

Sustainability Report



ECOPNEUS

Strategic value for the Circular Economy in Italy



ecopneus

2016

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Letter to the Stakeholders

Assuring a market – a real, free, non-assisted market – for about 115,000 tonnes of rubber and steel granules and powders recycled from ELTs has been an exciting task so far. The excitement is the one of our team of people, as well as the one of our consultants. Every day they try to find a balance point between the creativity of coming up with new uses of recycled rubber that did not exist until the day before, and the rationality in concentrating the efforts on those applications, which keep together the valorisation of the intrinsic properties of this material with the quantitative and qualitative potentialities of absorption of the sector. All this with a constant respect of the legislation in force.

The excitement has been the one of our **partner companies** that carry out the shredding of the ELTs on our behalf. They are rapidly growing companies, both dimensionally and culturally, and they are giving their activities a managerial style aimed at the quality of the product, the management and environmental efficiency and responsibility. But also the excitement of the companies who use the granules deriving from the shredding and which, downstream of the chain – and based on an exquisite business reasoning as well as an environmental awareness – give life to new products or new surfaces created with recycled rubber. They are objects and installations that will last for years and which, at the end of their life cycle, will be recycled once more.

The excitement has also been the one of the **bodies we collaborate with**: the associations of the companies of the application areas; the sports promotion bodies and some sports federations. They all strongly promote the use of recycled rubber for floors dedicated to several disciplines. Universities and Research Centres open new frontiers of knowledge for us with reference to safety in the use of recycled rubber and its performance: from Pisa to Bologna, from UISP to Matrec, from the Institute Mario Negri to Waste&Chemicals. But also the bodies we support – such as Legambiente – that believe, as we do, that the economy will become really circular only when the circle of the use of the materials deriving from recycling will be closed successfully on real and valuable applications; and the bodies we are members of, such as the Foundation for a Sustainable Development, Sybola and Sodalitas. For us, they are a strategic laboratory for the realisation of the principles of environmental responsibility of the producer with reference to the end-of-life of their products.

All this “excitement” is linked to the challenge of the recovery of material, the real “heart” of the circular economy, a challenge that has generated important environmental advantages (in terms of reduction of CO₂, savings of water and resources) and creates added value and richness to the Country, jobs (really green jobs), and sustainability knowledge and culture. In truth, we could easily solve the “problem” of the destination (of the 250,000 tonnes of ELTs that we collect every year) by directing all of them to the energy recovery channel of cement factories. The request of shreds is very high and the national absorption capacity is limited, but there are areas of the world (North Africa, Korea, Eastern Europe) whence we constantly receive requests for the same. It would be a very simple and cost-efficient solution. It would also allow an overall saving, if we think of all the activities linked to research and promotion of the application sectors and all that is connected to the granules (certificates, personnel, initiatives, as well as the cost per tonne, which is currently not compensated by the earnings deriving from sales and, so, still to be borne by Ecopneus). Such solution would allow us to have an even leaner structure and management costs reduced to the minimum.

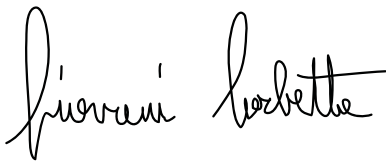
Why, then, choosing the harder way, the one of material recovery, instead of the easier one of energy recovery?

The answer lies in what we feel is the founding element of the activity of our consortium: that is, **guaranteeing, by the means of the collection and recovery of ELTs, the**

maximisation of environmental and social benefits as well as the minimisation of the financial cost for the community, with a full application of the principles of ethics, responsibility, and legality and in response to the institutional, European and national indications.


We asked the Foundation for a Sustainable Development to carry out a comparative analysis of the impacts of two simulations of extreme and alternative scenarios of ELT recovery at national level for the whole sector (full energy recovery vs. full recycling). From the study it emerges that, in a scenario of total matter recovery, the environmental, social and financial benefits for the country would be well above the ones of the alternative one. Bringing material to a new life respects the logics of the circular economy; it is a source of linked industry, it generates more richness and jobs, and it acts as a multiplying factor for the economy of the country. Recovering the material as product for new uses allows saving large quantities of CO₂, water and resources. The results of this analysis have encouraged us to carry on with our strategic choices. The same is to be said of the input coming from the European Parliament with reference to the circular economy. However, in order to make this happen, we need some operative tools. One of these tools is the recognition of the status of product for ELT granules and powder. Without this recognition it is not possible to close the loop. Without this, the excitement I have talked about - which also means investments, sacrifices, and risks - would be completely pointless. We are confident that this recognition will come soon and that the excitement will remain the sentiment of our joint work in the next years.


Giovanni Corbetta
General Manager of Ecopneus




Guide to Reading

With the **Green Economy Report 2016** Ecopneus continues its reporting for sustainability which started upon its own foundation. In line with the approach developed in the last years, the objective of this document is double: on the one hand, reporting about the results obtained by the Consortium in terms of contribution given to the process of transition towards a green economy; on the other hand, as every year, to deepen a topic of particular strategic relevance for the ELT recovery chain. In order to express this double objective, this report is organized in three distinctive levels.

The first part  **“The performance of the Ecopneus system”**, is organised in seven chapters. It reports the activities of ELT management carried out by the consortium system during the year 2016, with reference to environmental, financial and occupational performance indicators. These indicators have been elaborated according to the methodological approach developed by the Foundation for a Sustainable Development, which extends a company’s performance reporting also to products, goods and services, as well as the whole value chain in a life cycle perspective.

The second part is divided into five chapters.  **“The quality system of Ecopneus”** presents a more in depth analysis of the topic of quality in ELT management, starting from the approach experimented during these years by Ecopneus. Quality is one of the four founding pillars of the Green Strategy of Ecopneus, together with the full compliance with the legislation in force, the development of rubber recycling markets and the constant improvement of management efficiency. It is, in reality, a transversal factor. Indeed, in a phase of development of the national system of ELT management that is becoming more and more oriented to the promotion of recycling, it becomes essential to guarantee the respect of the end-of-waste criteria, promote new and more advanced applications, and improve market competitiveness of the products deriving from ELT recycling.

Finally, the third part is entitled  **“Communication of Ecopneus”**. It briefly summarizes objectives, modalities, and the main projects carried out by Ecopneus in 2016 for the study and the information to Institutions, companies, and the Public Opinion about the applications of recycled rubber, which is a fundamental link for a circular economy that may really become part of our society’s daily life.

Highlight 2016

245,722 t

collection at 26,689
ELT Generation
Points

20,500 t average of ELTs
managed every month
975 t average per day

+ 9 %

extra collection
with respect to
legal target

6,662 t

Collected in the
Land of Fires (the
area around the
cities of Naples
and Caserta)

+3% compared to 2015

56 %

of effective
material recovery

In the scope of the Memorandum
of Understanding with the
Ministry of Environment

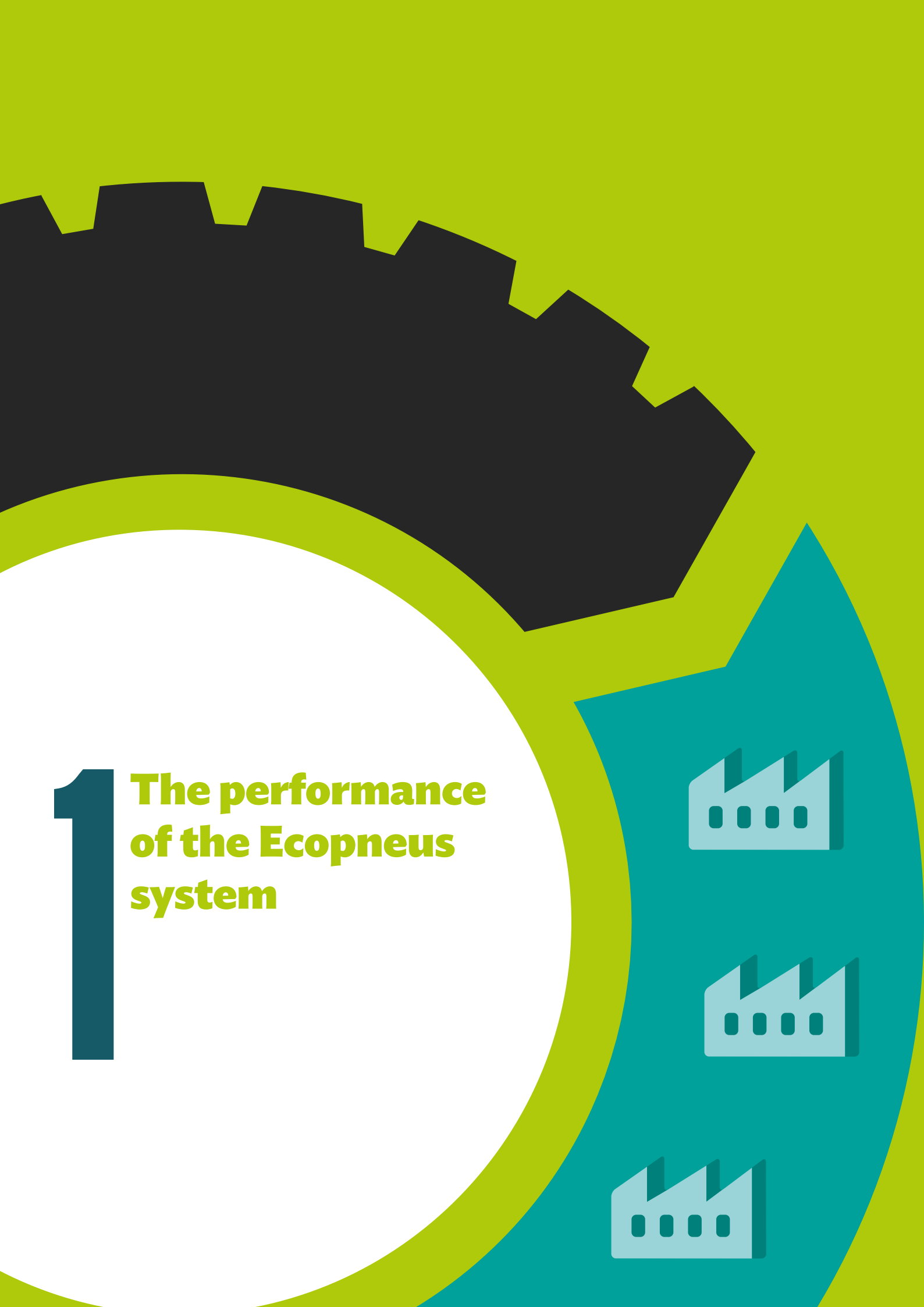
366,835 t
non consumed
resources

381,960 t
avoided CO₂
emissions

642
jobs in the
Ecopneus
system

1,871 million of m³
of saved water

130 Million/Euros
saving on Country's raw
material import



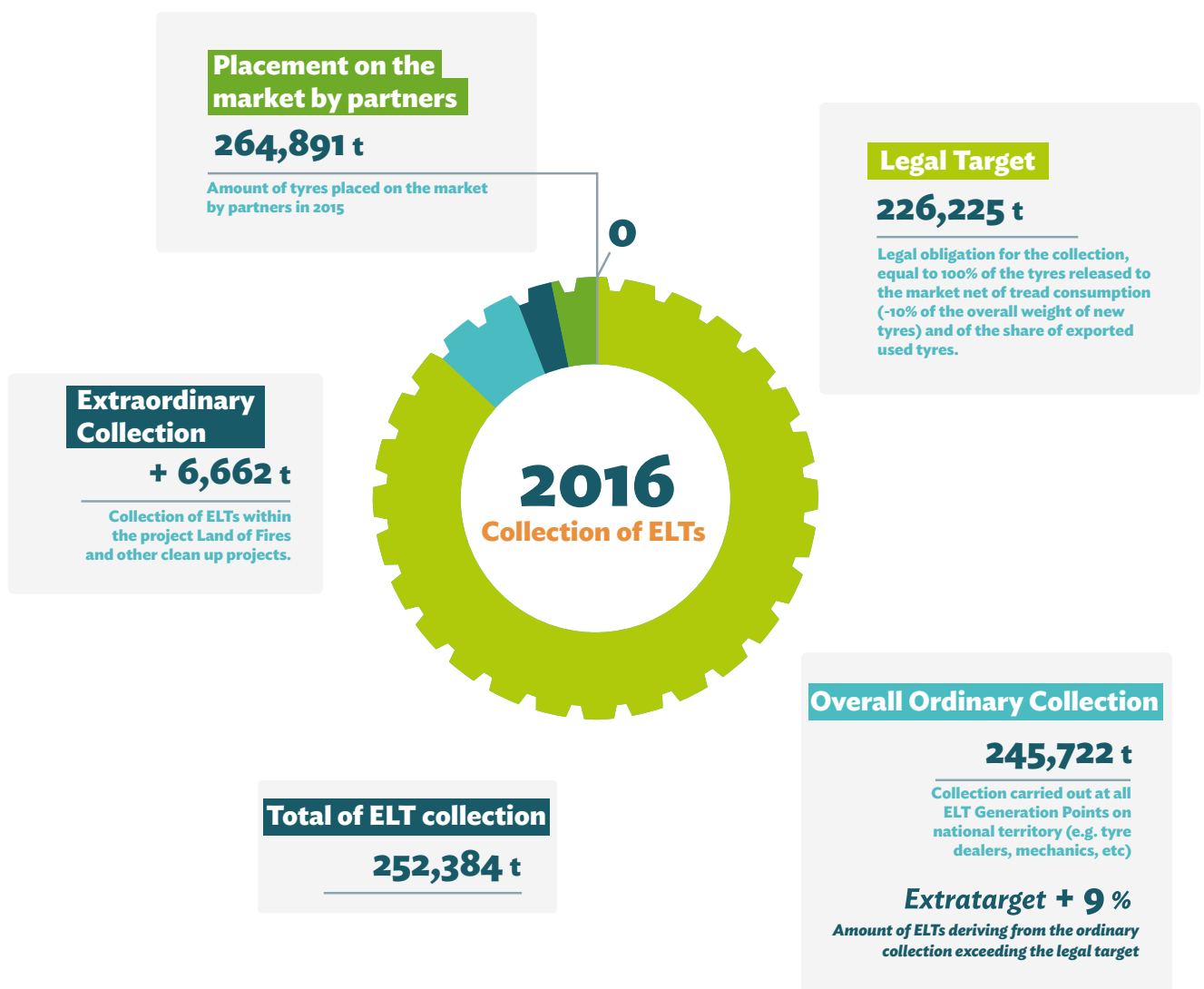
1 The performance of the Ecopneus system



1.1 The collection of ELTs in 2016

The collection of ELTs is the first link in the value chain of the Ecopneus system. It is thoroughly carried out at tens of thousands of ELT Generation Points (ELTGP) spread all over the national territory. Ecopneus has developed an IT system that allows a precise tracking of the ELT amounts collected from every single waste generation point, historical stock or any other authorised site. The IT system also allows the

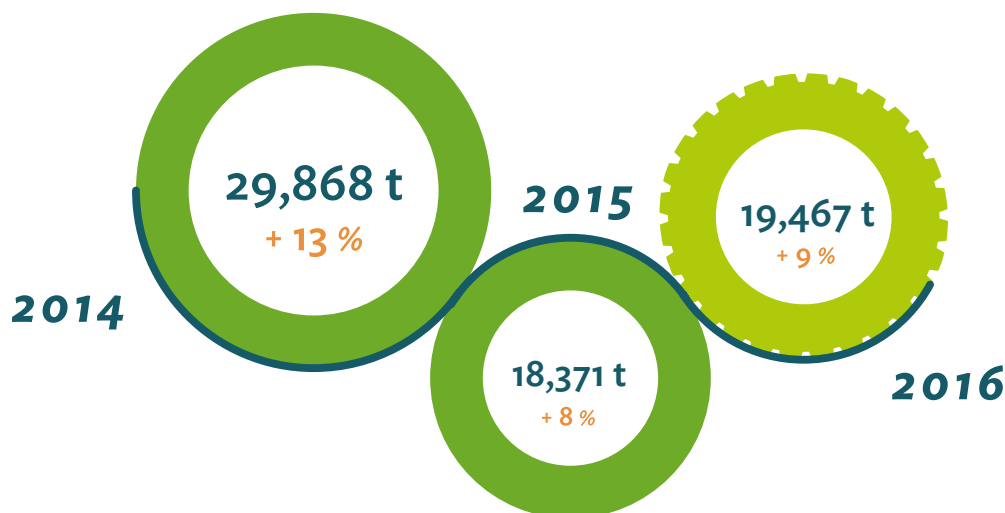
monitoring of the phases of the recovery of the ELTs. By the means of its ordinary collection, in 2016 Ecopneus handled 245,722 tonnes of ELTs. This amount is 9% higher than the legal target. In the last three years the overall ELTs collected above the legal target, that is, without the financial protection deriving from the collection of the Eco fees, has been more than 67 thousand tonnes.



Ordinary collection performance beyond the legal target in the years 2014-2016



**Amounts of
extra target collected ELTs**



For what concerns the extraordinary collection from historical stock to be carried out with 30% of the operating surplus of the previous fiscal years (Ministerial Decree 82/2011, Art. 5), in 2016 no interventions were planned, because the balance sheet of Ecopneus did not have any surplus for the year 2015. Other activities of extraordinary collection in 2016 were completed within the Memorandum of Understanding for the Land of Fires for the recovery of ELTs abandoned on the territory of the Provinces of Naples and Caserta. In collaboration with the local municipalized companies, a total of 6,662 tonnes of ELTs left along

the roads or lying in sizeable stocking sites were collected". By the means of both ordinary and extraordinary collection, the ELTs managed by Ecopneus in 2016 amount to a total of 252,384 tonnes.

The collection activities were carried out at 26,689 ELTGP spread all over the national territory (see detail per province). There were a total of 67,797 collection requests satisfied by hundreds of vehicles that, overall, travelled more than 9 million km.

Logistics of collection



ELTGP served

26,689

Tyre dealers, mechanics, service stations, body shops, farms etc.



Missions carried out

67,797

Collection requests satisfied by the collection companies.



km travelled

9,091,715

Collection fleet vehicles overall travelled distance.



Average manual load

2,1 t

ELT amounts collected with manual loading by the collection companies.



Average container load

4,6 t

ELT amounts collected with container loading by the collection companies.



Ordinary collection per province

Valle d'Aosta 72

Valle d'Aosta 72

Piemonte 6,856

Alessandria 1,541
Asti 382
Biella 54
Cuneo 1,486
Novara 968
Torino 1,891
Verbano-Cusio-Ossola 436
Vercelli 98

Lombardia 29,409

Bergamo 3,463
Brescia 3,800
Como 1,416
Cremona 1,019
Lecco 1,024
Lodi 926
Mantova 951
Milano 7,839
Monza e della Brianza 2,226
Pavia 1,633*
Sondrio 926
Varese 4,186

* Si aggiungono 2,434 tonnellate di PFU raccolte dallo stock storico di Castelletto di Branduzzo (PV)

Toscana 15,422

Arezzo 1,783
Firenze 3,852
Grosseto 1,491
Livorno 1,167
Lucca 1,068
Massa-Carrara 1,059
Pisa 787
Pistoia 1,527
Prato 890
Siena 1,797

Sardegna 11,970

Cagliari 4,212
Carbonia-Iglesias 722
Medio Campidano 837
Nuoro 1,507
Ogliastra 683
Olbia-Tempio 1,593
Oristano 1,108
Sassari 1,309

Trentino 15,422

Alto Adige
Bolzano 2,969
Trento 6,747

Friuli

Venezia Giulia 4,045

Gorizia 544
Pordenone 709
Trieste 851
Udine 1,941

Liguria 2,681

Genova 1,279
Imperia 95
La Spezia 1,155
Savona 151

Lazio 21,151

Frosinone 3,108
Latina 2,652
Rieti 764
Roma 13,650
Viterbo 977

Umbria 4,946

Perugia 3,901
Terni 1,045

Campania 20,346

Avellino 2,090
Benevento 1,501
Caserta 3,468
Napoli 8,760
Salerno 4,528

Basilicata 3,725

Matera 1,319
Potenza 2,406

Sicilia 18,624

Agrigento 424
Caltanissetta 1,090
Catania 5,258
Enna 776
Messina 3,150
Palermo 3,771
Ragusa 1,348
Siracusa 1,545
Trapani 1,263

Veneto 22,244

Belluno 800
Padova 3,866
Rovigo 1,029
Treviso 3,512
Venezia 3,575
Verona 5,194
Vicenza 4,267

Emilia Romagna 22,971

Bologna 3,702
Ferrara 1,530
Forlì-Cesena 1,377
Modena 4,346
Parma 3,402
Piacenza 2,161
Ravenna 1,519
Reggio nell'Emilia 3,518
Rimini 1,414

Marche 7,832

Ancona 1,996
Ascoli Piceno 1,207
Fermo 1,158
Macerata 1,610
Pesaro e Urbino 1,861

Abruzzo 6,357

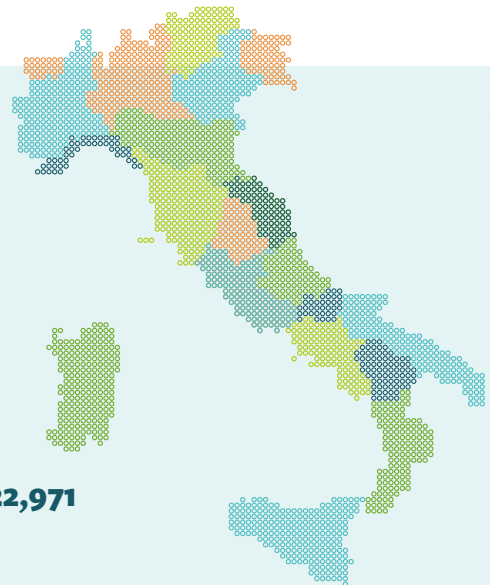
Chieti 2,215
L'Aquila 1,383
Pescara 1,339
Teramo 1,420

Molise 1,370

Campobasso 999
Isernia 371

Puglia 23,566

Bari 8,414
Barletta-Andria-Trani 1,948
Brindisi 2,025
Foggia 4,624
Lecce 3,581
Taranto 2,974



