB- BRUSSELS GEWEST
- Trillingen tot - 20 dB



Source: STIB/MIVB

possible to create long life equipment with qualities that are more durable than those of an EPDM track and whose mechanical characteristics are better.

Rail Transport

The rail and tramway sector offers a huge potential for the use of TDM. Throughout the world there are many projects looking at the advantages of using recycled rubber in rail and tramway construction.

The TDM has its potential uses in many sectors, from sub-ballast – the underlying layer of ballast that forms the bed upon which the trackbed is laid, through coated ballast that helps reduce impact and noise to the rail ties or “sleepers” that the rails are bedded into.

In tramways the use of rubber to mount the rails reduces noise and vibration, making trams more acceptable in the modern city.

A case in point is the use of ELT-derived rubber by STIB, the “Société des Transports Intercommunaux de Bruxelles” since 1998, first as recycled rubber filler blocks (97% recycled rubber) placed on both sides of the tramway rail leading to 3dB(A) noise attenuation, then since 2000 as “sleepers” (made of 97% recycled rubber) placed on both sides & below the rail with vibration attenuation performances up to -5dB(A). A further innovation to further reduce vibration came with the use since 2003 by STIB of vibration damping mats (made of 95% recycled rubber), that are placed horizontally in the rail casing (with a vertical edge). This solution helps reducing vibrations up to -20dB.

Rubber can also be used in pedestrian areas to provide shock absorbing surfaces, and in components for the vehicles used on the transport system.

An example of the use of rubber in rail construction can be found in the Swiss National Rail system's ballast free trackbed, which has been in use since

1978. Here, every sleeper or “tie” rests on a rubber pad. Another project (NEUVIA), sponsored by Signus, is the design of a slab track system using a mixture of polyurethane & ELTs.

As a peripheral use, rubber and concrete screens can be used to reduce noise levels at high traffic areas.

One promising development has been the creation of sleepers, which are moulded from a blend of recycled rubber granulate and recycled plastics. For every km line equipped with these sleepers from Greenrail, 35 tonnes each of tyres and plastics will be used according to the manufacturer.

In the UK alone, according to a WRAP report by Anne and Russ Evans in 2006, the UK rail network comprised 10,478 miles of track, and with an even sleeper arrangement across the network, if all wooden and concrete sleepers were replaced with rubber and polyurethane sleepers, the market would be around 34.1 million sleepers, an equivalent of 115 million tyres, or one and a half years’ ELT arisings.

According to the EU Transport Pocket Book, 2011, Europe has some 212,345 km of rail lines. The total number has shown a slow decline since 1990, (-9.74%). However, this belies the fact that countries such as Spain, Italy, and the UK are all considering major improvements, upgrades and even new rail lines.



CHALLENGES TO THE RECYCLING OF ELT

The use of recycled materials faces a dichotomy. On the one hand the idea that goods produced from waste will be of a lesser quality, or they will be cheaper is an often quoted excuse for not using recycled materials. Neither is necessarily true, though both can be correct. This does nothing to allay market fears about using recycled materials, which they widely consider to be of inferior specification.

On the other hand, the construction and steel industries have been using recycled materials for millennia. It has been the norm to recycle old building materials, and steel (and other metals) have always been recycled to make new designs or better products.

From R&D concept to commercial reality

The development of alternate markets requires a leap of faith on the part of both the manufacturer of new end products and the developer of the materials themselves. It is one thing to prove the prototype, quite another to commercialise the concept. Our streets are full of steel and concrete bollards. The Instituto Tecnológico del Plástico (AIM-PLAS) and the Instituto de Biomecánica de Valencia (IBV), Spain, proved the capability and suitability of bollards made from sintered recycled rubber. Yet the project has not gained commercial acceptance. It has

to first overcome market concerns about recycled materials, and then it has to replace long standing market suppliers of concrete and steel urban furniture – both of which are manufactured from a high percentage of recycled materials themselves.

Anyone coming to the market with recycled rubber products has mountains to climb even after proof of concept and meeting any homologation requirements for the market.

Tyre-to-tyre recycling

There is however, perhaps a need, on the part of the recyclers to reconsider the concept that they can take material from tyres and recycle it and see it re-enter the process as an element in the new compound for making new tyres. That closed loop concept is, although not a dead-end street, not perhaps the highway to recycling that many would wish.

