

WASTE TIRES IN SERBIA - SOURCE OF POLLUTION OR RECYCLABLE MATERIAL?

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***Abstract:** Irregularly disposed waste tires may produce a series of negative environmental impacts and severely endanger wildlife and human health. On the other hand, if treated in the appropriate manner, waste tires can provide a sustainable source of energy and reduce the use of natural resources, hence contributing to environmental protection and conservation. In the Republic of Serbia, waste tires represent a serious environmental issue. In spite of the normative framework and strategic documents, there are still numerous practical obstacles standing in the way towards the sustainable and environmentally acceptable use of all the potentials of this specific waste category. Therefore, the authors of this paper highlight the potentials of waste tires as a recyclable material in the context of environmental pollution prevention and sustainable development, analyse existing legal and strategic framework for the treatment of waste tires in Serbia, provide an insight into current state regarding the issue of waste tires disposal and recycling in Serbia, draw a brief comparison between Serbian and European Union legislation and practice in this area (having in mind the importance of European integrations) and, finally, point out key practical problems regarding this issue in Serbia, offering suggestions for their resolving.*

***Keywords:** waste tires, waste management, recycling, sustainable development, environmental pollution, environmental legislation.*

INTRODUCTION: Waste tires as a recyclable material and its potentials in the context of environmental pollution prevention and sustainable development

Used tires are form of waste (end-of-life tire: ELT) and should be treated as a special kind of waste (Torretta et al. 2015). According to the Rules on the manner and procedure regarding the treatment of waste tires (Official Gazette RS, No. 104/2009 and 81/2010), waste tires are defined as tires from motor vehicles (cars, buses, trucks, motorcycles, etc.), agricultural and construction machinery, trailers, aircraft, towed machines, other machines and appliances and other similar products, after the end of

the life cycle, which owner discards or intends to discard due to damage, wear and tear or other reasons (Article 2). As, according to the same Rules, waste tires cannot be disposed of in landfill (Article 4), that they are considered recyclable materials which must be treated as it is prescribed.

Tires consist of many components: carbon black, elastomer compounds, steel cord, several other organic and inorganic components. The treatment of vulcanization allows high resistance of tires to microorganisms for more than 100 years, and that is why it is unjustifiable to throw tires in the landfill (Torretta et al. 2015).

According to the Regulation on the products that become special after use (Official Gazette RS, No. 54/2010, 95/2018 - other law), daily records of the quantity and type of manufactured and imported products (tires) that become special streams of waste after use, as well as the annual report, are run by payers of the compensation (Article 4).

Understanding used tires as a recyclable material is especially important in the context of environmental pollution prevention. Used tires discarded in landfills are the source of many negative factors for the environment. They form uncontrolled landfills, occupy large areas, and biodegrade very slowly. Moreover, they are easily accessible to combustion and retain water which leads to the proliferation of insects and causes the risk of infection. Uncontrolled burning of old tires releases several toxic substances: carbon monoxide, lead, dioxins, furans, benzene, polycyclic aromatic hydrocarbons, and after burning organic compounds remain in the soil, such as pyrolytic oils, which are harmful to the flora and fauna (Technical Working Group of the Basel Convention 1999: 5; Torretta et al. 2015).

For this reason, ELT should be considered and used as recyclable materials. They can be used for a reconstruction of tires, or for the recovery of material and/or energy (Torretta et al. 2015).

There are numerous uses of old tires as a recyclable material. End-of-life tires can be used in asphalt, bitumen, varnish, pavement and cement factories, in power plants for the production of energy/steam, as noise barriers, artificial barriers and bales, drainage and insulation, floor tiles, roofing materials, articles for road marking, sports flooring, curbs, coating material, waterproofing agent, shoe soles, coatings for electrical cables, automobile parts etc. (Gupta et al. 2014; Martínez et al. 2014; Shu and Huang 2014; Torretta et al. 2015). A ton of tyres is equivalent to a ton of good quality coal or 0.7 ton of fuel oil (Technical Working Group of the Basel Convention 1999: 2).

Using ELT for their reconstruction or for recovery of material and/or energy (as an alternative fuel) has the potential to reduce the consumption of natural resources significantly. In this way, tires waste management provides the benefits for sustainable development.

LEGAL AND STRATEGIC FRAMEWORK FOR THE TREATMENT OF WASTE TIRES IN SERBIA

Law on Waste management

Law on Waste Management (Official Gazette RS, No. 36/2009, 88/2010, 14/2016 and 95/2018 - other law) treats waste tires as a type of waste that belongs to special streams of waste. Namely, according to its Article 5 Paragraph 22, special streams of waste include the streams of waste such as waste batteries and accumulators, waste oils, waste tires, waste derived from old electronic devices, waste vehicles and other sources of waste, from the place of their emergence, collection, transport and treatment to their final disposal at waste landfills.

The Law on Waste Management is familiar with some types of waste (including waste tires) that may lose the status of waste (in the sense of Article 5 Paragraph 1 Point 17 of the same Law) provided that they have undergone the process of reuse, including recycling, under the following conditions: 1) that the substance or object is commonly used for special purposes; 2) that there is demand for such products; 3) that the substance or object meets technical requirements for special purposes and conditions prescribed by the laws and standards applied on such products; 4) that the use of substance or object will not cause overall negative environmental impact or human health (Article 8v Paragraph 1). Technical requirements for the treatment of individual types of waste that lose the status of waste in accordance with the European Union guidelines (such as paper, glass, tires, textile, aggregates and metal) and the procedure for the compatibility assessment are prescribed by the Minister in charge of the environmental issues (Article 8v Paragraph 1).