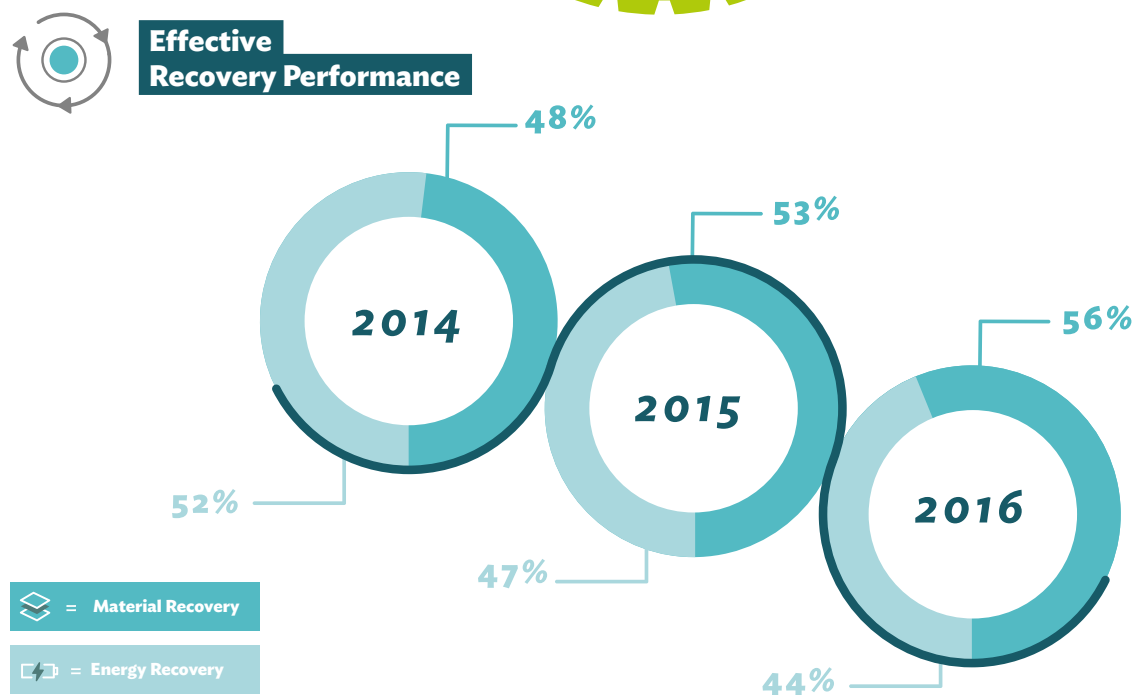
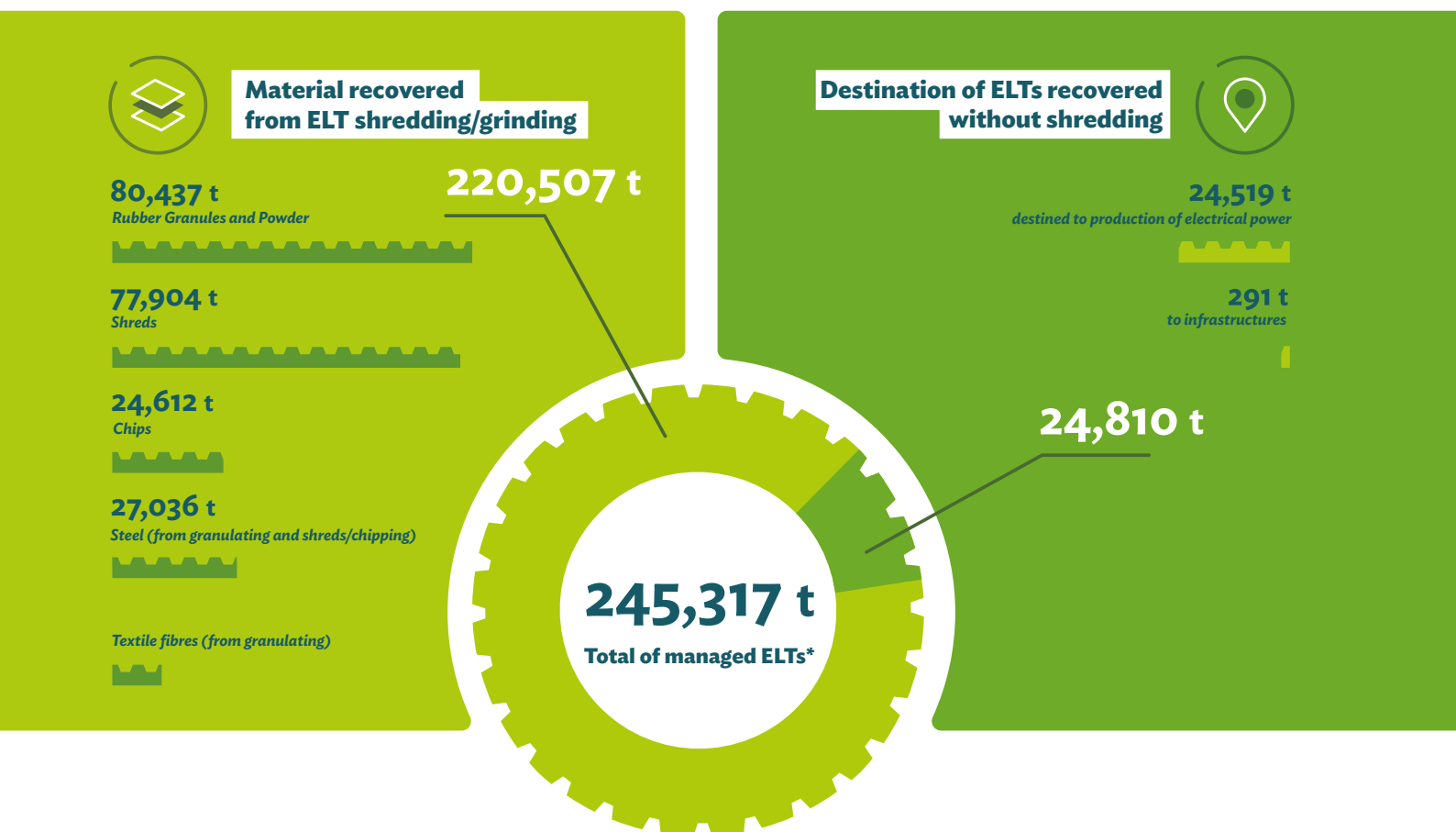
* To the ordinary collection, one must add a further 6,662 tonnes of extraordinary collection thanks to the interventions carried out in compliance with the Memorandum of Understanding for the Land of Fires

* Data expressed in tonnes



Month	Tonnes Collected (t)	Month	Tonnes Collected (t)
January	25,041	July	23,891
February	17,244	August	14,874
March	19,344	September	20,974
April	18,773	October	22,297
May	21,244	November	22,978
June	20,072	December	18,989

1.2 ELT recovery



* The flow analysis refers to the ELTs managed for recovery up to 31/12/2016. These do not consider the stocks of ELTs delivered to plants but still not processed for recovery

In 2016, the ELTs delivered to the treatment and recovery plants of the Ecopneus chain amounted to a little more than 245 thousand tonnes. Of these, about 25 thousand tonnes of ELTs were recovered as fuel for the production of energy. A minimal part was used as filling material in the covering of landfills. The remaining 220 thousand tonnes were sent to treatment facilities for their recycling or for energetic recovery.

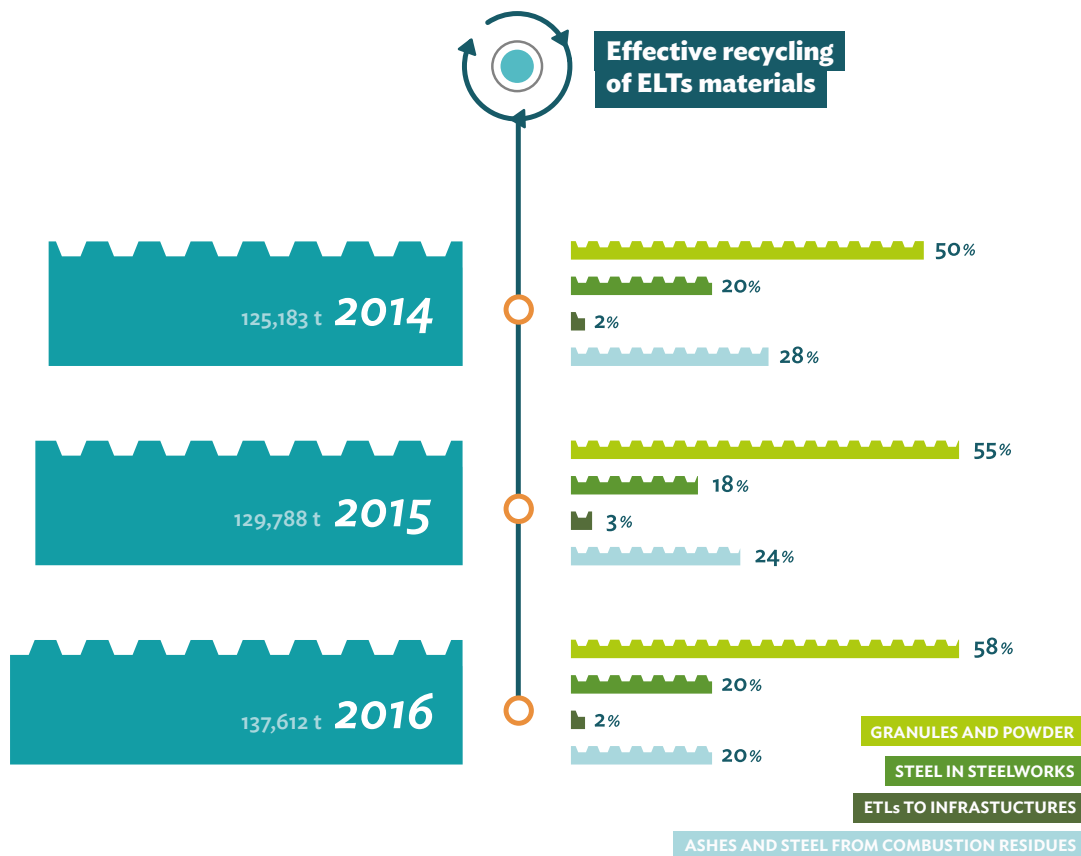
80,437 tonnes of granules and powder of rubber polymer were produced from the treatment. They were destined to the recycling market. 102,516 tonnes of shreds and chips were also produced and used as Tyre Derived Fuels (TDF), mainly in cement factories, both in Italy and abroad. Moreover, 27,036 tonnes of steel were also recovered from the treatment. They were recycled as iron scraps in steelworks. 10,518 tonnes of textile fibres were recovered and destined to energy recovery in foreign cement factories.

The use of shredded and chipped ELTs in cement factories has a double effect: on the one hand, it recovers energy by replacing a very polluting fuel such as pet-coke; on the other hand, it recovers matter, because the ashes deriving from the burning and the steel contained in the ELTs are recycled in the cement and replace other binders and virgin iron oxides.

Even in the use of whole ELTs in the plants for the production of electrical power, ashes and steel are separated downstream of the combustion and sent for recycling. If we include also these materials among the recycled ones, which are about 24% of the weight of the ELTs, the effective recovery performance of the Ecopneus system in 2016 is about 56% of material recovery and 44% of energy recovery, with a growing trend in the years.

If we describe in detail all the products of the treatment recovered as materials, 2016 confirmed a positive trend in the increase of the production of rubber polymer granules and powder. These are the materials with the greatest added value that derive from the recovery of ELTs and their production has increased of over 16 thousand tonnes (+24%) since 2014. A similar trend can be seen for the steel derived from the treatment for the recovery of ELTs: it increased of 2.5 thousand tonnes (+10%) compared to 2014. Instead, after the anomalous peak occurred in 2015, the use of ELTs as material for the covering of landfills set itself at an average value a little lower than 3 thousand tonnes. By contrast, thanks to the decrease of the amounts of ELTs destined to energetic recovery in favour of the ones sent for recycling, we recorded a decrease of the residues of ashes and steel from ELTs combustion in cement factories and electrical power plants.

Details of effective recycling of materials from ELTs management



**The calculation method of the effective recovery has been developed and perfected by Ecopneus in collaboration with the Sustainable Development Foundation based on data deriving both from the literature and the results of new tests carried out at universities and international research centres by commission of several collective management systems in Europe.*

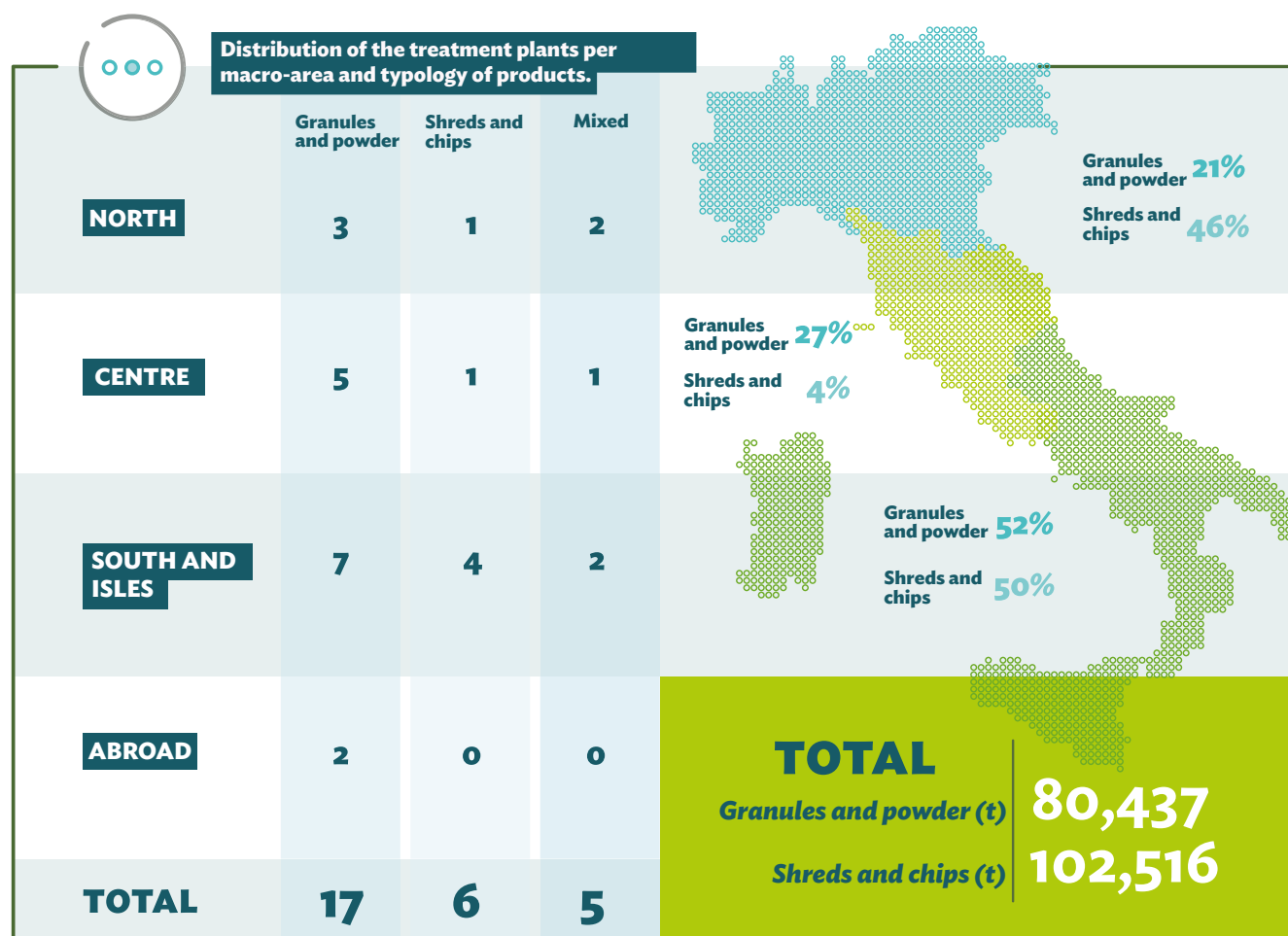
1.3 ELT treatment

28 companies were involved in the transformation of ELTs in derived products appropriate for the recovery in the shape of materials or energy in 2016. The production of granules and powder of rubber polymer involved 23 companies, of which: 17 are specialised in the production of these materials (3 in the North, 5 in the Centre, 7 in the South and Isles, 2 plants abroad, in Austria and Germany), and 6 are equipped with mixed installations for the production of granules and powder, and derived fuels (2 in the North, 1 in the Centre and 2 in the South and Isles). In terms of overall production, 52% of granules and powder were produced in the plants located in the South and Isles; 27% in the regions of the Centre, and the remaining 21% in the regions of the North. Please note that the shipment of ELTs for their recycling treatment beyond the national borders represents an exceptional case, linked mainly to logistic optimisation factors (geographical

proximity of the collected ELTs to the foreign plants) and it involves only minimal amounts of ELTs – this to confirm the strategy of Ecopneus of keeping the added value of the treatment of ELTs in Italy.

The processing of ELTs for the production of derived fuels in the shape of shreds and chips involved 11 companies, mainly located in the South and Isles, where 50% of TDFs were produced. The remaining part was produced in 3 plants in the north (46%) and in 2 plants in the regions of the Centre (4%)

For what concerns the residues of the treatment, the steel was recovered in steelworks and foundries, whilst the textile fibres were recovered as fuel in authorised cement factories. This is due to the fact that a valid technology for their recycling is still not available.



 Products  Typology of treatment plant

1.4 The recycled rubber market



Sound proofing

3,327 t

ELT rubber granules are used in the production of panels, sound proofing membranes and other products used in the construction industry as elements for the acoustic soundproofing of buildings and the reduction of vibrations.

 3,321 t  3 t  0 t



Playgrounds

5,660 t

The elasticity of the rubber recycled from ELTs can be used to create anti shock flooring for children's safety in playgrounds or for horse-riding surfaces, which protect the animals' articulations

 242 t  190 t  5,229 t



Rubber compounds

3,305 t

ELT rubber powder can be recycled in compounds (with a variable percentage based on the performances requested to the final product) for the production of recycled rubber goods. A minimal part is also used in compounds for the production of new tyres.

 1,677 t  492 t  1,135 t



Re-moulding

17,574 t

Mixed with polyurethane resins or combined with other thermoplastic polymers, ELT rubber granules can be used for the production of urban furniture elements (speed bumps, kerbs, lane separators etc), as well as for the production of mattresses for animal farming or rubber tiles.



 14,207 t  361 t  3,006 t



Traders

24,302 t

A percentage of ELT granules produced in Italy is sold to traders and distributors, who, in their turn, recover it in various applications both in Italy and abroad.

 18,935 t  1,711 t  3,655 t



Sports

22,350 t

Rubber granules from ELTs are used as infill material in artificial turf football fields. They can also be mixed with resins and polymers to create basketball, tennis and multifunctional courts characterised by high playability in every season of the year.

 17,022 t  1,371 t  3,956 t



Asphalts

3,138 t

The addition of rubber to bituminous mixtures (asphalts) allows the realisation of extremely long-lasting road surfaces, which can resist cracks and permanent deformations. Moreover, rubberised asphalts reduce the noise produced by the transiting vehicles, constantly guaranteeing an excellent adherence in all weather conditions.

 893 t  1 t  2,244 t

79,653 t
granules and powder

2016

Due to the vulcanization process it undergoes during the tyre production process, the rubber deriving from ELTs cannot be reused - but in minimal quantities - in its original production cycle. For this reason, it is very important to assure a market for granules and powders deriving from the treatment of ELTs. From the moment that they inherit the characteristics of elasticity, resistance to wearing, resistance to heat, resistance to the action of oxyding agents etc of the vulcanized rubber, they are particularly suitable for recycling. Indeed, they can be used in many highly added value products and applications as the main material, thus, replacing polymeric ones that would otherwise derive from virgin raw materials.

In 2016, the companies of the Ecopneus system placed on the market a total of almost 80 thousand tonnes of granules and powder of rubber polymers from ELTs. This is the highest ever-reached amount from the operative start of the national management system. About 30% of these granules and powder was sold by the means of market intermediaries (traders), with fairly stable quantities in comparison with the previous year. The remaining amount was sold directly from the companies of the Ecopneus chain.

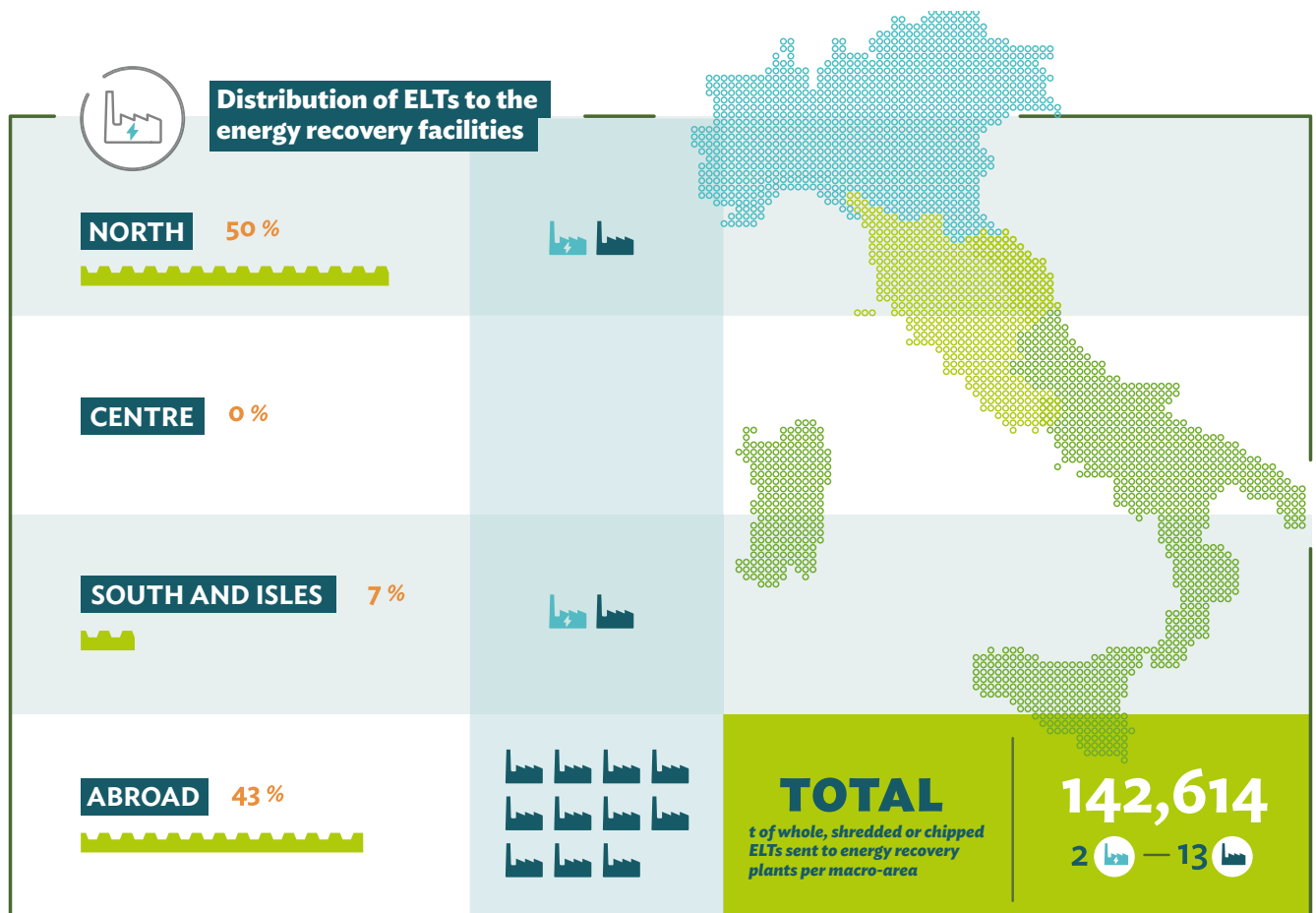
Looking into the details of the usages of ELT granules and powder, the sports applications overall increased significantly, recording a sharp rise in their national share (+52% compared to 2015), thus becoming the main application with 22,350 tonnes. Recycling in re-moulding, the second most important destination, instead, showed a slight decrease compared to 2015. To compensate, however, this sector showed a significant rise of the amounts sold in Italy (14,207 tonnes), at the expense of export shares. The recycling of granules in the production of playgrounds almost halved compared to 2015, going from over 10 thousand tonnes to less than 6 thousand, with a sharp fall of sales both in Italy and in the EU, whilst the extra-EU ones showed only a slight reduction.