There are many reasons why new tyre rubber compounds may not be the El Dorado that some seek. Not the least of which is that the tyre manufacturers would want control of their input so would almost certainly seek only to recycle material from their own products. There is then the percentage of recycled rubber that they might wish to introduce to their new compounds, and for the biggest markets, truck and car tyre, quality and performance are key factors in specification and any element that might compromise the end product would have to be considered very carefully.

Recovered Carbon Black

What then of rCB, that recovered black from the pyrolysis of tyres? Well again, the issue is one of specification, and the rCB does not meet the same specifications as Carbon Black used in the tyre sector. However, even if it came close to specification, the average car tyre uses only around 6% Carbon Black

by weight as a filler, and any rCB added to the mix would only be a small percentage of that 6%, so without additional, expensive refining, the car tyre market for rCB is not huge. Even if technically close to the requested specifications, its economic viability has yet to be demonstrated.

Though in relative terms, 1 per cent of the CB market in tyres would still be a big prize for any industrial scale company to achieve. A very recent breakthrough for use of rCB in automotive chassis plugs is an opening for further research. Further standardisation on rCB specifications could be an incentive for further market uptake.



Characterisation of ELT-Derived Raw Materials through Standardisation

One of the great challenges to the tyre recycling sector over the past has been the lack of standards for the products resulting from ELT size reduction processes. Tyre shredders would, and still often do, work to their own specifications. That is to say, if they focus on TDF production, anything else they may produce will be to whatever specification comes out at the classification process.

The fine-tuning of equipment lines to produce a particular narrow band specification involves considerable investment in plant, plant maintenance and of course space, and also in sales and marketing of the end product.

In a chicken and egg scenario, there has been a reluctance to invest in plants to produce a high quality material when there is no standard specification to work to. And with no specification, investors have been reluctant to invest in plant and equipment.

Therefore, standardisation activities in CEN Technical Committee (TC) 366 have been initiated with the aim to enable the field of ELTs to become more reliable, long-lasting, industrially and economically balanced and to better respond to the needs of industry by standardizing relevant physical and chemical properties of tyre derived materials.



This led in a first stage to the publication in 2010 of CEN Technical Specification (TS) 14243, defining the categories of TDMs obtained from end-of-life tyres in relation to their size or impurities. In a second stage, a new TC366 Business Plan was adopted to assess the robustness, reproducibility, repeatability of the test methods proposed in CEN TS 14243 in order to turn the TS into an EN standard.

CEN TC366 also identified the need to work on the determination of:

- ④ specific physical characteristics of TDMs (such as bulk density of granulates and powders, of steel, density of rubber material, determination of morphology of granulates, abrasion resistance of granulates, sampling methods for granulates & powders stored in a big bag...).
- ④ specific chemical characteristics of TDMs (such as elastomers identification, odour intensity & fogging tests on granulates, determination of non-metallic contents of steel derived from ELTs, moisture content, ...)
- ④ Quality criteria for the selection of whole tyres, for recovery and recycling processes.

Upon completion of the various studies and reports, and upon their acceptance, CEN will have been able to establish sampling and measurement methodologies that will enable suppliers and clients to discuss requirements and specifications without confusion on the standards involved.

A next standardisation step necessary for the future is to develop standardized secondary product specifications towards increased recognition and acceptance by the market. An evidence of this is the recently launched work programme in ASTM International (D24:67 sub-committee) to establish the methodologies and standards for recovered Carbon Black (rCB). This includes material from the pyrolysis and gasification of ELT.



CONCLUSIONS

Used Tyres treatment rate of 96% in Europe is unrivalled – no other waste material stream performs as high as the ELT sector in Europe.

ELT management companies are the main driver towards circular economy for tyres in Europe. EPR schemes by which manufacturers and importers of tyres organise collection and management of UTs & ELTs are the dominant model for managing tyres. The increase of reuse & energy recovery over the last 15 years can to a large extent be attributed to the activities of these ELT management companies.

There are nevertheless significant challenges to overcome. A number of applications for rubber granulates were developed over the past years; some have reached a mature stage and have little potential for additional growth but others are still at their early stages of market development and have large growth potential. However, these companies making new products or using rubber granulates in construction applications are often SMEs or small and in a weak position compared to their competitors using virgin materials. In particular, their capacity to develop new products, to develop effective marketing and communication and therefore penetrate new markets is limited.