There are also other “minor” destinations, which involve about 3 thousand tonnes of material. However, they are very important in the perspective of future growth. The recycling of rubber in soundproofing materials for the building sector, which is 99% produced in Italy, showed a 12% increase in 2016 compared with the previous year and it is now worth over 3,300 tonnes. Instead, the sales for the production of rubber compounds show an important fall (about 30%), linked, in particular, to the dynamics of their usage both in Italy and in Europe. The signal coming from the sector of the production of modified bitumen is very important: it went from the few hundreds tonnes of rubber from ELTs in 2015 to the over 3 thousand tonnes in 2016. The sales mainly involved Extra-EU countries, but we recorded a large growth also of the amount sold on the national market, which gives hope for the next years.

1.5 Energy Recovery

In the context of the green strategy of Ecopneus, the option of recovering the ELTs as fuel for the production of energy is subsidiary to their recovery as recycled materials. Indeed, in the chain, energy recovery is planned following the refusal from the part of the recycling companies. The energetic recovery is mainly done in cement factories and electrical power plants, and, based on the characteristics of the plants, the ELTs can be recovered whole or following their shredding or chipping. In 2016 the recovery of ELTs as derived fuels for the production of energy was carried out in 15 plants, of which: 13 cement factories and 2 power stations.

67% of ELTs (which include whole and shredded or chipped ELTs) was recovered in 5 plants for the production of cement and of electrical power in Italy, mainly in the North of the country. The remaining 43% (which include the textile fabrics separated during the shredding of the ELTs for the production of granules and powder) was sent to foreign cement factories in Morocco, Turkey, Romania, Austria, Germany and Hungary. Even in this case, for the delivery, Ecopneus favoured the national energy recovery facilities, diverting to foreign plants only when the capacity of the national ones is saturated.

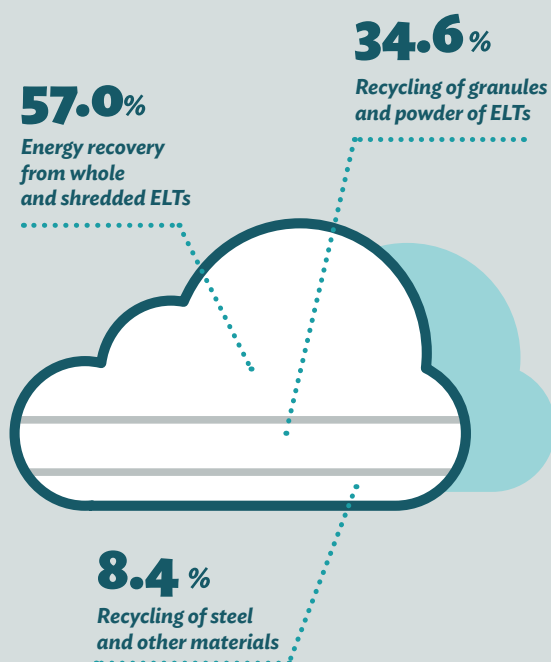


1.6 Environmental Benefits

Carbon Footprint

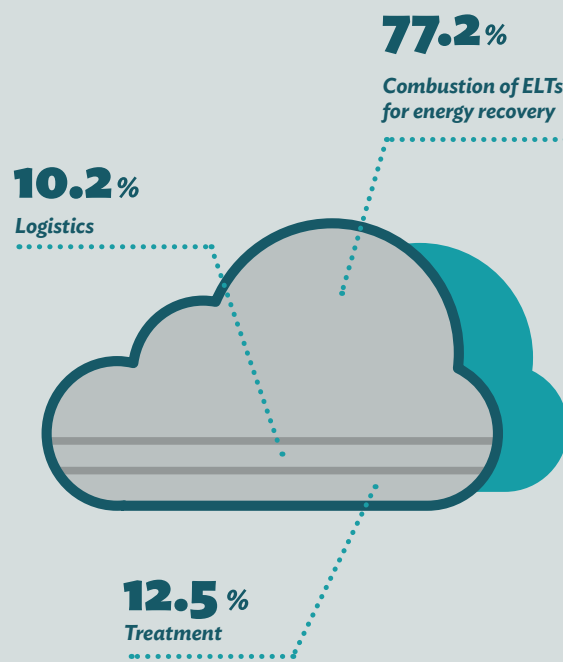
Balance of *emissions*
-381,960 tCO₂ equivalent

Avoided Emissions



Total of avoided emissions
-579,365
tonnes of CO₂ equivalent

Generated Emissions



Total of generated emissions
197,405
tonnes of CO₂ equivalent



Thanks to the activities of management of ELT recycling and recovery in the Ecopneus system, the balance of the climate-altering gas emissions in 2016 amounts to a total of almost 382 thousand tonnes of CO₂ equivalent (tCO₂eq). That is equal to the emissions of 230 thousand automobiles travelling 10,000 km in a year (Ref. ISPRA's Emissions Yearly Report, 2014).

For what concerns the negative impacts that generate emissions of greenhouse gases, the main contribution is linked to the activity of recovery of ELTs as fuel for the production of energy, mainly in cement factories, which in 2016 generated the emission of 152 thousand tCO₂eq (77,2% of the overall emissions). To these, one must add the emissions generated by the activities of logistics and treatment of the ELTs, which were responsible for about 45 thousand tCO₂eq in 2016.

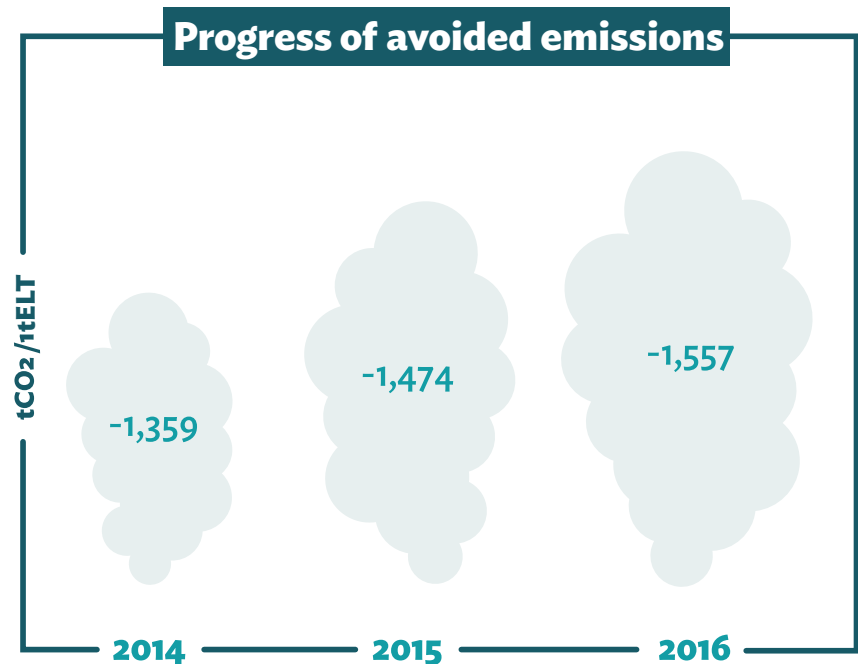
These negative impacts are, however, widely compensated by the positive effects of the energetic recovery and the recycling of materials. On the one hand, there are the 330 thousand tCO₂eq of avoided emissions due to the fact that the usage of ELTs as fuel allowed to avoid the exploitation of other fossil fuels (in particular pet-coke used in cement factories), whose overall life cycle impact, from production to combustion, is way higher. On the other hand, the recycling of over 80 thousand tonnes of granules and powder of rubber polymers allowed avoiding the primary production of equivalent materials, thus determining the saving of a further 200 thousand tCO₂eq (34,6 % of the total). To these, one must add another 48 thousand tCO₂eq of saved emissions thanks to the recycling of steel and of other materials in their respective chains.

Overall, in the last three years the balance of carbon footprint of the Ecopneus system recorded a progressive growth of avoided emissions that can be attributed, above all, to the increase of rubber recycling – an activity that entails the greatest possible benefits in terms of avoided emissions.

What is Carbon Footprint?

The carbon Footprint is measured in kilograms of CO₂ equivalent and represents the total amount of greenhouse gases emitted directly and indirectly in the life cycle of a product, from the extraction of raw materials to their transformation into semi-finished and finished products, up to the management of their related waste.

It is the indicator of reference used by the international community for climate impact assessments of products, including the PEF - Product Environmental Footprint - developed in Europe. A negative value of this indicator shows that the life cycle emissions avoided thanks to the recovery of materials or energy from a product, which avoids new productions from virgin raw materials, are higher than those produced by the activities - from transportation to manufacturing - linked to the analysed process.



Material Footprint

Balance of *resources*

-366,835 t of materials

Non consumed resources

43.5%

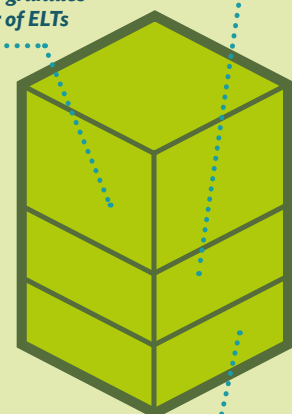
Recycling of granules and powder of ELTs

30.0%

Energy recovery from whole or shredded ELTs

26.5%

Recycling of steel and other materials



Total of non consumed resources

-419,007
tonnes

Consumed resources

54.0%

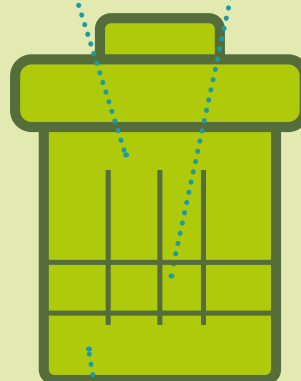
Logistics

20.9%

Treatment

25.1%

Combustion of ELTs for energy recovery



Total of consumed resources

52,172
tonnes



In 2016 over 366 thousand tonnes of raw material were not extracted from the environment thanks to the recovery of ELTs in the Ecopneus system. This amount is equal to the weight of 750 Frecciarossa 1000 trains (Italian high speed trains) composed of eight wagons plus locomotive (ref: Producer's technical sheet)

Going into the details of the balance, the impact of the life cycle generated by the activities of collection, transportation, treatment and recovery of ELTs amounts to over 52 thousand tonnes of consumed natural resources. This contrasts, however, with an avoided impact that is eight times higher (419 thousand tonnes of non used resources), thanks to the recovery and the avoided consumption of virgin raw materials.

For what concerns the consumed resources, the main impact is associated to logistic activities (54%), due to the amounts of fuel consumed by the vehicles used in the collection and transportation, which, in 2016, overall travelled more than 11 million of kilometres. The relevance of the data contained in this detailed piece of information emerges with greater clarity if compared with the information recorded by the carbon footprint indicator. In it, the weight of logistics appears to be "limited" to about 10% of the total of the generated emissions. This confirms the utility of an overall evaluation of all the impact indicators, in order to intervene with the aim of increasing the system efficiency. By looking only at the carbon footprint indicator, one could make the mistake of relativizing the importance of interventions of the system efficiency during the logistics phases; whilst, by widening the evaluation to more indicators, it emerges with greater clarity the importance of paying particular attention also to this aspect.

The same thing is to be said with reference to the evaluation of the avoided impact thanks to ELT recycling and recovery. About this, the Material Footprint indicator states that the benefits are 70% related to the recycling of both ELT rubber and steel, as opposed to the 43% recorded by the analysis of Carbon Footprint – a further confirmation of the environmental advantage of recycling compared to energy recovery.

What is Material Footprint?

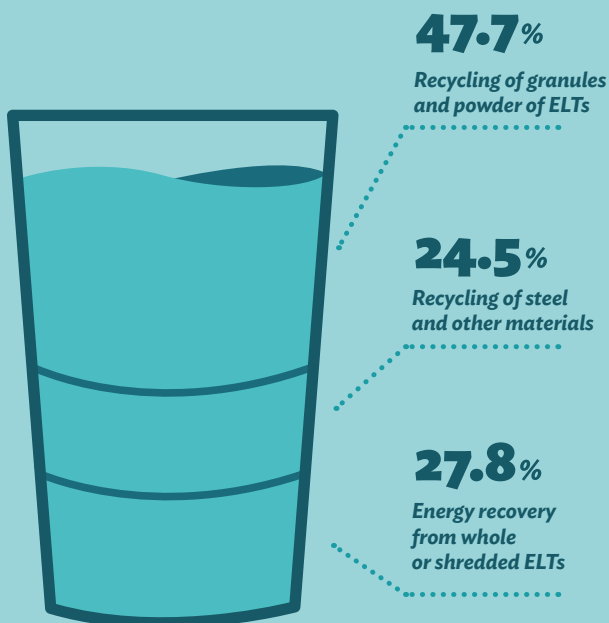
Material Footprint is expressed in kilograms of materials and represents the total flow of mineral and fossil resources that have been extracted for the production of a particular good or service during its life cycle: from the extraction of raw materials, to their processing into semi-finished and finished products, up to the management of their related waste. It is the reference indicator used by the international community for impact assessments on product resources, among which: the Environmental Product Declaration – International EPD System – and the European Union's Beyond GDP initiative. A negative value of this indicator expresses that the positive impact connected to the resources that have not been extracted and consumed thanks to the recovery of materials or energy along the life cycle of a product (avoiding new productions from virgin raw materials) exceeds the negative one linked to the consumption of material necessary for the carrying out of the same activities (in this case, for example, the ones of collection and treatment of ELTs). The methodological reference adopted for the calculation of material footprint is the Life Cycle Assessment Inventory with reference to the Ecoinvent 2014 database.



Water Footprint

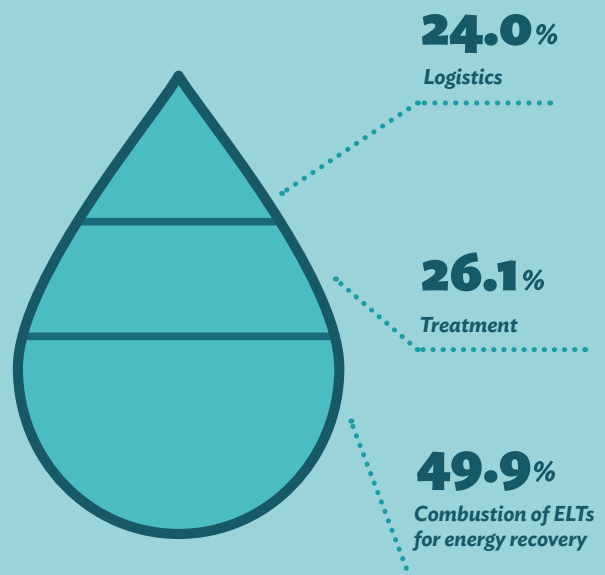
Water balance
-1,870,887 m³ of water

Non consumed water



Total of non consumed water
-2,349,319
m³

Consumed water



Total of consumed water
478,431
m³



In 2016 the management of ELTs in the Ecopneus system avoided the consumption of about 1.87 million of m³ of water - a volume equivalent to the average domestic consumption of 7.6 million of Italians (Ref. Istat 2014). For what concerns water consumption associated to the activities of the recovery chain, estimated in 478.4 thousand of m³ of water in the consumption life cycle by the water footprint indicator, 50% is caused by the combustion of the ELTs destined to energy recovery, whilst the remaining half is equally divided among the usages connected to the activities of logistics and treatment.

To compensate for the consumption, the overall benefits of recycling and recovery of the ELTs concern more than 2.3 million of m³. Their main contribution is determined by the recycling of granules and powder of rubber polymers, for an overall amount of 1,121,300 m³ (47.7% of the total) of saved water. One must then add a further 574.5 thousand m³ deriving from the recycling of steel and other materials (24.5%); whilst only 27.8% of the saving of this precious resource is determined by ELT energy recovery in cement factories and plants for the production of electrical power.

Overall, as it has already been highlighted by the Carbon and Material footprint indicators, also the Water footprint indicator shows that the benefits of the life cycles associated to the recycling of ELTs significantly exceed the ones associated to the recovery of ELTs as fuel, thus confirming the validity of the strategic choices of Ecopneus.

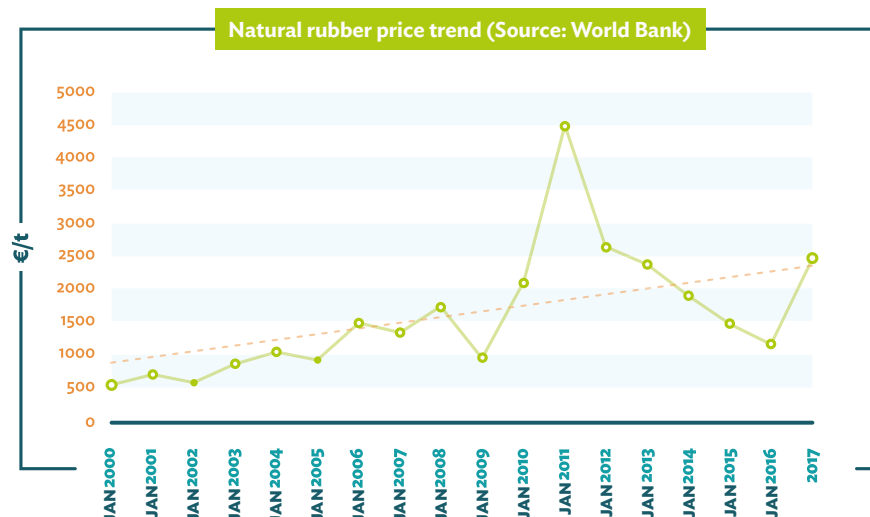
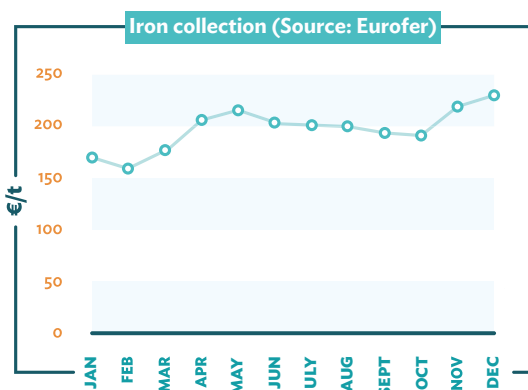
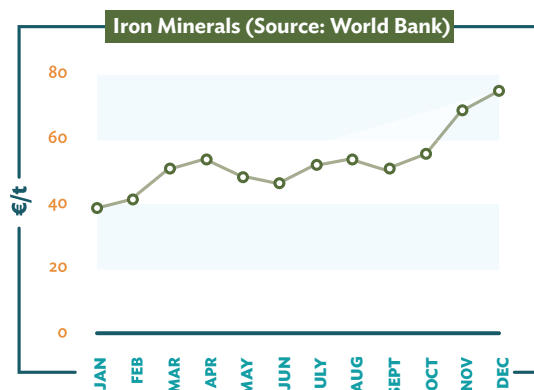
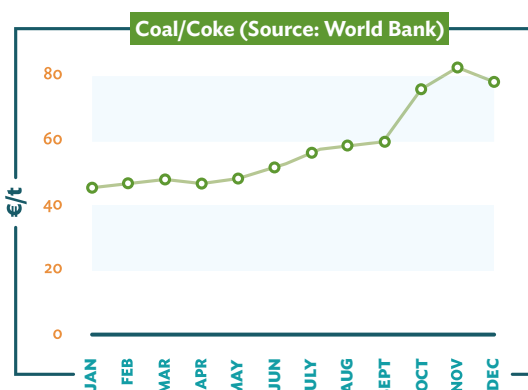
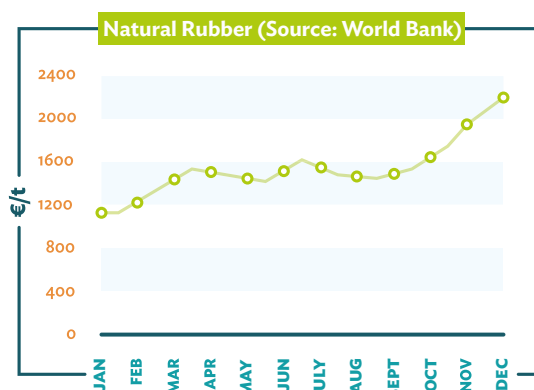
What is Water Footprint?

Water footprint is measured in m³ of water. It evaluates the consumption of water linked to net withdrawals of water resources and their pollution (degradation, eutrophication, toxicity and acidification) caused by the production of a particular good or service along its life cycle: from the extraction of raw materials, to their transformation into semi-finished and finished products, up to their related waste management. Given its characteristic as an impact indicator, it is the reference indicator in the European Regulation Product Environmental Footprint (PEF). A negative value of this indicator expresses that the amount of water not consumed and not contaminated thanks to the recovery of material or energy along the life cycle of a product, which allows to avoid new productions from virgin raw material, is higher than the one, which, vice-versa, has been consumed to feed the various analysed activities. The methodological reference adopted for calculating water footprint is the one developed by Hoekstra et al. (University of Twente, The Netherlands) and it is called "Water Scarcity".

1.7 Financial Benefits for the Country

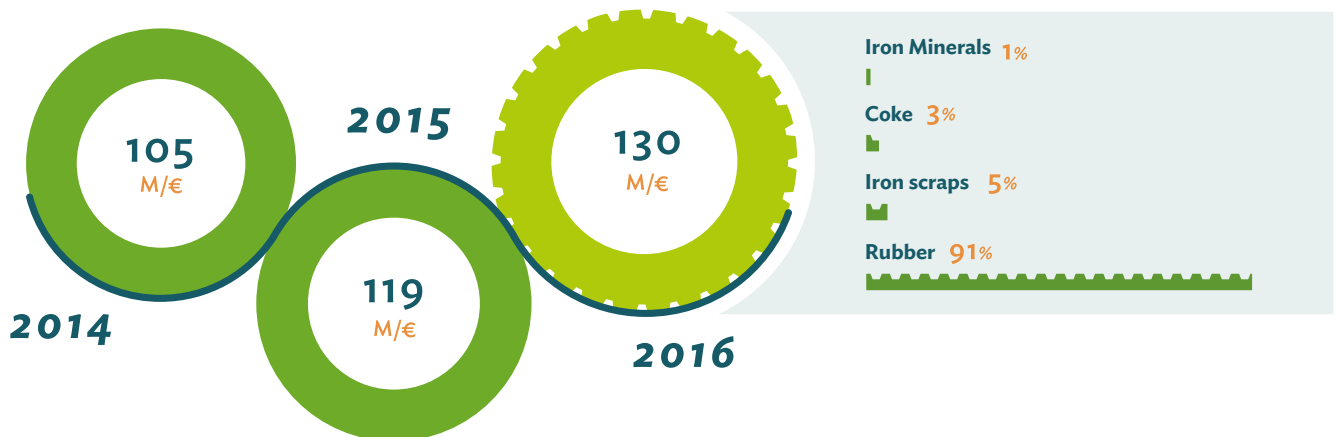
The recovery activities of ELTs not only offer evident environmental benefits, but also reduce the dependence from abroad for the supply of raw materials - with important positive consequences on the Country's trade balance. Expressed in monetary terms with reference to the yearly average market value of the raw materials replaced thanks to the recovery of ELTs in the Ecopneus system, the financial benefit of the

avoided imports for Italy amounts to about 130 million Euros. This number is on the rise compared to the previous years, thanks to the increase of the amounts of rubber polymers of recycled ELTs and the increase of the price of the virgin rubber on the commodities market. This last value has shown a trend of constant growth in the years, attributable both to the increase of the request for this resource, and to its scarcity.





**Saving from avoided
imports of raw materials**



91% of this saving can be traced back to the recycling of rubber granules. This confirms that the recovery of materials from ELTs with a high added value entails not only some environmental benefits, but also some important financial ones. In particular, the use of rubber granules on the Italian market avoided the import of virgin rubber (both natural and synthetic), whose average price in 2016 was about 1,488 Euros per tonne, thus allowing an estimated saving of about 119 million Euros.

A further positive contribution to the trade balance, for an estimated value equal to 6.7 million Euros (5% of the overall savings on the avoided imports), derives from the recovery of the steel present in the ELTs recycled as iron scrap in mainly Italian steelworks, and as a binder in the cement productive cycle for those ELTs destined to energy recovery in

Italy. In particular, facing an average value of 197€/t for iron scraps, we estimate a financial benefit equal to 6 million Euros from steel recycling in 2016; whilst from the recovery as cement binder replacing iron minerals, the estimated value of the saving is equal to 700 thousand Euros, for a market value of the replaced iron ores of 53 €/t.

Even the energy recovery of ELTs used in replacement of other fossil fuels impacts on the avoided imports of raw materials - albeit to a lesser extent than the one of recycling. Indeed, virgin rubber has an average market value of about 30 times the one of carbon coke. In financial terms, faced with an average price of coke of 58 €/t on the commodity market in 2016, the saving deriving from the energy recovery of ELTs carried out in Italy is 4.3 million Euros (3.4% of the total).

Ecopneus's balance sheet

	2014	2015	2016
GENERATED FINANCIAL VALUE	65,643,130	62,358,374	68,595,902
Revenues from environmental contributions	65,565,382	62,257,448	68,574,097
Other revenues	77,748	100,926	21,805
DISTRIBUTED FINANCIAL VALUE	66,687,066	64,172,812	63,056,637
Total cost to suppliers (goods and services)	65,271,518	62,649,491	61,520,877
Of which to the Suppliers of the operations chain	59,266,215	56,562,095	54,826,490
Of which to other suppliers	6,005,303	6,087,396	6,694,387
To personnel	1,127,513	1,151,119	1,028,789
To the corporate bodies (Board of Directors)	0	0	0
To Public Administration	219,769	181,792	336,124
To providers of capital	68,266	190,409	170,847
Provisions for the year	1,493,115	914,181	1,101,235
Depreciation and amortisation	179,063	135,257	131,806
OPERATING SURPLUS (profit/loss of fiscal year)	-2,651,023	-2,863,876	4,306,223
30% operating surplus for interventions on historical stocks (art. 3, paragraph 5, Ministerial Decree 82/2011)	0	0	1,291,867
Profit of fiscal year	-2,651,023	-2,863,876	4,306,223

Reclassified balance sheet according to the scheme of the Global Reporting Initiative (GRI-G4) international standard from the data of the Ecopneus financial statements - amounts in Euros

In 2016 the economic value generated by the consortium contributions amounted to almost 68.6 million Euros, which generated an operating surplus of about 4.3 million Euros, after the deduction of the economic value distributed to cover all costs incurred for system operativity. As provided for by the current legislation, 30% of this value - for a total of 1.3 million Euros - is available for interventions on ELT historical stocks present on the national territory during 2017, after that the losses for the years 2014 and 2015 had reduced the financial means to provide for this activity.

Ecopneus has spent about 3 million Euros on this activity since 2011, collecting over 17 thousand tonnes of ELTs from

historical stocks all over the national territory. The remaining part of this financial surplus has been saved to cover any future management needs.

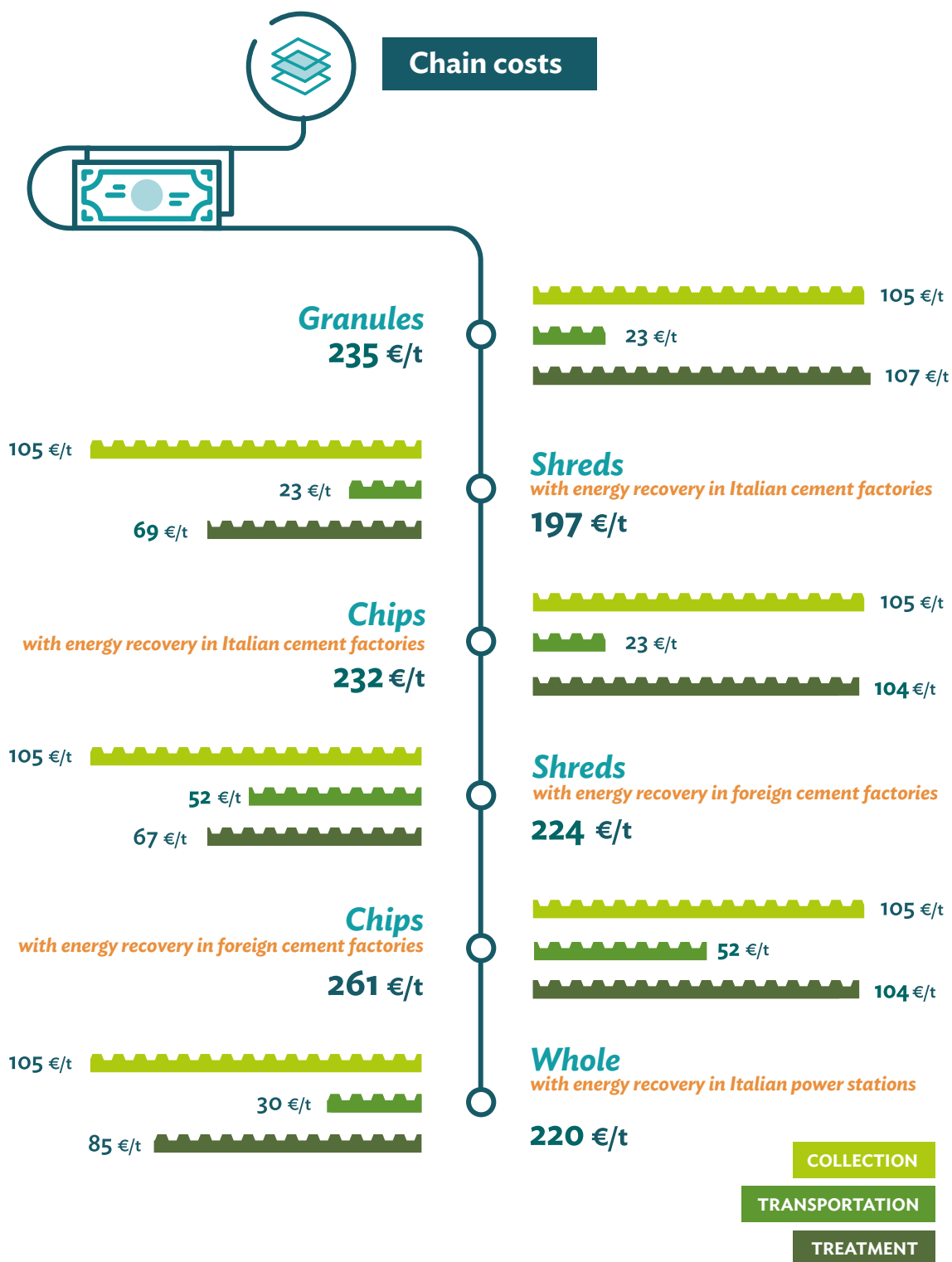
Going into detail of 2016's balance sheet, the economic value distributed by Ecopneus in the value chain amounted to over 63 million Euros. 13% of this amount (for a total of 8.2 million Euros) was used to cover general costs, whose main items refer to personnel's costs (about 1 million Euros), as well as investment in several research projects for the promotion of recycled rubber applications, the rubber market development with their related projects of awareness raising and communication - which were allocated about 4 million Euros.

Breakdown of the economic value distributed in 2016



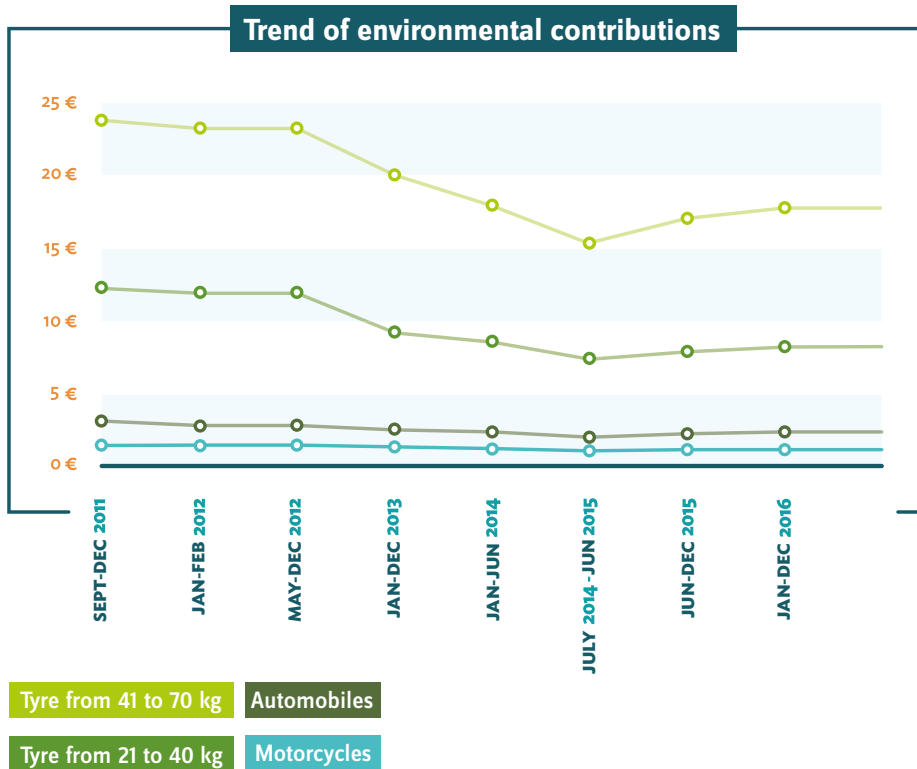
The most important part of the distributed economic value, equal to 87% of the total, was allocated to remunerate the companies of the chain for the activities of collection, transportation, treatment and recovery of ELTs. The allocation of the expenditure is carried out in a framework of cost optimisation compatible with both the commercial agreements made with the chain treatment companies, and the planning of the fluxes destined to the several ELT recovery options. In agreement with the green strategy of Ecopneus, the planning prioritises the requests of treatment from the part of the recycling companies.

Average costs for recovery management



The sound financial management of Ecopneus has allowed to progressively reduce the environmental contributions upon sale of new tyres, carrying on to guarantee service continuity, assuring the timeliness of payments to the companies of the chain, promoting important research and communication projects as well as intervening, by collecting and recovering at regularly au-

thorised tyre dealers, mechanics, service stations, bodyworks etc over 100 thousand tonnes of ELTs above the objectives stated by the law. This avoided the generation of occasions for illegal dumping of ELTs on the territory. The unitary value of the environmental contributions applied to the sale of new tyres of the partners of Ecopneus during 2016 has been confirmed also for 2017.



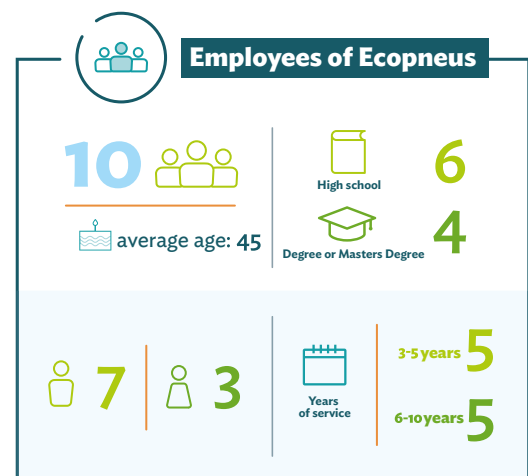
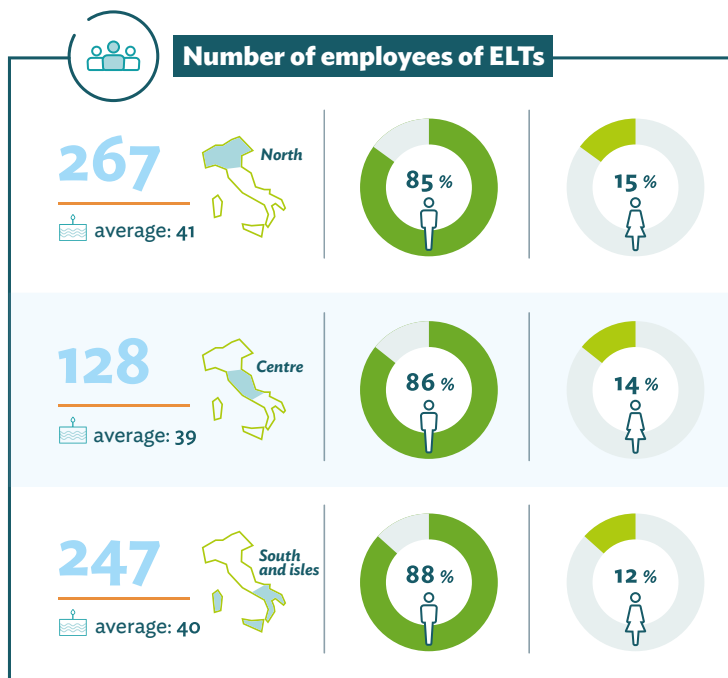
Employment in the Ecopneus system

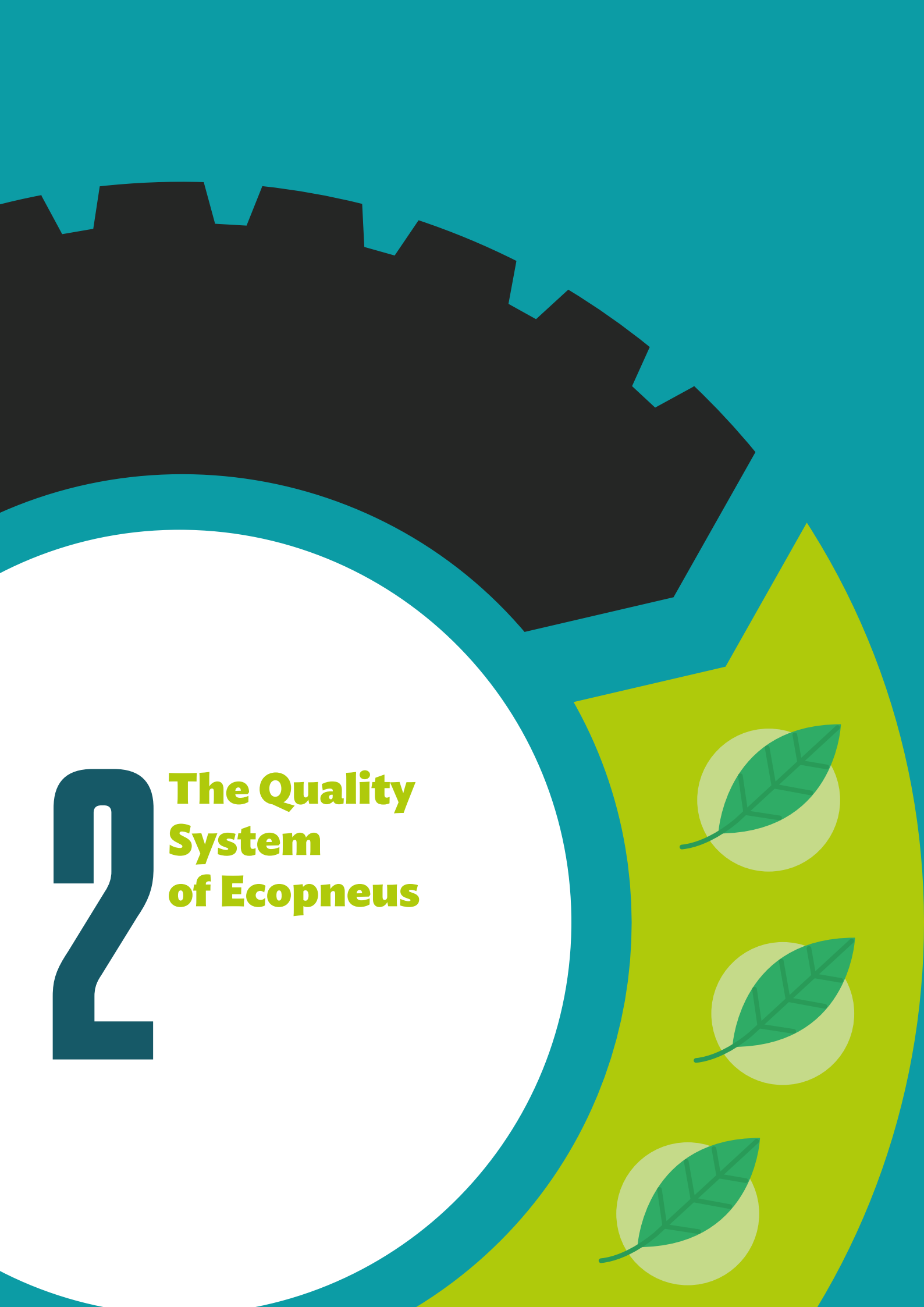
The Social Footprint analysis of the Ecopneus system with reference to 2015 counted a labour force of 642 people, of whom the majority were men.

This analysis has not been updated by Ecopneus, as the structure of the companies of the chain has not substantially changed. It is, thus, believed that this statistic

reflects the effective employment situation also for 2016.

On top of these workers, there are the employees of Ecopneus Without their daily work in Milan's offices and at the companies all over the territory, everything that has been reported in this Sustainability report would not have happened.





2

The Quality System of Ecopneus

2.1

The management of ELTs from the free market to the guarantee of rules

Following the landfill directive 1999/31/EC of the European Council, accepted in Italy with the Decree law nr. 36 of 13th January 2003, according to which the dumping of ELTs in landfills became illegal, tyre dealers, mechanics and other economical operators that had the need of getting rid of end-of-life tyres generated by their activities began getting involved in the waste management market with companies or intermediaries, who offered to solve the problem upon payment.

In many cases they were regularly licensed companies, which had the right plants and entrepreneurial skills for guaranteeing that the ELTs would be effectively managed for their recovery complying with the legislation in force at the time; among which, by way of example, the rules and regulations of the Ministerial Decree of 5th February 1998. This Ministerial Decree disciplined the possible activities of ELT recovery under the arrangements of a simplified procedure. Although the Decree already recognised the potentialities of rubber recycling, not least, the one of the modified bitumen sector, only a minimal part of these tyres was managed for recycling, whilst the majority was transformed into secondary solid fuel. Unless used in the few authorised centres in Italy (for example, some cement factories), this fuel was sent to remote destinations, mainly in the Far East, often violating the international rules about waste export. This clearly appeared from the irregularities encountered during several investigations carried out by the Italian police corps at the main ports of the Country. In other cases, the end-of-life tyres collected from tyre fitters ended up abandoned in illegal stacks spread all over the national territory. Once more, we are now aware of these illegal stacks thanks to the work of the police corps, who have seized hundreds of illegal dumping sites of ELTs in the course of the years.

It was the Decree law n 152 that first put some order into this situation, which, perhaps not very prudently, had left to market dynamics the task of guaranteeing that the recovery of a waste flow of almost 350 thousand tonnes per year (the equivalent in weight to about 35 million car tyres) would happen without any damage to both the environment and society. Indeed, in respect of the principle of “those who pollute, they shall pay”, art 226 of this Decree Law, which is at the foundation of the EU environmental policies, states that the producers and the importers of tyres are to guarantee the correct management of ELTs. At a later time, in 2011, the Ministry of Environment approved the Ministerial Decree n. 82, “Rule for the management of end-of-life tyres”. This Decree defined the set of rules according to which such management is to be carried out and, in particular:

- the financing modalities of the collection and recovery activities, with the environmental contributions applied upon purchase of a new tyre;
- the possible legal forms (consortium or sole proprietorship) the manufacturers can make reference to in order to organise the management service;
- the criteria and the priorities in waste management with reference to the European hierarchy;
- training, research and development activities, as well as all those activities of communication aiming at an efficient management from an environmental point of view;
- the opportunity to act in order to reduce the historical stocks of end-of-life tyres already present on the territory upon approval of the same Ministerial Decree;
- the need to track the flow of the amounts of ELTs from their origin, their collection, and use.