Finally, current recycling technologies which still produce a material of a quality that may meet the standards needed to allow for large scale applications – for example rubberised asphalt – face market barriers. The tyre industry is committed to stimulating and supporting high quality recycling. The role of recycling will become crucial towards reaching circular economy objectives. Rubber granulates have a number of unique properties including shock absorption, noise reduction, resistance against changes of temperature and against chemical degradation. There are a lot of best practices on how to apply the material, for example in construction works. However, this step requires proper regulatory and market conditions for which public authorities have a role to play

CONTACT

*Jean-Pierre Taverne,
Coordinator Environment &
ELT Technical Support*

E-mail: jp.taverne@etrma.org

Tel: +32 2 218 49 40

Website: www.etrma.org

Designed by AdGrafics Design Studio | www.adgrafics.eu



ANNEXES

- **Annex I: Used Tyres recovery in Europe**
- **Annex II: National ELT management companies**



Annex I: Used Tyres recovery in Europe - UT/Part Worn Tyres/ELT's Europe - Volumes Situation 2013

National figures (tonnes)	Used Tyres (UT Arising*)	Reuse of Part-worn tyres			ELT Arising	ELT recovery				Landfill/Unknown (J)	Total UT treatment (K)= (H+I)	UT treated (L)= K/A
		Reuse (B)	Export (C)	Retreading (D)		Material			Energy recovery (I)			
						Civil engineering, public works & backfilling (F)	Recycling** (G)	Total Material recovery (H)=(F+G)				
(A)	(B)	(C)	(D)	(E) = A-(B+C+D)	(F)	(G)	(H)=(F+G)	(I)	(J)	(K)= (H+I)	(L)= K/A	
Austria (est. 2010)	63.000	0	0	3.000	60.000	0	24.000	24.000	36.000	0	63.000	100%
Belgium	76.000	3.000	7.000	11.000	55.000	0	45.000	45.000	10.000	0	76.000	100%
Bulgaria (est.)	29.000	0	0	4.000	25.000	0	15.000	15.000	4.000	6.000	23.000	79%
Croatia	-	-	-	-	-	-	-	-	-	-	-	-
Cyprus (est.)	5.000	0	0	0	5.000	0	0	0	0	5.000	0	0%
Czech Rep. (est.)	57.000	0	0	2.000	55.000	0	17.000	17.000	28.000	10.000	47.000	82%
Denmark	39.000	0	1.000	0	38.000	0	38.000	38.000	0	0	39.000	100%
Estonia (est.)	15.000	0	0	0	15.000	0	15.000	15.000	0	0	15.000	100%
Finland	51.000	0	0	1.000	50.000	34.000	8.000	42.000	8.000	0	51.000	100%
France (1)	457.000	20.000	50.000	35.000	352.000	33.000	92.000	125.000	227.000	0	457.000	100%
Germany	582.000	10.000	84.000	75.000	413.000	0	201.000	201.000	212.000	0	582.000	100%
Greece	34.000	0	1.000	1.000	32.000	1.000	15.000	16.000	14.000	2.000	32.000	94%
Hungary	36.000	0	0	0	36.000	0	27.000	27.000	9.000	0	36.000	100%
Ireland	30.000	3.000	1.000	1.000	25.000	0	12.000	12.000	9.000	4.000	26.000	87%
Italy (est.) (2)	421.000	22.000	17.000	28.000	354.000	2.000	118.000	120.000	234.000	0	421.000	100%
Latvia (est.)	9.000	0	0	0	9.000	0	4.000	4.000	5.000	0	9.000	100%
Lithuania (est.)	23.000	0	0	0	23.000	0	9.000	9.000	9.000	5.000	18.000	78%
Luxembourg	-	-	-	-	-	-	-	-	-	-	-	-
Malta (est.)	1.000	0	1.000	0	0	0	0	0	0	0	1.000	100%
Netherlands	91.000	0	27.000	2.000	62.000	1.000	50.000	51.000	11.000	0	91.000	100%
Poland (est.)	169.000	8.000	0	3.000	158.000	0	35.000	35.000	123.000	0	169.000	100%
Portugal	84.000	5.000	0	13.000	66.000	1.000	38.000	39.000	27.000	0	84.000	100%
Romania	34.000	0	0	0	34.000	0	3.000	3.000	31.000	0	34.000	100%
Slovak Rep. (est.)	27.000	0	3.000	1.000	23.000	0	17.000	17.000	6.000	0	27.000	100%
Slovenia (est.)	15.000	0	0	0	15.000	0	8.000	8.000	7.000	0	15.000	100%
Spain	296.000	6.000	22.000	40.000	228.000	6.000	98.000	104.000	124.000	0	296.000	100%
Sweden	80.000	0	1.000	0	79.000	20.000	19.000	39.000	40.000	0	80.000	100%
UK (estimated by UTWG)	527.000	40.000	29.000	39.000	419.000	34.000	174.000	208.000	187.000	24.000	503.000	95%
EU28	3.251.000	117.000	244.000	259.000	2.631.000	132.000	1.082.000	1.214.000	1.361.000	56.000	3.195.000	98%
Norway (3)	39.000	0	1.000	0	38.000	2.000	11.000	13.000	18.000	0	39.000	100%
Switzerland (est. 2010)	40.000	0	40.000	0	0	0	0	0	0	0	40.000	100%
Turkey (4)	260.000	7.000	0	39.000	214.000	0	98.000	98.000	38.000	78.000	182.000	70%
EU28+NO+CH+TR	3.590.000	124.000	285.000	298.000	2.883.000	134.000	1.191.000	1.325.000	1.417.000	134.000	3.456.000	96%