**A wide report of the investigations carried out by the Police corps with reference to the illegal management of ELTs can be found in the report “Copertone Selvaggio” (Wild Tyre), written by Legambiente in collaboration with Ecopneus.*

Based on this legislation framework, which has been adopted by the majority of the EU member countries, the main tyre producers at a global level (Bridgestone, Continental, Goodyear, Dunlop, Marangoni, Michelin, Pirelli) founded Ecopneus. Starting from the assurance of complying with all legal obligations with reference to the management of ELTs on behalf of its partners, the mission of Ecopneus is to give life to a system of efficient management, by putting first the recovery of material from ELTs in applications that can offer maximum environmental benefits, minimizing costs for both companies and end users

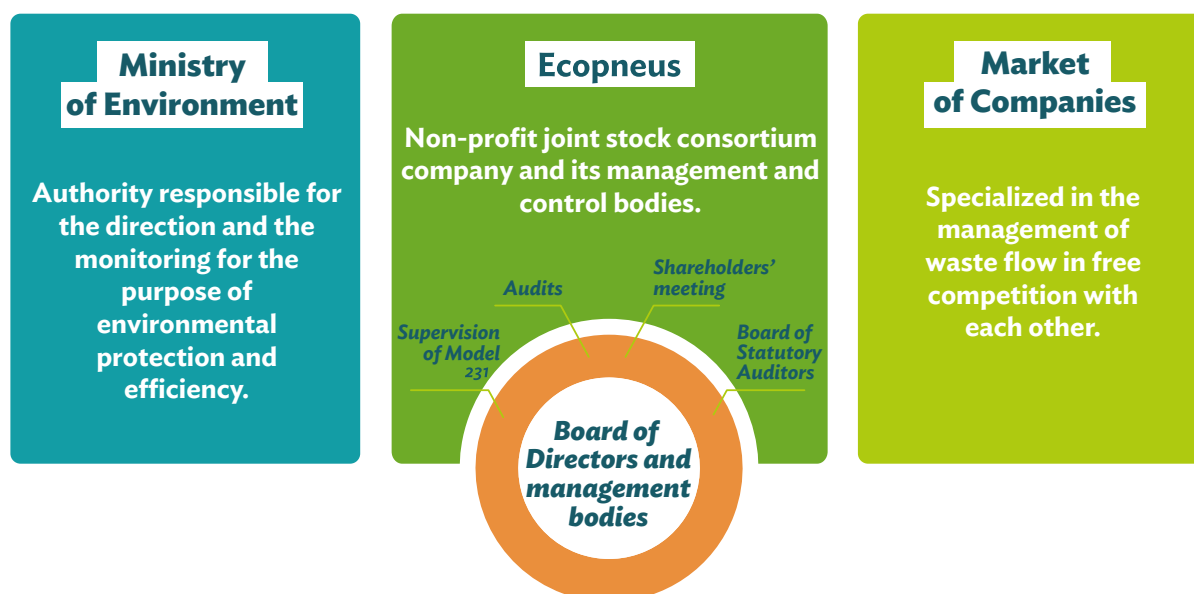
To protect both transparency and the interests of all stakeholders, the system of corporate governance of Ecopneus includes some mechanisms of decision-making and control aimed at avoiding the insurgence of potential conflicts of interest among its partners. These mechanisms are also to assure fair and equal conditions of competition to all the companies taking part to the chain and protect the consumers' interests. Indeed, the latter are those who finance the functioning of the consortium system with their environmental contributions - both for what concerns all aspects linked to environmental protection and legality.

As stated in the consortium's articles of association, approved with a Directorial Decree of the Ministry of Environment, the governance of Ecopneus makes reference to a non profit model of joint-stock consortium company, whose Board of Directors is nominated by the six founding companies. Each one of the same companies owns a share that gives them the sole right to have access to the services managed by Ecopneus. The President of the Board of Directors represents the top management and is assisted by the General Manager. The management of the company is fully delegated to the General Manager. This is to avoid any conflict of interests among the companies who are shareholders of Ecopneus - but also competitors on the market. In order to guarantee the independence of his decisions, the General Manager takes part to the Boards of Directors meetings and to the assemblies, but he has no right to vote.

For the organisation, the management and the control of all activities, Ecopneus has chosen the so-called **Model 231**, as reference. This is the set of principles, procedures and provisions as per the Legislative Decree 8th June 2001, n 231 about the discipline of penal liability of the legal persons. As a further protection of all issues linked to legality in its relationship with its stakeholders, Ecopneus has adopted not only the Model 231, but also a **Code of Ethics**. This Code includes the principles of the company's conduct to guide the actions and the behaviour of all those who are involved in the activities, both directly and indirectly. The control bodies are the **Board of Statutory Auditors** and the **Supervisory Body**. The function of the Board of Statutory Auditors is to verify the respect of both the law and the statutory regulations, as well as the control of the truthfulness and the correctness of the company's balance sheets. The Supervisory Body is to control all aspects of both civil and penal responsibility of the administration with reference to the adopted Model 213.

In this governance framework, Ecopneus has identified a valid operative solution of the organisation of the activities of collection, transportation and recovery of the ELTs. It is the solution of making use of specialised companies selected on the market, leaving to a highly qualified managerial structure the management of the processes such as waste traceability in the collection activities, and the allocation of the recovery of ELTs to the several options - in respect of the European waste hierarchy and favouring recycling to energy recovery.

In Ecopneus, the management of these processes makes reference to the procedures of the *Integrated Management System (IMS) for Quality and Environment*, certified with the 2015 update of the UNI EN ISO 9001 and UNI EN ISO 14001 standards. It was developed within the framework of an evaluation of the legislative and market contexts of reference of the company - as well as their linked risks - with the aim of guaranteeing the operative continuity and the improving of the performance by the means of the involvement of all the chain operators. The view is the one of consolidating an ELT management system inspired to the principles of total quality in every aspect of the value chain.

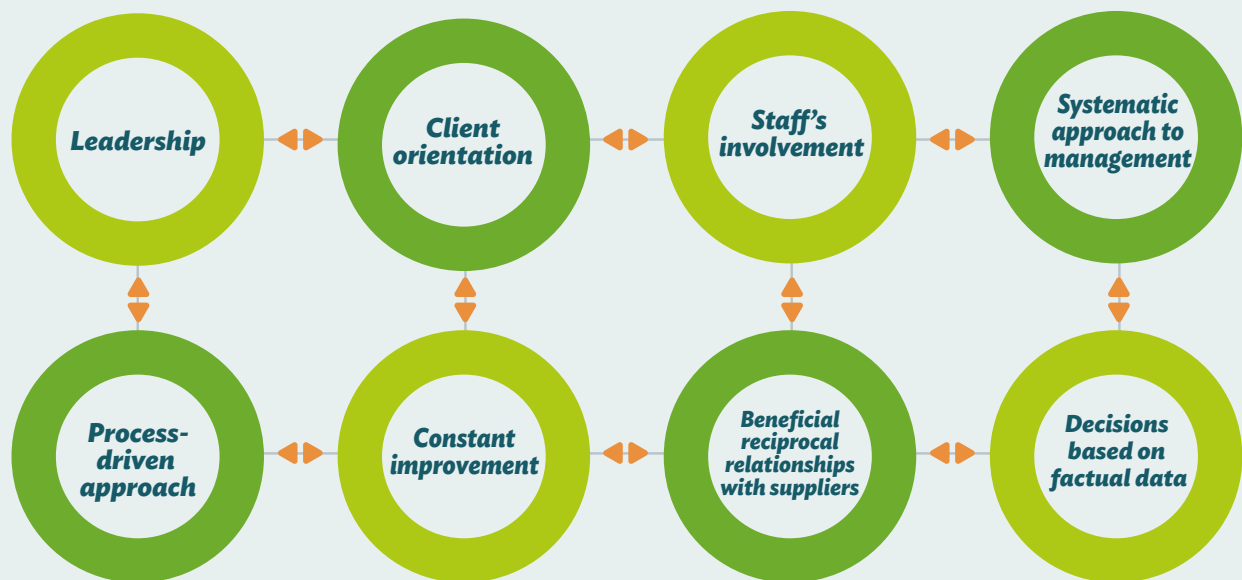


The principles of Total Quality in company management

The Total Quality Management (TQM) or “Total Quality” is a company’s “holistic” management philosophy. Its objective is to constantly improve all the activities of each function within the organisation. TQM was born in Japan in 1949, when the car manufacturer Toyota commissioned to one of its engineers the definition of a production management model appropriate for the emerging market needs. Starting from the concept of quality meant as end of line control (typical of the Fordian model en force at that time), this model consolidated in a new conception of value chain management of a company that considers quality as responsibility, in all and of everybody, whatever their function in the company. The TQM guideline is the full and substantial implementation of the concept of quality at all levels of the supply chain in an organizational scheme favourable to the achievement of constant improvement objectives, by putting at the centre the satisfaction of all stakeholders’ needs, whether they are internal to the company (the workers) or external (the clients). The Total Quality Management principles can be summarised in: customer orientation; leadership; personnel’s involvement; approach per processes, system approach to management; constant improvement; decisions based on

factual data; relationship of reciprocal benefit with suppliers. Such principles appear to be interconnected and have equal importance in the management of a company’s value chain. A company that decides to follow the path of total quality faces two big challenges. On the one hand, they shall modify the modalities of management of the company’s processes, for example, by adopting control and monitoring procedures inspired by ISO regulations. These are not to be considered as a limitation, but as a stimulus for a constant improvement in the company’s operative and market context. On the other hand, one must redefine the company’s guide values in order for everybody to favour a new approach to work, inspired to the client’s needs satisfaction, environmental respect and health and safety on the work place.

The implementation of a model of Total Quality in a company is a long term strategic choice with an initial investment cost, both for what concerns the definition of the same model, and for the adaptation of the company’s processes, staff’s training etc. This investment is paid back by an increase in efficiency of process management as well as by a greater capability of entering and competing on the markets of reference.



2.2 The Ecopneus value chain

The objective of making of ELT recovery a virtuous activity capable of generating important benefits for society is pursued by Ecopneus by involving the companies that take part to the system value chain primary activities (logistics of collection and transportation, treatment and recovery). This involvement is carried out within an industrial strategy of green economy based on four guidelines: respect of all legal obligations; qualification of a quality chain; development of recycled rubber markets; constant improvement of management efficiency.



As well as the respect of ELT collection objectives guaranteed all over the national territory, the compliance to legal obligations for Ecopneus means also to prioritise ELT recycling compared to the other forms of recovery. It also means to collaborate in the emptying of the ELT historical stocks present on the territory, as well as to sustain activities of extra-ordinary collection, for example, in the Land of Fires. They are accompanied by activities of communication and awareness raising aimed at the spreading of legality in the chain of tyres, from retail to the management of their end of life.

The Memorandum of Understanding for the Land of Fires

The expression “**Terra dei Fuochi**” (Land of Fires) first appeared in 2003 used by Legambiente in their “Ecomafias Report”.

Since then, this expression has spread in its usage to indicate a vast part of the Region Campania, between the provinces of Naples and Caserta, where widespread dumping of toxic waste and its subsequent burning has been documented. ELTs are often used to stoke and prolong these fires, which heavily affect the quality of both the environment and living standards in the involved territory.

In order to concretely intervene on such situation, in 2013 Ecopneus signed the “*Memorandum of Understanding for the actuation of interventions of collection and management of End-of-Life Tyres abandoned on the territory of the provinces*

of Naples and Caserta” upon request of the Ministry of Environment. Ecopneus made available a total of 3.8 million Euros, which came from the environmental contributions of its Shareholders. Within the scope of the Memorandum of Understanding signed by the Ministry of Environment, the Prefectures and the Cities of Naples and Caserta and the person in charge of the Land of Fires from the Ministry of Interior, over 7 thousand tonnes of ELTs have been collected since 2013. The overall expenditure is of 1.9 million Euros, which include also the costs for the promotion of information and awareness raising campaigns against the purchasing of tyres on the black market. These campaigns aim at interrupting the chain of illegality that links the environmental contribution to the dumping of ELTs in the environment.

The qualification of the recycling chain, that is, the progressive introduction of high quality standards of processes and products, is another central aspect of the green strategy of Ecopneus. It represents a key factor of competitiveness. Thanks to the same, it is possible to increase the penetration in the market of ELT recycled rubber with high added value products. Moreover, this allows the achievement of two objectives: it increases the recovery of ELT material as a more environmentally advantageous option than the other forms of recovery. Secondly, it permits to create value in the virtuous cycle of the circular economy, favouring the reaching of an economical balance of the management system, and reducing the burden of the environmental contributions paid by the consumers.

In this context one must see the actions put into place by Ecopneus to favour the development of the market of recycling. These actions take the shape of research and promotion projects aimed at consolidating and spreading technical knowledge and financial and performance advantages of the use of ELT rubber in products and applications, both in the b2b market, and within the scope of the Public Administration's "green purchases", as an opportunity for an increase of the demand.

The managerial efficiency of the governing structure is the other strategic lever used by Ecopneus to achieve its objective of maximising the benefits of ELT recovery. This is translated into the optimisation of the allocation of the internal and external resources in a structure organized per roles, responsibility and measurable objectives.

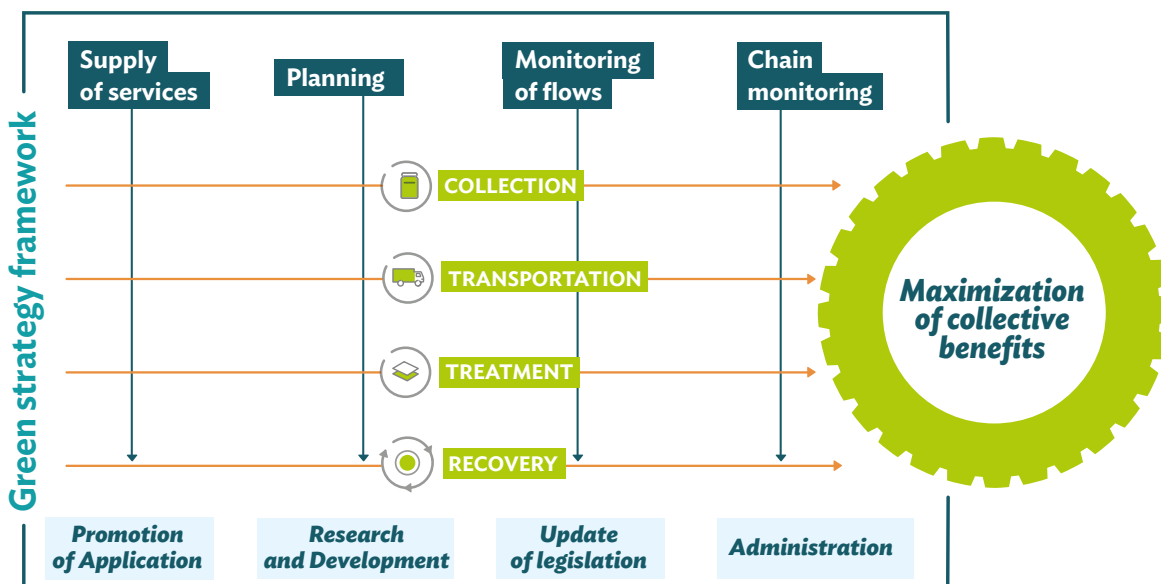
In this context, the creation of value in the consortium system is consolidated through the various activities accomplished by Ecopneus to support the primary processes for the services of col-

lection, transportation, treatment and recovery, which are executed by the companies of the chain. The goals and the description of these activities and of their processes are described in the Integrated Management System for Quality and Environment (IMS), certified according to the 2015 ISO 9001 and ISO 14001 standards. In the framework of a systematic approach to ELT management and in order to guarantee the continuity of service, the IMS has been designed starting from the evaluation of the various legislative, technological, and competitive contexts in which Ecopneus and the companies of the system act. This evaluation is also assisted by a risk-based analysis aimed at determining any management critical factors and all possible prevention actions.

For what concerns the operative management, the supply of the services of collection, transportation, treatment and recovery is among the driving principles of the efficiency of the primary processes. In the Ecopneus system, these are awarded to accredited companies that satisfy detailed tender specifications. This modality assures the possibility of organising the system chain in a way that is functional for an operative planning coherent with the Consortium's green strategy, giving priority to those companies who require ELTs for the production of materials destined to recycling.

The monitoring of the flows keeps track of all waste movements, from its collection to its effective recovery based on documented information supplied by all the companies involved in a physical exchange of ELTs or their derived materials. This activity is managed with the help of an IT system (ELTIS) specifically developed by Ecopneus. ELTIS simplifies the checking of the correspondence of the information given by the several companies for an accurate and effective control. Moreover, the cross reading of this information allows Ecopneus to know the turnover of the treatment companies' warehouses, thus opti-

Primary and support activities in the value chain of the Ecopneus system



missing the recovery planning.

Finally, the monitoring of the recovery chain verifies the compatibility of the companies of the system to operate on behalf of Ecopneus in the management of ELTs, thus guaranteeing the continuity of the service in a perspective of constant performance improvement. The activity verifies conformity according to a checklist of requisites defined by Ecopneus with reference to the authorizations to work, the quality of the productive processes, as well as the level of environmental protection and safety on the workplace. An external accredited company periodically carries out audits, regardless of the fact that the firm may possess other certifications. In case of non-conformity, the process provides for the activation of some consultancy support for the resolution of the encountered problems.

The frame of the activities, which transversally define the chain qualification process, is completed by:

- The consolidation and the diffusion of the quality certificates of rubber granules and powder and the promotion on the market of applications and products that use prime recycled rubber;
- The development of research projects concerning the technical and technological characteristics of such products;
- The participation in institutional working tables for legislative updates. For example: contribution to the definition of the End-of-Waste criteria for ELTs, as well as the introduction of awarding criteria for products and applications that use ELT recycled rubber in the Public Administration's Green Purchases.

The approach to ELT management followed by Ecopneus that we have so far described is translated into the guarantee of waste traceability, from its collection to its effective recovery. It also guarantees the quality of the treatment processes and the recycled products to put on the market of the second raw materials - in line with the indications of the European Commission for waste management aimed at the End-of-Waste.

“EoW criteria are all the requirements that have to be fulfilled by a material derived from waste, and which ensure that the quality of the material is such that its use is not detrimental for human health or the environment. [...] In order to guarantee that the end of waste requirements are actually met during the waste stream recovery process, recognized quality control procedures must exist. If conditions on source control, processing parameters and product quality standards are defined as part of end of waste requirements, these must be under quality control procedures in order to guarantee the fulfilment of end of waste product quality requirements”.

*End of Waste Criteria, Final Report, 2008
Joint Research Centre, European Commission*

System approach to management, leadership and personnel's involvement

A company's capacity to achieve the objective of creating value is favoured by an approach to management that identifies and oversees, as if they were a system, the related activities and processes. These are to be evaluated in the context of a risk-based analysis of both exogenous factors (state of the art of technologies, binding legislation, competitive frame etc) and endogenous ones (governance, strategy, policies, competences, relationships etc), which define the context the company operates in.

One must carry out a risk assessment linked to the context in which the company operates involving all company's levels. This is to be done in order to have a wider vision of any eventual critical activity with the aim of setting up all possible prevention measures. New improvement possibilities can emerge from this analysis, such as, by way of example, the development of better performing products/services, as well as waste reduction, and the increase of productivity.

According to the principles of Total Quality Management, leadership plays a fundamental role in the achievement of a systematic management of activities, as it establishes unity of intents and of goals within the organization with the objective of creating and maintaining a work environment that may involve all staff in the achieving of shared objectives. The people are the essence of a company and their conscious engagement allows making their skills fully available. The employees must be made responsible in making decisions based on their roles and responsibilities. In order to do that, it is important that a company promotes activities of training for their members of staff, for example, by organising training courses. They would improve the skills of every single employee by putting him/her in the conditions of proactively acting for the constant improvement of the efficacy of the processes they are involved in, evaluated in a wider frame.

Waste traceability

As we have just seen, from the moment waste is generated and enters an organised management circuit, whether it is referred to a collective or an individual system, until the moment it is treated to be transformed in Secondary Raw Material, its traceability is an essential requisite of the European Discipline that rules the definition of the End-of-Waste criteria. Indeed, Traceability guarantees the end user that the recycled products are effectively referable to the waste flux identified upstream as appropriate for EoW. It also guarantees the fact that such waste is effectively managed in compliance with the quality schemes defined for the recycled product.

For this purpose, in Ecopneus ELT traceability is guaranteed by a monitoring system designed per processes, namely, an organised number of activities and decisions shared by all the chain players. This system allows the collection of precise information about the transported amounts and the state of the transformation of ELTs in every step of the value chain. It is a multitude of processes referred to every single phase of the activities carried out by the companies of the system, starting from the collection of the ELTs at the point of waste generation and up to their effective recovery. Every process is codified in standard procedures in the Ecopneus Integrated Management System for Quality and Environment and the generated information is entered into the IT system ELTIS (End of Life Tyre Information System). This is the business intelligence system used by Ecopneus for waste monitoring as well as for the planning of the ELT stream sorting to the companies for the final recovery.

The first link of this system is the process of tracking of the amounts and of the typology of the ELTs collected at the points of generation (tyre dealers, mechanics etc). Being it special waste, this process is ruled in compliance with the legislation currently in force for the transportation of waste by the means of the Waste Identification Form (Art. 193 of the Decree law 152 2006 and its following modifications and integrations).

In detail, the process starts with the request of collection issued by the waste holder, for example, a tyre dealer. This is done by accessing via the Internet to the ELTIS IT system and stating the type of collection (by container or manual load) and an estimate of the number of pieces to collect. The request is automatically sent to the collection company associated to the holder. Based on the various requests received for the area of their competence (more waste holders are associated to a single collector), the company plans their trip using the appropriate means for carrying out more collections, thus optimising the journeys. Once the loading has been completed, the collector fills in the Waste Identification Form (WIF) in four copies and indicates the estimated weight of the load, which is subsequently checked by the means of a certified weigh station upon entering the Collection Centre. Simultaneously, the management process of the Form is closed and the data is entered into the ELTIS system.

Similar processes based on the documental management of the WIFs (or a similar procedure based on the transboundary transportation form that concerns all waste exported to be valorised abroad, Decree Law nr. 22 1997, Art. 16) are activated every time the ELTs or their derived waste-classified products (shreds, chips, textile fibres and steel) are transported along the chain. In this category, one can find the processes involving: the transportation of whole ELTs from the Collection Centres to the plants for their transformation into derived products (or Shredding Centres, SC) as well as, eventually, the plants for energy recovery and the ones of recovery in infrastructures (or Centres of Valorisation, CoV); the transportation from SCs to CoVs of all products deriving from the shredding destined to recovery as fuel (shreds, chips, textile fibres), as material for infrastructures (shreds), and steel (as iron scrap) destined to recycling.

Even in these cases, the processes provide for several checks of the transported amounts and the entering of all the information into the ELTIS system. In case of delivery of whole or shredded ELTs to the plants for energy recovery, the process ends with the plant providing the information of the effective recovery, which may happen even after days or weeks from the date of the delivery of the ELTs due to production planning reasons.

For what concerns the products of granulation, whose transportation does not require a management through WIF, the companies communicate to Ecopneus the effective warehouse unloading upon shipping to the client, in order to monitor the stock situation to optimise production planning.

In addition to the processes strictly linked to the transportation of ELTs and of their derived products that are still considered waste and, thus, are subject to control by the means of management through documents as per law, the traceability of Ecopneus streams provides for further processes, activated and managed directly by the companies of the chain. These concern, for example, the entering into the ELTIS system of information about the monthly production planning, the amounts and the typology of the products derived from the manufacturing, as well as the warehouse levels of granules and powder of rubber polymers destined to the recycling market.

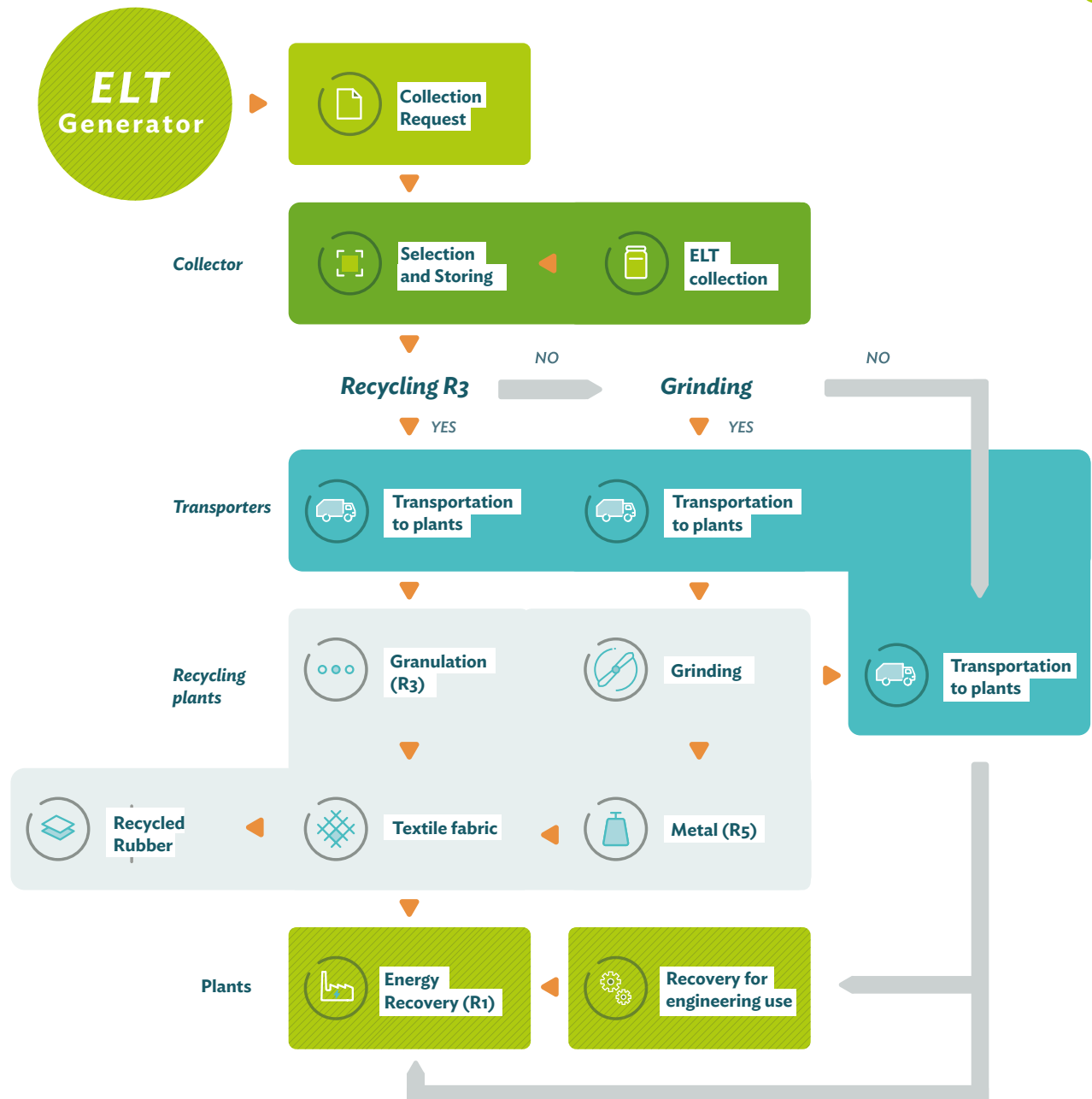
In this way, Ecopneus knows in real time the amounts of whole ELTs collected on the territory, temporarily stored at the Collection Centres or lying at the plants waiting to be treated.

They are also aware of the companies' estimated production planning, of the stock of the treatment products in warehouses and of the amounts of ELTs effectively recovered as fuel or recycled as materials. This is a wealth of information, which, on top of guaranteeing the complete traceability of the waste, also allows optimising the planning of tyre streams to be sent to the several forms of recovery.

The planning of the streams is based on an articulated process of chain activities planning that aims at keeping the management aligned with the objectives identified by the legislation in force, bearing in mind the recovery priorities defined with the green strategy, which prefers recycling to energy recovery.

In Ecopneus this process involves Management and the operative and the administrative departments. It is supported by a system of business intelligence capable of elaborating the data related to all operative processes activated during the chain-monitoring phase, transforming them into information useful to making management decisions. These concern, by way of example, sending a certain amount of collected ELTs for recycling to satisfy the supply needs of the granulating companies, having verified the compatibility of the request with the warehouse stock levels of the same company for what concerns both the stock of whole ELTs still to be treated and the eventual amounts of unsold granules.

Such decisions are then periodically monitored, looking at the effects they produce on management performances, by the means of a Plan-Do-Check-Act (PDCA) analysis, which is typical of a certified Integrated Management System for Quality and Environment based on an approach per processes.



Approach per processes

For a company to be efficient, it is necessary that it defines and manages several interconnected activities. According to the Standard ISO 9000, a process can be defined as an activity (or a number of activities), which uses resources and is managed to allow the transformation of input elements into output elements. The latter, in their turn, can become input elements for other processes. One of the advantages of an approach of management per processes is the possibility of keeping under constant control their efficacy - individually, in combination and in multiple interactions - , in order to increase the added value for the whole supply chain.

This objective can be reached by the means of the Deming Cycle or PDCA (Plan, Do, Check, Act). According to this Cycle, any process can be seen as a cycle divided into four moments. In the first phase, the "Plan" phase, which is related to planning and programming, one must define both the objectives

and the recipients in compliance with the client's requisites and the policies of the company. After this phase, every member of the company will have to be dedicated to the actuation of the processes in what is defined as the "Do" moment - or the moment of action and realization. One enters, then, the "Check" step, i.e., the phase of control and monitoring of the work carried out according to both qualitative and quantitative criteria and requisites, in line with the company's management and strategic policies defined during the first phase. The fourth moment, the "Act", is, instead, divided into two parts. On the one hand, one is to provide for the actuation of corrective measures, going back, whenever necessary, to all the value chain to identify the root cause of the problem; on the other hand, preventive measures are to be developed, in order to increasingly reduce the time and costs linked to conformity controls.

2.4 Quality in the Ecopneus system

The European Commission's criteria for an End-of-Waste legislation state the requisites that are to be satisfied from a waste-derived material, in order to be sold as a product without it damaging human health and the environment. These requisites concern all the processes associated to waste management (from the selection and management of the waste entering the recovery process, to the technologies for the treatment processes, the potential applications on the market, etc.) and, for each one of them, one must highlight the aspects which are to be taken into consideration to guarantee the final quality of the EoW products.

For example, a crucial aspect discussed in the criteria refers to the contamination risk of the waste entering the treatment process. For instance, this problem could arise if the waste came in contact with other types of waste or dangerous substances because it could undermine the guarantee of quality and safety of the final products.

In the ELT chains, the risk of contamination of tyres concerns in particular the phases of storing and transfer. Contamination can happen, for example, when the tyres come in contact with petrol, lubricating oils, grease and other substances classified as dangerous for human health and for the environment and that are typically used in those workshops where the majority of waste is generated. ELTs can also be contaminated during transportation, in those cases when the means of transport used by the companies have not been appropriately set to keep the ELTs separated from other types of waste collected during the same journey, or if the same means of transport are not appropriately cleaned before any collection. However, contamination can happen even during the storing phase in the Collection Centres, if the latter do not possess adequately kept and separated spaces for the storage.

To prevent the risk of ELT contamination and to be able to guarantee adequate standards of quality for both granules and powder, Ecopneus requires the involved companies to adopt quality management systems integrated with some specific indications, even of procedures, for what concerns all the activities carried out both in the logistic phases of collection, temporary storing and point-to-point transportation, and in the phases of valorisation and recovery of the ELTs as whole or derived materials.

This commitment derives from the awareness that every element of risk caused by an inappropriate management of the ELTs, if not appropriately addressed with prevention and control actions, can negatively impact on the overall performances of the system, not only in terms of negative health and environmental impacts, but also by damaging the development of the market of the ELT recycling-derived products.

End-of-Waste of ELTs in Europe

According to the data published by ETRMA, the association of the European manufacturers of tyres and rubber goods, 2.7 million tonnes of ELTs were recovered in Europe in 2014 (EU28). Of this amount, 2.6 million tonnes (97%) were destined to material and energy recovery. 1.4 million tonnes of the same were recovered in the form of granules and powder of rubber polymer. For what concerns material recovery, in this statistic Italy ranks second after Germany and before the United Kingdom with an amount of ELTs recovered as material equal to about 210 thousand overall tonnes, more than half of the end-of-life tyres collected in the country.

In this frame, it is very important to be able to possess an effective legislation of reference to support recycling, thus overcoming the limits caused by the absence of a European End-of-Waste legislation. Some European countries have already acted on this topic.

In 2009 the United Kingdom introduced the Quality Protocol “End of waste criteria for the production and use of tyre-derived rubber materials”, renewed in 2014.

In this scheme, the tyre-derived materials – granules, powder or other sizes – are recognised as End of Waste, providing that an accredited body previously certifies that the treatment process and the same products respond to some specific criteria described in the Protocol. The scheme defines the possible uses of the rubber once that the EoW has been reached. It can be used both in a “bound” form (that is, combined with other materials, for example: polymeric resins, cement etc), and in an “unbound form” (that is, as bulk material). Among the uses

indicated by the Protocol there are playgrounds, sports surfaces, synthetic turf football pitches, building products, civil and industrial engineering constructions, the car industry etc.

More recently, the Ministry of Environment of **Portugal** has prepared an EoW Decree for the recycling of ELT rubber. The Decree, which has already successfully concluded the verification procedure at European level, is supposed to be published in the second part of 2017. The criteria of the EoW Decree concern primarily the management process of the waste entering the treatment plants, in particular, the traceability of the same, as well as as the mechanical processes that are to be used for the recovery of ELTs. They have also provided for the chemical and physical characterization of the products with reference to specific technical regulations of the sector (for example: the DNP CEN/TS 14243 “materials produced from ELTs”) and the quality testing of rubber. To have access to the qualification of EoW, the respect of the criteria expressed in the Decree is to be certified by a conformity evaluating Body accredited according to the European legislation.

Differently from the UK, the regulations proposed in Portugal do not define, among the EoW criteria, the scopes of use of the recycled materials (to the exception of excluding their usage as derived fuel for energy recovery, as well as their disposal in a landfill, which is already forbidden at European Community level for what concerns ELTs). They, instead, specify that the derived products recognised as EoW fall within the scope of the material and product legislation. Both schemes make obviously reference to precise process and quality requisites.

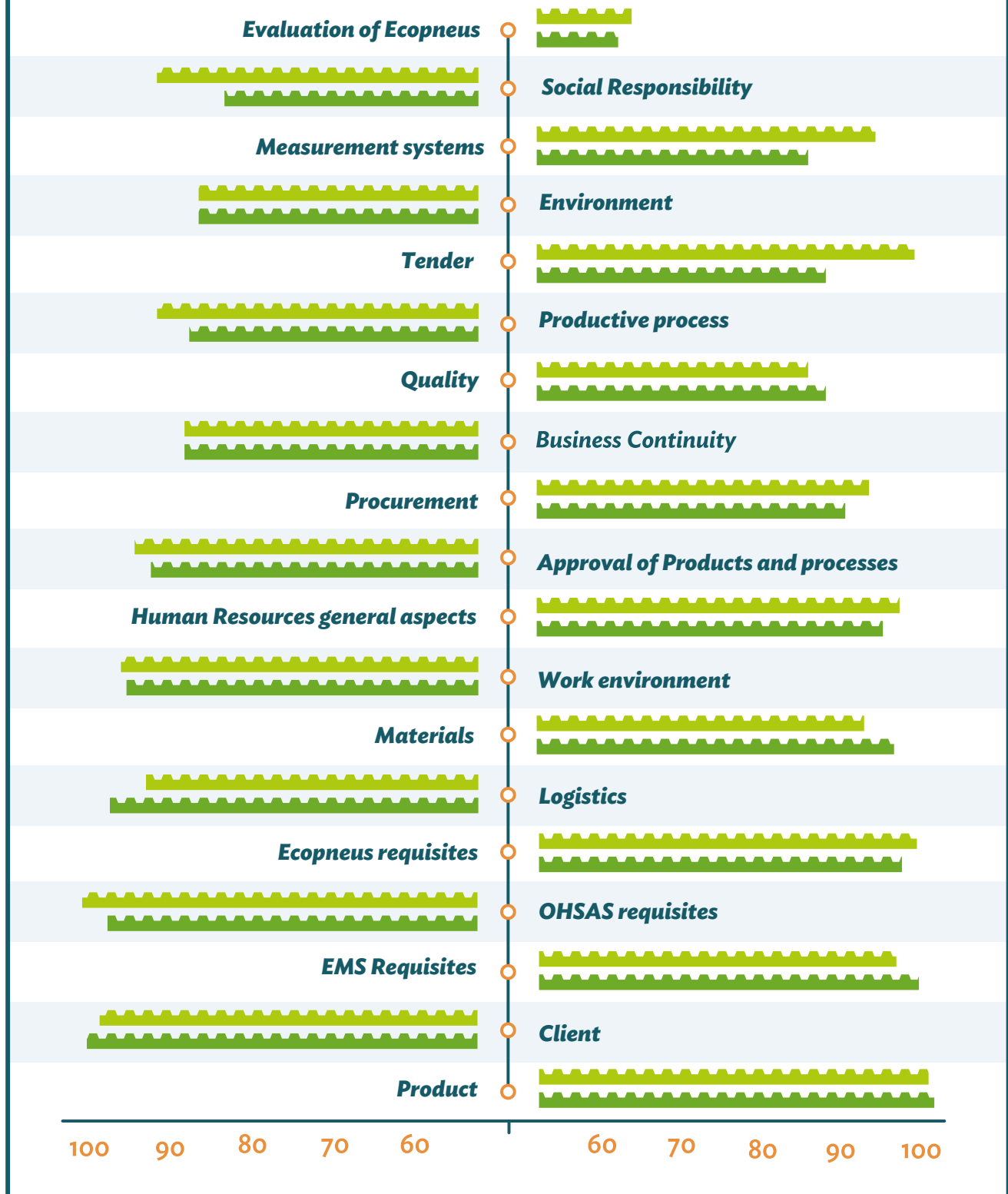
The Vendor Rating system of Ecopneus

To guarantee the respect of the agreements made during the contractual phase with all the companies of the chain, the quality system of Ecopneus provides for a programme of Vendor Rating Audit, carried out in collaboration with accredited certifying bodies. This programme aims at a performance verification of the companies. The audits, which are conducted by TUV Italia since 2015, are focused on Company System Compliance and performed regarding a checklist of more than 130 requirements, grouped and defined with reference to what stated in the standards OHSAS 18001, ISO 9001, ISO 14001 and EMAS.

These objective requisites take into consideration specific mandatory obligations. For example: they refer to the validity of the Company waste management permit, and to other aspects related to the completeness and reliability of the procedures of managerial and technical nature; they may also refer to the control of productive processes, to the management of personnel and clients etc. In addition to the requisites identified in this checklist, the Vendor Rating of Ecopneus considers also the “Ecopneus Evaluation”. This is a subjective evaluation carried out by the members of Staff of Ecopneus and it refers to aspects of company administration. For example it deals with commercial management, results orientation, or the Management’s willingness to change.



Performance indicators for the requisites of the Ecopneus Vendor Rating during the period 2015-2016

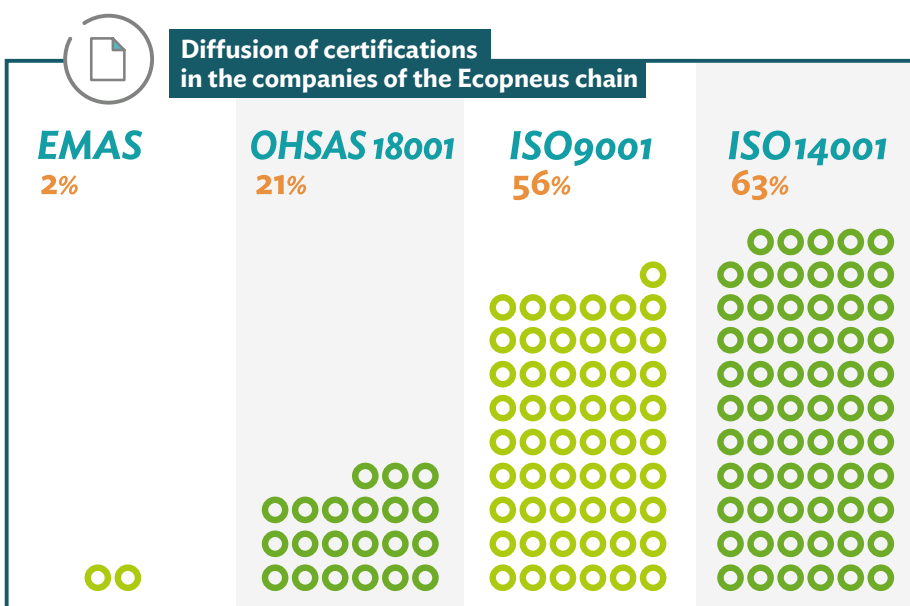


Performance 2016

Performance 2015

The Ecopneus Vendor Rating programme for the period 2015-2016 involved 61 companies of the system out of 64. It has provided satisfactory conformity results in many of the sensitive areas identified by the checklist of objective requisites; these results have raised the opportunity to intervene with improvement actions in the three main macro areas assessed during the audit - Quality, Environment and Safety, and Social Responsibility. In particular, for what concerns Quality, the analysis highlighted the need to intervene to uniform, at chain level, the management methods of the streams and of their process controls. In the Environment and Safety area, the need for improving some aspects related to the management of the plants auxiliary to production (e.g.: thermal plants etc) was noticed. For what concerns Social Responsibility, instead, it is fundamental to spread at all levels a greater awareness of the fact that the guarantee of business continuity cannot disregard an ethical approach to company management, which excludes every situation of social risk: an approach that is consolidated starting from the acceptance and the promotion of the main international conventions for the protection of human rights and work. The Ecopneus Evaluation related to company management is less positive, also due to its nature of subjective assessment based on management aspects of non-procedural nature. In any case, the detailed analysis of these pieces of information referring to each single company provides Ecopneus with useful indications about the most urgent matters, which need to be further improved with specific actions. In this regard, in 2017 Ecopneus has activated a new project in collaboration with the company M&IT Consulting. In the first place, this project is addressed to the granulation plants and it aims to elaborate valid solutions to improve the quality of management of the most critical processes. In the future the project is expected to be extended also to the plants producing shreds and chips for energy recovery.

More in detail, the project provides for a first phase of verification of the management modalities of the main company processes, which impact on quality. This first phase is carried out in collaboration between the company and M&IT consulting skilled members of staff. For every process, sub-process and activity they identify the strengths and weakness of the control procedures, both formal and substantial, implemented by the company. Their critical revision leads to the definition of a shared plan of improvement interventions to be carried out according to an established plan. The targeted processes are the ones related to procurement, with reference to the modalities of ELTs reception, the planning of both production and maintenance of the plants, the quality control of the treatment products, and the phases of packaging, storing and shipping to the client. One of the main factors which has contributed to the reaching of good results is the fact that over 3 companies out of 5 operating in the Ecopneus system possess one or more environmental certifications (ISO 14001 or EMAS), quality certifications (ISO 9001) and certifications for safety on the workplace (OHSAS 18001), released by the main accredited bodies at international level.



The logistics of collection and transportation

In the Ecopneus system, the collection service of the ELTs is managed by 16 main contractors. In their turn, upon authorisation from the part of the consortium, they collaborate with subcontractors (51 companies in 2016), in order to guarantee an appropriate coverage of the territory.

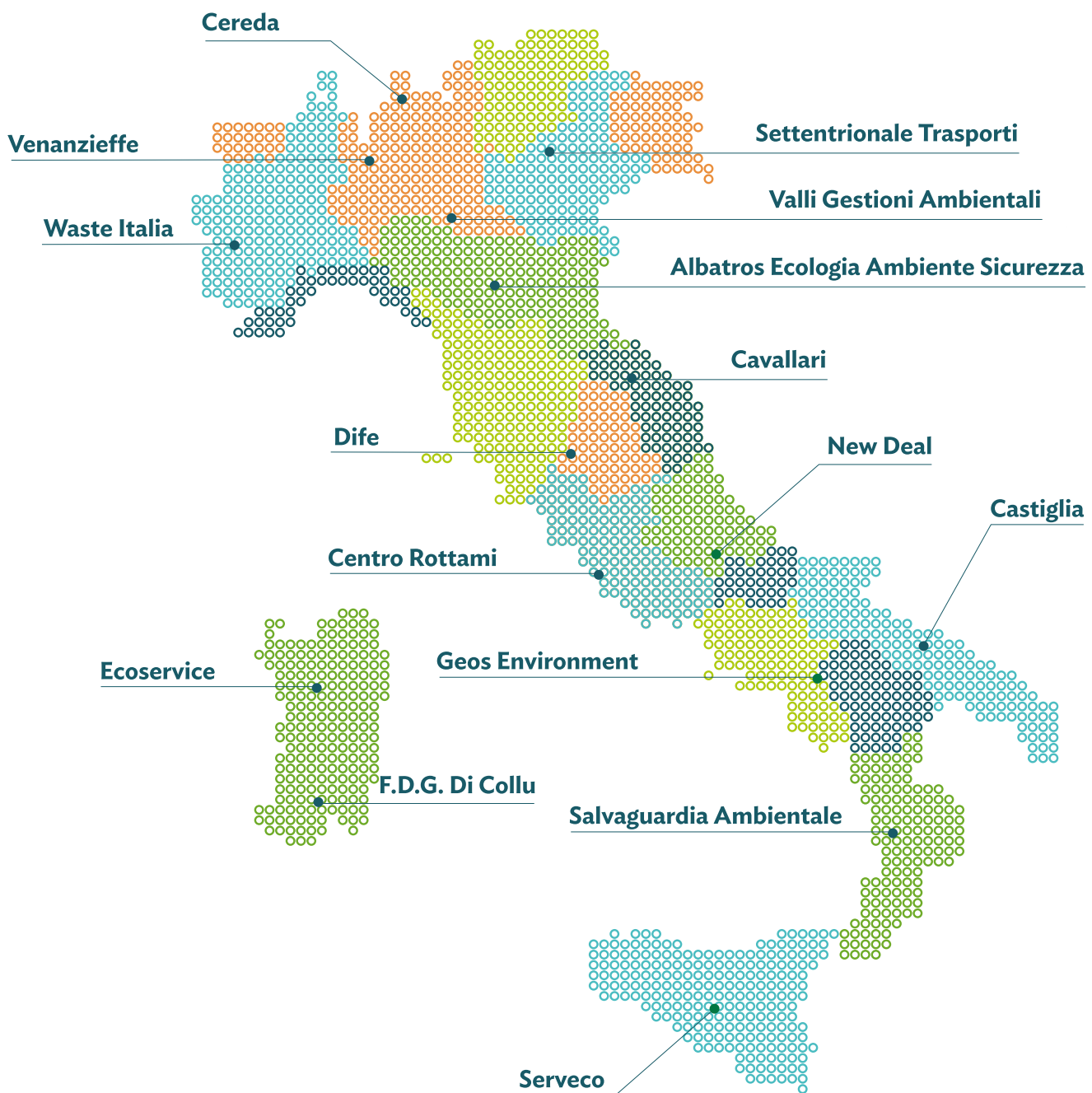
The service covers the following main aspects:

- Door-to-door collection, which is performed directly at the waste generator premises;

- Temporary storage at collection centre;
- ELTs size selection in order to facilitate subsequent deliveries to the recovery plants

For these reasons, on top of track-and-trace procedures which are performed during the entire ELTs collection activity, Ecopneus supplies the companies carrying out this service with specific indications about the operative procedures for the collection activities, asking for them to be taken into con-

The main collection contractors in the Ecopneus System



sideration in the company's quality management systems. In particular

- During the collection phases, the main indications make reference to the effort of the collector to verify that only whole ELTs are collected, categorically excluding any other waste typology not provided for by the legislation (by way of example: bicycle or aeroplane tyres, inner tubes etc). They also are to make sure that their state of preservation complies with specific standards with reference to signs of partial combustion, the presence of water in their cavities and their cleanliness, especially for what concerns potentially contaminating substances;
- During the phases of transportation to the collection centres, Ecopneus requires the companies to use authorized means of transport of a size adequate for the amounts they are expected to carry. Ecopneus also expects the trucks/vans to be in a state of maintenance appropriate to the technical requirements of safety, cleanliness and hygiene. They are also to be appropriately equipped to avoid that the ELTs may come in contact with other substances and waste;
- Finally, during the phases of ELT temporary storing and their dimensional selection in the Collection centres, Ecopneus recommends to make reference to the certification of the weighing system of the amounts, the possession of appropriate tools for internal transportation, and the need for the waste to be temporarily kept in roofed areas. Ecopneus recommends also that the ELTs are not to come in contact with other contaminating waste and substances even in this phase

The collection companies are the direct interlocutors of the tyre dealers, the mechanics and of all the other clients of the service. In their turn, also these categories can contribute to the quality of the chain, by equipping themselves with appropriate generated waste management procedures in accordance with the indications provided for the collectors.