(1) France: Since 2012, reported figures include the treatment of historical stocks by Recyvalor (12.000t) in the treatments of ELTs and in the UT arisings. (2) Italy: Reported figures include the treatment of historical stocks in the treatments of ELTs (in accordance with the legal prescriptions of the Italian ELT Decree). (3) Total UT recovery includes 7.000t of stocks. (4) In Turkey, the 2013 national UT arising is estimated at 260.000 t. The producer responsibility obligation for 2013 is limited to collecting and managing 70% of that tonnage. This obligation is set to rise to 100% by 2014. National obligations were fully met. * ETRMA UT arisings calculations methodology: New tyres (replacement market) + Retreaded tyres (national market) + import of second-hand tyres. ** Recycling: includes ELTs sent to granulation (1.119.000t), use of ELTs in steel mills and foundries (7.000t) as well as use as dock fenders, blasting mats... (43.000t) and pyrolysis (23.000t).

Annex II: National ELT management companies

Belgium	 RECYTYRE	Chris Lorquet: www.recytyre.be
Czech Republic	 eltma	Radim Filak: www.eltma.cz
Estonia	 Eesti Rehviliiit	Kaur Kuurme: www.rehviliit.ee
Finland	 SUOMEN RENGASKIERRÄTYS	Risto Tuominen: www.rengaskierratys.com
France	 ALIAPUR	Hervé Domas: www.aliapur.com
Greece	 TECO elastika	Giorgios Mavrias: www.ecoelastika.gr
Italy	 ecopneus Riviera del pneumatico fuori uso, 1999	Giovanni Corbetta: www.ecopneus.it
NL	 RecyBEM B.V. BAND & MILIEU	Cees van Oostenrijk: www.recybem.nl
Norway	 Norsk Dekkretur AS	Jon Erik Ludvigsen: www.dekkretur.no
Poland	 CUO CENTRUM UTYLIZACJI OPION ORGANIZACJA ODZYSKU S.A.	Grzegorz Karnicki: www.utyliczacjaopon.pl
Portugal	 valorpneu	Climénia Silva: www.valorpneu.pt
Romania	 ECO ANVELOPE END OF LIFE TYRES MANAGEMENT COMPANY	Liviu Buzetelu: www.ecoanvelope.ro
Spain	 SIGNUS SISTEMA INTEGRADO DE GESTIÓN DE NEUMÁTICOS USADOS	Gabriel Leal Serrano: www.signus.es
Sweden	 SDAB SVENSK DÄCKÅTERVINNING AB	Fredrik Ardefors: www.svdab.se
Slovakia	 eltma	Radim Filak: www.eltma.sk
Turkey	 LASDER® Lastik Sanayicileri Derneği	Korhan Ul: www.lasder.org.tr



ETRMA

Avenue des Arts 2, Box 12
B-1210 Brussels

Tel. +32 2 218 49 40
info@etrma.org

Written By Ewan Scott, Editor of Tyre
and Rubber Recycling Magazine.
Designed by Ad Graphics Design Studio.