For what concerns the service of transportation for the delivery of the whole or shredded ELTs to the centres of treatment and recovery, Ecopneus recommends the companies to pay attention to how the means of transportation are equipped. They are to possess an appropriate waterproof coverage for the loads; the trailers are to be clean to make sure that, during transportation, no eventual residues of contaminating substances may come in contact with the load of ELTs. Moreover, the transportation is to be carried out at maximum load, optimising the position of the ELTs on the trailers. In 2016 Ecopneus collaborated with 33 national and international transport companies for the logistics of ELT handling.

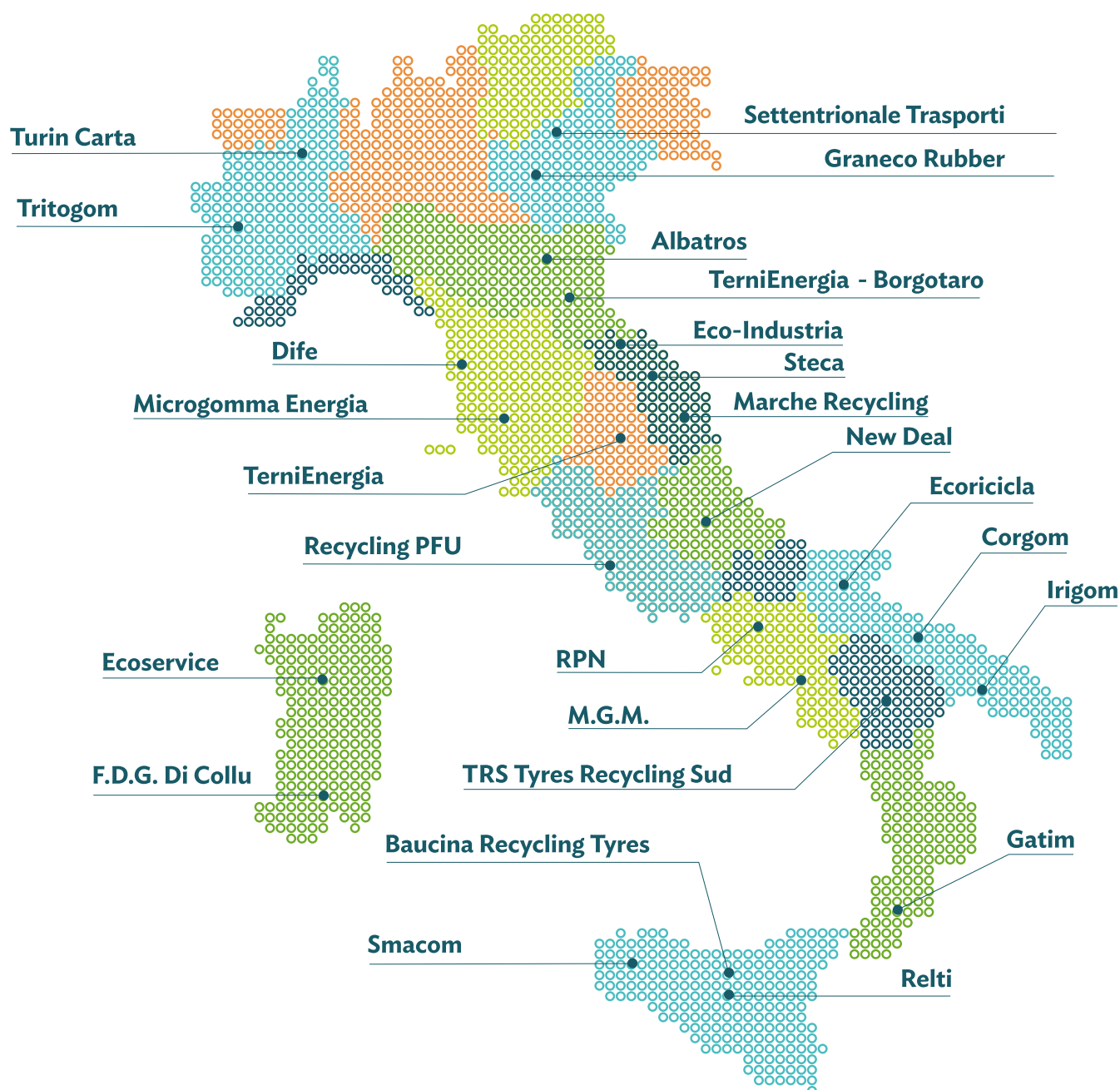
The treatment

In the Ecopneus system, the treatment for the transformation of End-of-life Tyres into derived materials good for recovery is carried out by 28 companies. They have an overall installed productive capacity of about 400 thousand tonnes, equal to the estimate of the total ELTs generated on the national territory every year.

With the current available knowledge and technologies, the devulcanisation of tyre rubber, which would allow its recovery

in the original productive cycle, is not available at industrial level, and the treatment for the recovery of ELTs is mainly based on mechanical shredding/grinding processes, which do not modify the original composition of the materials. These, based on their characteristics after their treatment, can be recycled into materials or they can be destined to energy recovery. In both cases, the treatment process deals with the intermediate production of goods that are subsequently to be absorbed by the market. The same market shall, first of

The treatment companies of the Ecopneus System.



all, evaluate the quality characteristics of these treated materials with reference to the various needs of production and of the end-product market.

For what concerns recycling, the main characteristics that define the quality of granules and powder are:

- Dimensional homogeneity of the various grain sizes required for granules and powder from the various production sectors of end goods.
- The impurity contents from foreign matter, such as: different rubbers from ELTs, filaments of iron and textile fibres, other materials (for example: stone chippings).
- The chemical-physical stability of the granules as vulcanised rubber polymers derived from ELTs and, thus, the absence of external polluting agents (for example: seals, pipes, etc), which cause substantial variations in the material composition, as well as lubricating oils or solvents the ELTs may accidentally have come in contact with.

In the case of those companies, which use recycled rubber from ELTs as secondary raw material for the production of goods for final use, the request for prime granules and powder is related to all those variables that may influence the productive processes and their final products.

To make some examples of how the guarantee of quality of the materials derived from ELT recovery with reference to these three variables can influence the quality of the end products, one can think about the production of artificial turf football pitches, which use ELT granules as performance infill. One may also think about the production of technical goods made with mixes of polymers of different nature. For football pitches, the ELT granule size homogeneity guarantees greater compactness and uniformity of the infill, which is reflected in a better response to the biomechanical needs of the athletes; whilst the absence of impurities and contaminating agents guarantee against the risks of release of substances which are dangerous for both human health and the environment. For technical goods, the absence of impurities and the dimensional and compositional homogeneity of the powder of the mix guarantee that, during the heating phases for the moulding of the products, there are no “cold areas” caused by granules of a larger dimension than the ones required by the productive process. These “cold areas” may not adequately respond to treatment during the moulding phase and, thus, could remain as (even functional) flaws in the final product.

In the case of cement factories, which absorb the majority of the shredded and chipped ELTs as derived fuel (TDF - Tyre Derived Fuel) for the production of energy replacing coal or pet-coke, the main variables of quality evaluation of the TDF make reference to the dimensional homogeneity of the tyres and the stability in the composition in rubber and steel. The dimensional homogeneity guarantees the plants about the process of TDF loading into the furnaces, because it avoids having to introduce expensive layout modifications. It also ensures the combustion rate of the TDF, which affects the process temperature and, as a consequence, the productive results. The stability of the composition assures a more accurate quantitative evaluation of the production parameters, as the use of TDF in co-processing in the clinker furnaces modifies the cement production recipes due to the content of inorganic ashes and steel derived from their combustion, thus reducing the consumption of primary materials - in particular the one of calcareous materials from a quarry and iron oxides.

Quality Manual

To stimulate the recycling plants to adopt uniform procedures of the productive processes for the quality of the end-products, whether they are destined to the recycling market or to energy recovery as fuels, Ecopneus has written a “Quality Manual for ELT Recovery Plants”, which can be used by the companies as a guideline to integrate their existing Quality Management Systems.

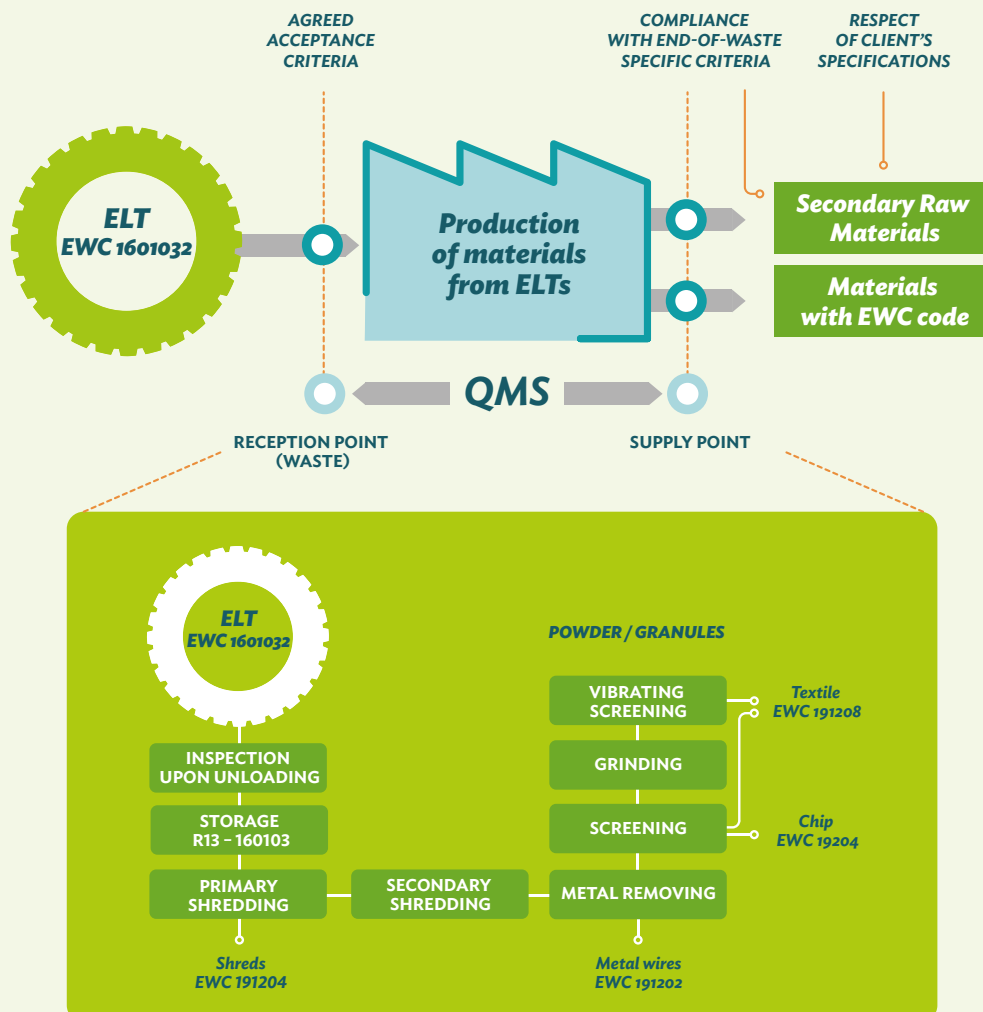
The Manual contains the aspects and the procedures a company of this sector is to take into consideration upon implementing a Quality Management System of the ELT treatment plants. They are elaborated with reference to the primary processes of an ELT treatment plant, starting from the consideration that every transformation phase directly or indirectly impacts on the following ones, and, thus, all activities are to be subject to specific procedures of conformity execution and

verification. Moreover, all information related to the performed inspections is to be crosschecked, in order to allow an analysis of the overall process.

In line with this methodological process, the technical proposal of the Manual refers to four priority points:

A. Control of processes and of products: procedures for a quality management of the various phases of the transformation of the ELTs (from ELT delivery to the plant, to the production, as well as the planning of the maintenance of the plants) and for the control of the compliance with specific legislative and clients' requests of the derived materials, whether they are semi-manufactured or finished, by the means of standard procedures of sampling and analysis.

Reference Framework of the Quality Manual for ELT Recovery Plants that are Partners of Ecopneus.



- B. Traceability of the materials along the productive cycle:** procedures for the monitoring of transportation and storing of the managed materials (ELTs in input, semi-manufactured and finished products), as well as their related samples of conformity analyses, during all the management phases. This is to guarantee the homogeneity of the production batches' quality.
- C. Management of relationship with clients:** management procedures for customers' requests and complaints, aimed at constantly improving the offer of products and services.
- D. Internal and external communication:** procedures to make sure that all company functions are informed about the quality objectives to be reached and that the product specifications are accessible to all stakeholders

The Quality Manual for ELT Recovery Plants has been developed by Ecopneus based on the information collected from the companies, re-elaborated with reference to the main international standard rules and regulations for what concerns Quality Management Systems (UNI EN ISO 9000 and 9001; UNI ISO 10005) and integrated with the specific requisites for Secondary Solid Fuels (UNI EN 15358:2011 and linked rules for their classification, sampling and characterisation by the means of laboratory analyses, UNI EN 15359:2011, UNI EN 15442:2011, UNI EN 15443:2011, UNI EN 15413:2011 UNI EN 15415-2:2012, UNI EN 15415-3:2012). It has also been integrated with the indications of the standard UNI CEN/TS 14243:2010, which has been specifically developed for "materials produced from end-of-life tyres". This standard defines the categories of ELT-derived materials based on their dimensions and impurities and it defines the appropriate methods of sampling and of analyses.

Relationships of reciprocal benefit with suppliers

In an integrated chain, in which every company is supplier of an input for another company until the product is finally sold to the consumer, the total quality approach provides for a co-ordinated management of activities carried out in the several steps of the value chain. This particular management modality is to be based on the reciprocal trust and the sharing of standards, in order to avoid that the costs of the non-quality of goods and services input to the productive processes (for example: the generation of production waste, the need of repairs and re-processing, the management of non-conformities etc) reduce the value generated by the value chain, putting at risk an acquired market position. The introduction of International Standards (such as UNI EN ISO 9000 and 9001 or UNI ISO 10005) into the Quali-

ty Management System, together with the creation of other systems of quality classification and certification of both the productive processes and the product, encourage the companies operating in the same chain to adopt the same quality management systems. In certain cases, they have also signed supply contracts according to a "quality partnership", meant as a long-term commitment during which the parties work together with the aim of creating a mutual benefit, sharing information, risks and results. By the means of the consolidation of the relationship between clients and suppliers, the capacity of creating value and optimising the management of costs and resources increases, thus reinforcing the companies' resilience with reference to a constantly mutating market.



2.5 Quality of recycled materials

Given their characteristic as elastic, sound-deadening material with a high resistance to heat and outstanding durability, the ELT rubber granulates and powders are used in several market sectors to manufacture a variety of different products. In non-combined form, ELT granules are an excellent infill material, for example for the production of synthetic turf football pitches. Combined with other components, they give birth to high performing products of common use. If added to bitumen, it is possible to produce modified asphalts with superior fatigue resistance, cracking resistance and ageing resistance. Bound in a matrix of polymeric resins, they are used for the production of soundproofing panels or for sports surfaces for gyms, tennis and basketball courts, or athletics tracks. Mixed with other rubber polymers, they are used to manufacture new products and a small percentage of fine powder can also be reused in the production of new tyres.

Main sectors using rubber recycled from ELTs



Each of these productions requires that the materials have different dimensional characteristics based on the process they are manufactured with. This process is very often the result of expensive testing, which directly affects the quality of the end product. For example: anhydrous powder characterised by a constant particle size (less than 0.8 mm) is needed in the production of modified bitumen, in order to guarantee the homogeneity of the final product. The granules used for synthetic turf football pitches must be larger but, in any case, they must comply with the type of turf used (generally comprised between 0.8 and 2.5mm), so that the infill is sufficiently compact and distributed in an homogenous way on the surface of the playground, to guarantee the performance required by the players. Moreover, for many products using ELT recycled rubber, there must also be the guarantee that granules and powder are not contaminated from other materials, and, in particular, one must pay attention to the rubber coming from the management of waste different from ELTs, which may put at risk the guarantee of the end product quality, compromising both health and the environment.

Interview to Aetolia VZ

We would like to thank Aetolia, a company of the Valli Zabban group and leader in Italy in the sector of soundproofing products with recycled materials, for sharing with Ecopneus their experience with reference to the importance of the quality of the materials used in their products, which is reported in the interview here below.

1. How did VALLI ZABBAN make the decision to invest in the production of goods that use recycled rubber from end-of-life tyres?

The company had been looking with interest at the market of sound proofing for a long time, because this market was getting more and more interesting, and the materials made with recycled rubber, on top of the product technical characteristics, allowed an interesting operation of circular economy with reference to the possibility of using ready available material at competitive costs.

2. What are the advantages of the use of recycled rubber from ELTs compared to other materials usually used in your sector?

Great elasticity and high resistance to abrasion, which are fundamental for the product to face a series of treatments in the building site without being damaged, and low raw material costs.

3. What are the characteristics required for granules and powders of recycled rubber to be used in your products? How important is the guarantee of a quality certificate of the materials you use in the productive processes and for your products to be competitive on the market?

They must satisfy a particular grading curve appropriately studied to achieve the best possible results of elasticity of the end product. Obviously, the granules are to be without any impurity, such as textile fibres or iron, which would cause a lot of problems during the production phases.

4. In the modern industrial systems, the achievement of high quality standards is not strictly limited to the product and the productive process, but it is extended to the upstream procurement phase and the downstream management of clients. How does VALLI ZABBAN manage quality in the value chain?

By maniacally checking the quality of the raw material supplied at every delivery and during the production phases. This is done to reassure the market of the constant quality

of our products.

5. Do you think that a quality certificate of recycled rubber from ELTs is a useful tool to consolidate a positive perception of the market towards the products that use it as raw material?

It would most certainly be an added value and it would give a further tool to enhance the quality of our work.

6. The recycling of rubber from tyres in products and applications determines a benefit for both the environment and the economy. Do you think that the market recognises this value as rewarding factor for your products?

The market tends to reward this type of choice; however, we reckon that there is still a long way to go, above all, to dispel a series of misconceptions that, at times, oppose a priori the use of recycled material, which is often seen as “not so valid” or as an alternative to save money.

7. Increasing the demand of goods using ELT recycled materials as raw material means to augment the environmental and financial benefits of recycling. What actions could be undertaken to boost the demand of these goods? What is the role of the Public Sector?

As manufacturers of rubber materials, but, above all, of materials for sound-proofing, we believe that it would be of great help a relaunch of the sector by the means of a campaign aimed at explaining the importance of the acoustic certification of the buildings linked to the health of the citizens. The update of the legislation is fundamental, in particular, the new DPCM (Decree of the President of the Council of the Ministers, Prime Ministerial Decree) 5/12/1997

8. Do you think that an EoW legislation for granules and powder of ELT recycled rubber could help the expansion of the existing application sectors and incentivise the development of new ones?

An End-of-Waste legislation of the ELT sector would certainly contribute to increase the market trust to use the ELT polymer granules and powder as quality secondary raw material. This aspect would determine a win-win situation, by positively favouring the market request of ELT-derived products, and by also stimulating companies' investments in research and the development of new applications.

Ecopneus Quality Label (Qe Label) is a product quality certification that makes reference to technical specifications, which have been developed by Ecopneus in collaboration with CERTIQUALITY. These technical specifications certify the superior quality of rubber granules and powder qualified as “non-waste”, obtained by the means of ELT recovery activities by authorised plants as per Art. 210 and 212 of the Decree law 152/2006, or in possession of an Environmental Integrated Authorisation issued by the relevant Public Authorities.

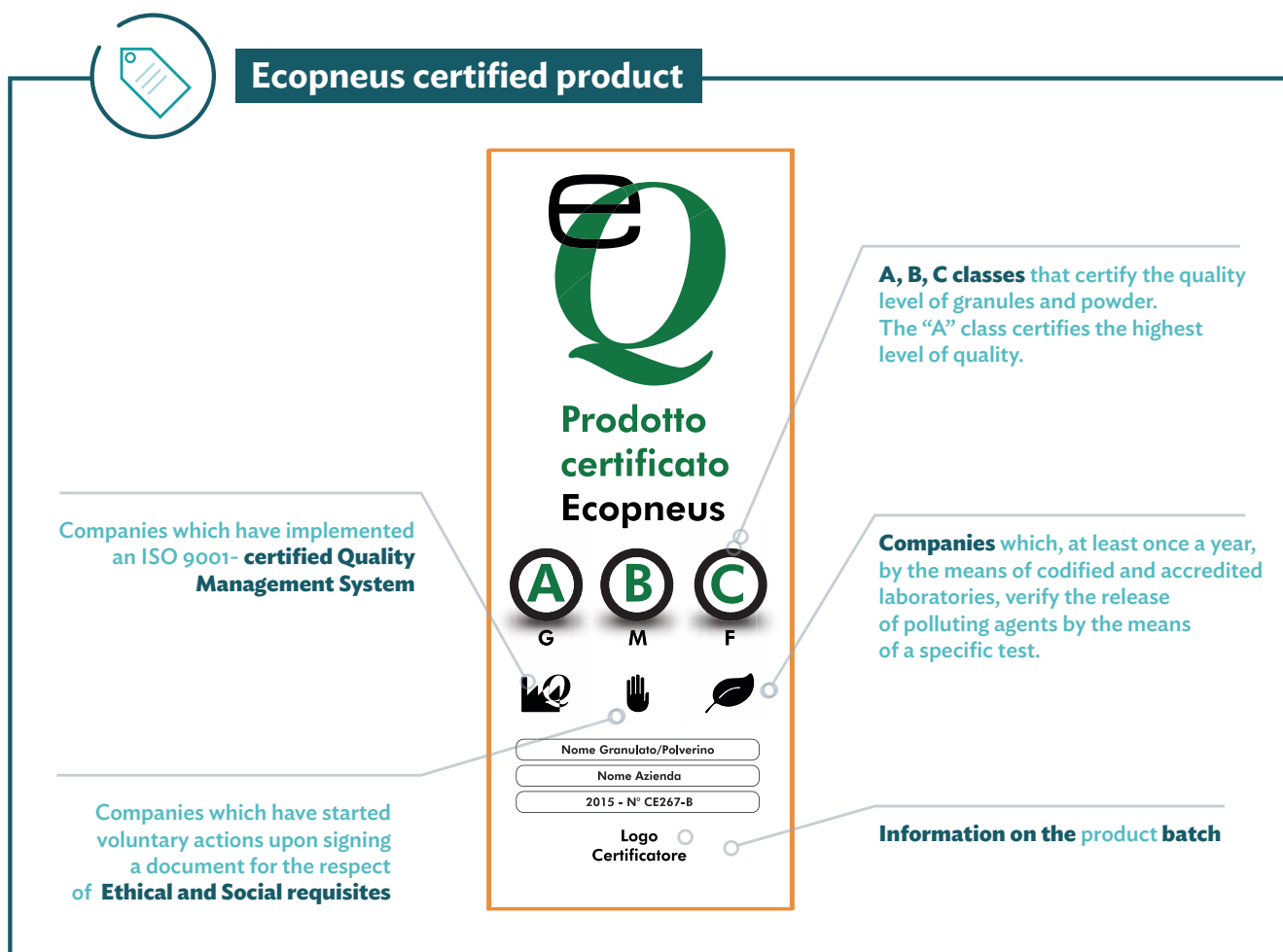
The Qe Label placed on the products guarantees the conformity of the materials compared to the minimum requirements certified by the means of inspection audits carried out by CERTIQUALITY. The technical specifications requirements refer to product traceability during the whole productive process, and to the chemical and physical characteristics of the products. They also make reference to company processes.

For what concerns product traceability, the technical specifications provide for the certification of the origin of the tyres, which are to come from the Ecopneus circuit, the keeping of the traceability of the production batches, the identification of the products in compliance with the declared specifications, and the certification of recycled product **REMADE IN ITALY**.

Compared to the product characteristics, the technical specifications require conformity checks with reference to their respective standards of parameters, such as the homogeneity of the granules, the content of textile fibres and free metals (UNI EN TS 14243), and the release of substances in water DIN 18035-7).

The Qe Label is divided into two levels identified by two different labels. The **basic level** certifies that the companies possess a “Quality Plan” that allows to manage and keep under control all the processes that determine the conformity of granules and powder with the requisites of the technical specifications. The **optional level**, instead, makes reference to the certification of the product compared to three further requisites: the company’s ISO 9001 certification; being a member of a voluntary project sustaining ethical and social principles for the respect of human rights and work and, finally, timetabled tests of the PAHs with reference to the standard DIN 18035-7 carried out in accredited laboratories.

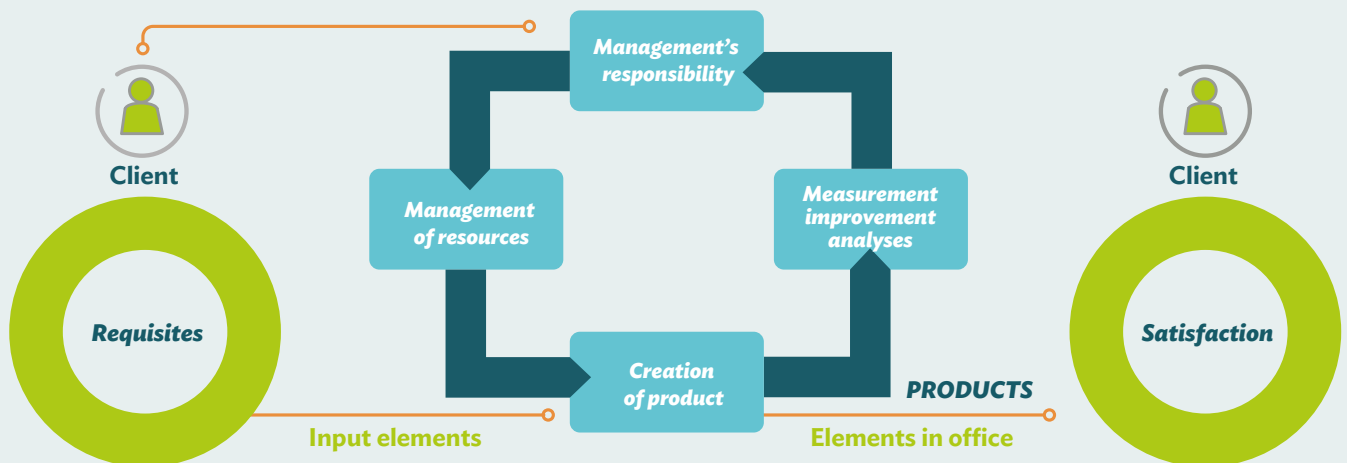
The process of certification requires CERTIQUALITY to follow a checklist to verify the company’s conformity to a number of criteria required by the Ecopneus quality certification technical specifications. Once the process has been completed and the evaluation report has been written, the Qe label is granted within 30 working days.



Customer orientation

The constant evolution of the relationship between market demand and offer had lead companies to focus on the importance of developing stable and long lasting relationships with their customers, aiming at consolidating reciprocal trust. In this respect, marketing has always played a crucial role in interpreting the clients' needs, or what is defined as "expected quality" from the part of the potential buyers. This interpretation is at the heart of a strategy of proposal of the value of the company. In this strategy, it is necessary for every company to pay attention to the ways in which this value is expressed and communicated to both the client and the entire internal organisation that is to create it. In such scope, the approach for Total Quality takes on a crucial role, offering tools and specific methodologies.

In a TQM system, the clients' expectations are elaborated and transformed into input requisites for the productive processes and the monitoring of the end user's satisfaction is decisive for promoting constant improvement. According to this model, every member of the company is responsible towards the final process output he/she is part of. This means that they are responsible for the satisfaction of the customer who buys the product, thus transforming the processes in occasions for creating company value, as they represent the bridge between activities and functions, performance and value and, above all, between "expected quality" and "offered quality".



The experience of those companies, which have adopted the Qe Label

The Ecopneus Quality Label (Qe Label) for granules and powder has been adopted by several Italian companies: **Corgom, Ecoricicla, Steca, Tritogom, TRS**. We have asked them to tell us their experience by the means of a questionnaire. The questions were eight. Here below we have reported the main answers to every question given by the interviewees. Moreover, from the comments, one can notice how all companies confirm the validity of their choice and they express satisfaction for the support they have received from Ecopneus.

1. What was the main reason for your company to adopt the Ecopneus Quality Label for the granulation products? How has this decision affected your company's "Quality Policy"?

All the interviewed companies have chosen to go through the process for the awarding of the Qe Label with the aim of consolidating their company's quality policies, in view of constantly improving the satisfaction of their customers' needs by the means of quality products. The certification process for the Qe label turned out to be an opportunity for revising the existing company policies. In certain cases they have been defined better by creating new processes. In other cases, they have been consolidated by improving the skills of analysis and control of the processes both internal and external to the company.

2. What were the most relevant problems faced in adopting and integrating the procedures required for the Qe label on the existing quality system? How have they been managed?

No particular problems were encountered upon updating the existing quality system with what required by the Qe Label specifications. Some interviewees highlighted the need for a significant involvement of their personnel, both for what concerns the new planned control procedures, and for their training. During the integration process, the companies already in possession of the ISO 9001 and ISO 14001 certifications were benefited, being the procedures of the Qe Label specifications inspired by those same standards.

3. What advantages have you had from the integration of the Qe Label certification procedures in terms of operative efficiency of the company, even in connection with other areas, among which, the one of environmental protection?

The integration of the Qe label procedures into the existing quality management systems, whether they were certified or not, has guaranteed a greater quality control of the products. Moreover, it has stimulated the companies to reorganise the activities of their productive processes and their related procedures of execution with a managerial approach. The greater involvement of the members of staff has had some positive consequences with reference to the individuation of anomalies in the productive processes, which are functional to management optimisation. The improvement of controls at all levels has made possible a complete traceability of the materials, which, has positively impacted on the quality of the end products. The adoption of the Qe label has also been considered as an opportunity to better understand the importance of rubber recycling within the scope of a circular economy of the sector and also for its contribution to the mitigation of the environmental impact of the production of virgin raw materials at global level.

4. In what way has the adoption of the Ecopneus Quality label of your products influenced your strategies/marketing actions/sales?

The Qe label is promoted as a distinctive element of the quality of the products derived from ELTs and the national clients appreciate very much its technical and communication potentialities, with regard to the opportunity of exploiting its message to support new commercial goals. For what concerns the foreign market, the Qe label has started attracting those companies that pay more attention to experimentation for the development of new applications. This gives hope for an increase in the requests coming from abroad in the years to come.



"Traceability and quality"

5. According to you, what is the right time frame to start verifying the advantages of the Qe Label certification for what concerns ELT granules and powder?

The appropriate time frame to start verifying the advantages of the Qe label for granules and powder is medium term. This period is necessary to move the typical demand-supply balance of a sector traditionally competing in price, including the quality as a competitiveness variable all the way along the recycling value chain, up to the products.

6. Do you think that a larger number of companies adopting the Qe Certification may help to reach more ambitious ELT rubber recycling goals, generating a competitive advantage of the chain?

Having a greater number of products certified with the Qe label can certainly help to qualify the chain. It can also help to contrast and discourage strategies of price competition on low quality products. With reference to this, according to some interviewees, it could be appropriate that the Qe label, which now has three classification levels of the quality of the goods, were brought to a single class. It is still fundamental to insist on raising awareness at all levels about the advantage of using ELT recycled products, as well as the promotion of research activities for the development of new applications, in order to favour a further increase of the demand for quality commodities.

7. What do you think the market perception of a “secondary raw material” with a quality label is? Do you reckon that an EoW legislation may further improve this situation?

The quality certifications certainly help to valorise secondary raw materials, despite a certain amount of distrust still remains in considering the products of ELT recycling as an effective resource. This aspect is above all linked to the persistence of some fears, among the workers of the sector, of possible complications linked to misunderstandings of the current legislation. An end-of-waste regulation for the ELT sector would contribute to clarify all latent doubts; it would validly contrast the prejudices on the derived products and favour the expansion of the demand of these materials.

8. Do you think that an EoW legislation could stimulate those companies that still do not possess the Quality label to start a process to get it?

Certainly an end-of-waste legislation that clarified once and for all the status of product for the materials derived from ELTs would contribute to a greater diffusion of the certifications for quality and the environment, both for what concerns the productive processes and for the products. It would obviously contribute to a greater spread of the Qe label too. However, in the company policies, the promotion of quality and environmental protection is a choice to be made independently of the legislation that rules the company's activities.



3

**The
communication
of Ecopneus**



Activities supporting a circular economy

The activities of Ecopneus in this sector respond to the mandate defined per law, which include also investments for training activities, awareness raising, and promotion of recycled rubber as a precious material and with multiple and very interesting possible uses.

In the previous chapters we have described the effort and the actions put in place by Ecopneus to create a prerequisite for a reliable, efficient and effective management for the ELTs, and to assert the availability of a quality material, i.e.: recycled rubber, potentially of great interest for several market areas.

The following step is the one of concretely acting by the means of:

- Detailed and widespread information about the benefits of the use of recycled rubber from ELTs
- Excellent performance of rubber from ELTs, in particular in some applications
- Realisation and promotion of demonstrative installations
- Partnership with bodies that support communication, both technically and scientifically, and that collaborate to the diffusion of the projects and of the information. They would also help in raising awareness in all sectors of society
- Fight against illegality along the whole chain, to contribute to the full functioning of the scheme

In the following pages we shall describe the main projects realised by Ecopneus in these sectors during 2016.

Promotion of sports installations

Roma, Sports Centre “Fulvio Bernardini”. The first important UISP sports centre in Rome with fields and tracks in recycled rubber from end-of-life tyres: a football pitch homologated by the National Amateur League, running track, gym dedicated to weights, playground for children.





Pollica, SA. Creation of a 7-a-side football pitch and of a tennis court.



New installation at Festambiente 2016. In the “TuttinGioco Park”, Ecopneus created some “inclusive” play structures designed for both normal and disabled children



Research, information and creation of roads

Start of the European Project Life-Nereide, Noise Efficiently REduced by recycleD pavements. Co-financed by the European Union, the project will test the noise reduction in some Italian towns. This is possible thanks to asphalts made with added recycled rubber from ELTs and “reclaimed” asphalt. Ecopneus is partner of the **Department of Civil and Industrial Engineering of the University of Pisa** (head of the project), **ARPAT** (Agenzia Regionale per la Protezione Ambientale della Toscana – the Regional Body for the Environmental Protection of the region Tuscany), the Belgian research centre **BRRC** (Belgian Road Research Centre), **the Institute of acoustics** and “**Orso Mario Corbino**” and the **region of Tuscany**.



Rimini, via Marecchiese. Street paving with rubberized asphalt. Thanks to this intervention, the noise of the vehicles transiting at about 50 km/h was reduced of about 5 dB (A) on the side of the road.



Research projects

Study on the safety of the use of recycled rubber in synthetic turf football pitches.

Research carried out by Bureau Veritas, CERISIE, the Institute for Pharmacological Research Mario Negri-IRCCS and Waste and Chemicals and promoted by Ecopneus to verify the non-toxicity of the materials deriving from ELT recycling. Started in 2014, it has confirmed the safety of granules from ELT recycling for the infill of synthetic turf playing fields.



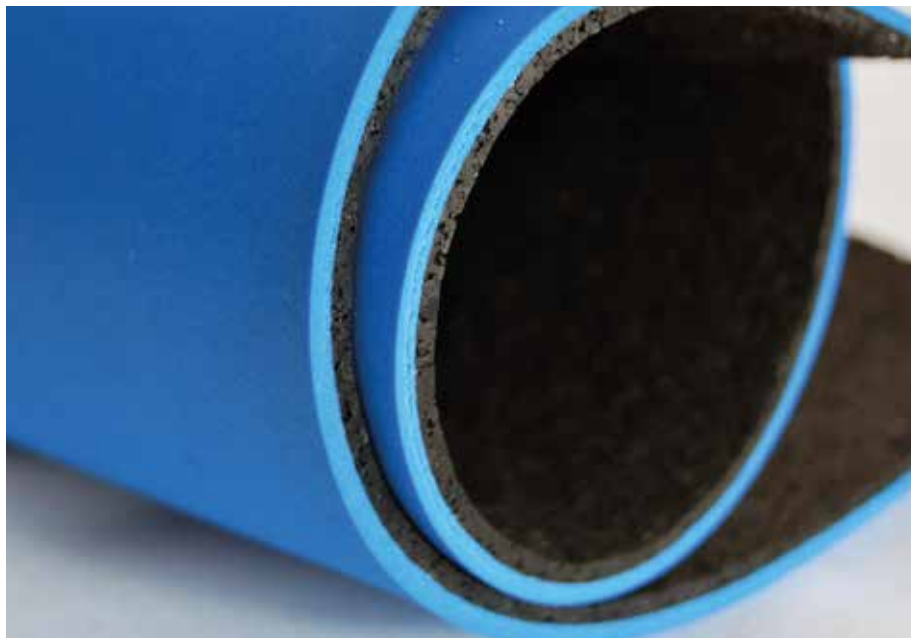
Conference at the Ministry of Environment for the presentation of the study.

The conference was opened by the Undersecretary of the Minister of Environment. Two of the Presidents of the Environmental Commissions of both the Chamber of the Deputies and the Senate, Mr Ermete Realacci MP and Senator Giuseppe Francesco Maria Marinello also attended the conference, as well as experts of several Ministries and Agencies, technical and research bodies and representatives of the industrial and market chain.



Collaboration and experimentation with Matrec on ELT recycled rubber poly laminates.

Start of research and testing of new poly laminated materials in which the recycled rubber from end-of-life tyres has been associated with leather, cork, textile fabrics, bamboo, paper and wood. Different material worlds but which, once united, give a new identity to ELT rubber, widening its commercial scopes: furniture, design, building, objects and the nautical world.



Collaboration with the architecture firm Parasite 2.0

Study on the possible creative uses of ELT rubber with new colours and realisation of the installation winner of the prize YAP 2016 - Young Architects Program- organised by the Museum MAXXI of the city of Rome, in collaboration with MoMA/MoMA PS1 of NY, Constructo of Santiago in Chile, Istanbul Modern and MMCA National Museum of Modern and Contemporary Art of Seoul.



Information to citizens and consumers

Sustainability Report 2015

5° edition of the document. It reports the activities and management of Ecopneus in a transparent way. Presented and discussed in the framework of a stakeholders' forum with all the main interlocutors, both internal and external to Ecopneus, and made available for consultation on the website: www.ecopneus.it.



The plants open their doors

It is now on its 4th year. With this initiative, the Authorities, the industrial world, the control bodies and the citizens are shown from within how the process of treatment and recycling of end-of-life tyres is carried out thanks to two partner companies, which in 2016 opened their doors to the public.



Events and trade fairs

Rimini, Ecomondo. The dialogue with all the stakeholders of the Circular Economy in Italy.



Verona, FieraCavalli. For the promotion of ELT rubber in the equestrian disciplines: flooring, walkways and paddocks.



Genoa, Sports festival. For the second year in a row, Ecopneus was partner of UISP (Italian Union Sports for Everybody) in their activities at the Old Port of the city of Genoa: the visitors could see flooring made of ELT recycled rubber.



Region of Piedmont, Educational Project. A training project for secondary school students developed in collaboration with Legambiente School and Training.



Region of Apulia, Closing event Puglia Educational Project 2015. Reflections and dialogue with the students who took part in the initiative and in the contest that will lead to the refurbishing of multi-purpose sports facilities in the winning school and to the donation of interior furniture and surfaces - all made with recycled rubber.



Commitment to legality

The “**Observatory on the illegal streams of tyres and ELTs in Italy**” was born. It was first created and conceived by Ecopneus and it has gradually involved all the operators of the tyre/ELT chain to promote legality and correctness in favour of the healthy economy of the sector.



PFU Academy in Ancona and Turin. Training and discussion about legality, environment and ELT management with Local Authorities and Control Bodies of the Public Administration.



Activities in the Land of Fires

Extra ordinary intervention of collection and recovery in Naples. On top of the activity of ELT collection in several places all over the territory, we concluded the clean-up of a warehouse containing 5,000 tonnes of ELTs that had been abandoned for years in the area around Gianturco, in Naples. In two months the equivalent in weight to about 550,000 car tyres was collected.



“RiScatta la Terra dei fuochi” (Redeem and take a photo of the Land of fires). Training project for schools and photo contest open to students and citizens of the provinces of Naples and Caserta. The best photos depicting the beauties of the territory of the Region Campania were awarded the creation of playgrounds and sports facilities in the winning schools and on the territory.





Activities of communication and press office

Constant and transparent communication through the media.

1,020 articles published in 2016.



Direct line with all the stakeholders: www.ecopneus.it.

82,119 users involved who viewed over 350,000 pages.

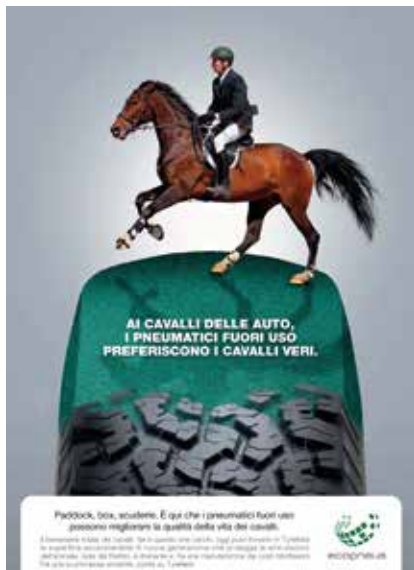


An always-available tool for dialogue: the Facebook page.

80,327 users viewed our facebook page, visualising over 580 thousand related contents.



Recycled rubber in sport in the pages of newspapers and specialised magazines.



List of partners as of 31 12 2016

A.r. Pneumatici Srl Unipersonale

Asperti Angelo

Autogomma Perego Srl

Bellotto Spa

B. R. Pneumatici Spa

Bersangomme Srl

Bis Srl

C.g. Service Spa

Camso Italy Spa

Catania Gomme Srl

Centro Europeo Ricambi Spa

Centro Gomme Snc

D.p. Commercial Tyres Srl

Devalle Gomme Snc

Di Pasquale Diego

Driver Italia Spa

Driver Servizi Retail Spa

Dst Srl

Eco-Ingea Srl

Emmegieffe Srl

Fca Italy Spa

Fintyre Spa

Gexpo Spa

Gottardi Srl

Grassini Pneumatici Srl

Grg Pneumatici Srl

Harley - Davidson Italia Srl Unipersonale

Idio Ridolfi E Figli Srl

La Genovese Gomme Spa

Marangoni Tyre Spa

Mazzon Leonardo & C. Snc Di Mazzon Roberto E Fabio

Mercedes Benz Italia Spa

Nuova Pneus Vignola

Outlet Gomme Srl

Parise Gomme Snc

Perla Pneumatici Siena Srl

Picone Pneumatici E Cicli

Pirelli Industrial Srl

Pneus Service Italia Srl

Pneus Sette Srl

Pneusmarket Romagna Srl

Pneuspergine Srl

Points Italia Unipersonale Srl

Ponente Gomme Srl

R.g.s. Pneumatici Srl

Re-Ta Gomme Srl

River Srl Unipersonale

Rossi Lamberto Srl

Satep Srl

Top Ruote Srl

Trelleborg Wheel Systems Italia Spa

Volkswagen Group Italia Spa

Zuin Spa

Bridgestone Italia Sales Srl

Continental Italia Spa

Goodyear Dunlop Tires Italia Spa

Marangoni Spa

Pirelli Tyre Spa

Michelin Italiana - S.a.m.i.

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