The Law on Waste Management defines waste tires as the tires from motor vehicles (cars, buses, trucks, motorcycles etc.), machines used for agriculture and construction works, trailers, dragged machines etc. whose life cycle has been completed (Article 49 Paragraph 1). According to this Law, the person who is in charge of collecting, transporting, treatment or disposal of waste tires must obtain a permission, keep evidence on the quantity of collected and treated waste tires and deliver

the information about these issues to the Environmental Protection Agency (Article 49 Paragraph 2).

The Law on Waste Management also regulates some financial aspects of waste management, including the management of waste tires. Namely, the Law specifies that the financial resources for waste management in Serbia are provided from the following sources: 1) the budget of the Republic of Serbia; 2) the budget of the autonomous province and local administration units; 3) European Union funds and other international funds; 4) donations, gifts, contributions, assistance and other similar resources; 5) loans given by international financial institutions and 6) other sources in accordance with the Law. Furthermore, in its Article 81, this Law enumerates the types of waste for which the expenses of investment and operation are covered by the aforementioned financial resources. They include, among others, the expenses related to the management of waste tires batteries, accumulators, waste oils, waste tires, waste from electronic devices, waste from fluorescent pipes that contain mercury and waste cars (Article 81 Paragraph 1).

Strategy on Waste Management

According to the Strategy on Waste Management of the Republic of Serbia for the period between 2010 and 2019 (Official Gazette RS, No. 29/2010), 1.4 million pieces of new tires are placed on the market annually. The existing quantities of waste tires are expected to increase due to the introduction of the Law on Traffic Safety on Roads (Official Gazette RS, No. 41/2009, 53/2010, 101/2011, 32/2013 - decision of the Constitutional Court, 55/2014, 96/2015 - other law, 9/2016 - decision of the Constitutional Court, 24/2018, 41/2018, 41/2018 - other law, 87/2018 and 23/2019) and it is estimated that their total quantity exceed around 50000 t per year.

The issue of current quantity of waste tires was supposed to be resolved by the end of 2014, but this task has not yet been completed. The cement factories have been given the permission to use a maximum of 15000 t of waste tires per year for the purpose of energy production (in the process of co-incineration).

The aforementioned Strategy also emphasizes that waste tires have to undergo a specific treatment, highlighting that recycling has the priority over burning (Part 7.3. of the Strategy on Waste Management for the period between 2010 and 2019).

Short terms goals, enumerated within the Specific goals of the Strategy on Waste Management for the period between 2010 and 2019,

(which referred to the period between 2010 and 2014) also included (among other goals) the establishment of a system for the management of special streams of waste (which include waste tires as well) by the end of 2014.

The projection of waste tires streams in Serbia (presented within the aforementioned Strategy) suggested that there would be 26 000 t of waste tires in 2010, 30 000 t in 2014 and 34 000 t in 2019. The Report on the state of environment in Serbia (Veljković (ed.) 2019), confirms that altogether 30 984 t of waste tires were treated in 2011 as well as that no waste tires were imported. No data available for 2010. In 2014, 28 766 t of waste tires were treated 781 t of waste tires were imported, which altogether comprises 29 547 t of waste tires processed to special streams of waste, which confirms that the projections were accurate. However, the data from 2018, when altogether 53 697 t of waste tires were processed, indicate that the projections for that period were not correct since a much larger quantity of this type of waste was treated. More than 20,000 t of tires were recycled in the first half of 2019. Tire collection is organized by recyclers, as well as individuals and legal entities collectors in about ten tire treatment plants. Also, in recycling centers, tires also come from waste generators such as tire repair shops, farms, landfills, industry, rubber, mining and transport companies, tire manufacturers and distributors (Tanjug 2019; Energetski portal 2020).

Rules on the manner and procedure regarding the treatment of waste tires

Rules on the manner and procedure regarding the treatment of waste tires (Official Gazette of RS No. 104/2009 and 81/2010) contains more detailed rules on the actual procedure of waste tires treatment. In its Article 2, the Rules define the subjects involved with waste tires management process, including: waste tires owner, collector, transporter, keeper and person in charge of their treatment. The owner of waste tires is defined as a natural or legal person who participates in the trade of waste tires or as a natural or legal person whose activities cause permanent or occasional generation of waste tires, whereas the terms: waste tires collector, transporter, keeper and person in charge of waste tires treatment refer to the persons with legally obtained permissions to perform these activities.

The Rules define the treatment of waste tires as every process of recycling or reuse of waste tires for the purpose of energy production (Article 2 Paragraph 1 Point 7). Furthermore, the Rules define waste tires

management as an assembly of measures that include their collection, transportation, keeping and treatment (Article 3). Waste tires management has to be conducted in the manner and within the procedure that guarantee the protection of human health and environment and waste tires are not allowed to be disposed on landfills (Article 4).

The owner of waste tires is obliged by the Rules (Article 5) to give them either to the waste tires collector or to the person who is in charge of keeping or treatment of waste tires, whereas these persons are obliged to accept them (Article 6 Paragraph 1). It is important to highlight that the owner of waste tires does not pay any compensation to collectors, transporters, keepers or persons in charge of waste tires treatment and all subjects involved with this procedure have to fill in a special form called Document on waste streams in accordance with relevant rules (Article 7).

The collection of waste tires has to be conducted in an appropriate manner and they must be kept in an appropriate space designed for that purpose, either indoor or outdoor, equipped for the loading and discharge of waste tires, in compliance with the law. The open depository of waste tires has to be located on a concrete surface and surrounded by a fence that is at least 2 m high, supervised in order to prevent the access of unauthorised persons and equipped with an appropriate fire protection system (Article 8).

The treatment of waste tires has to be conducted within a facility that complies with the requirements prescribed by the law and other legal acts, particularly in the terms of the measures necessary for the prevention, minimisation and removal of potential negative environmental impacts (Article 9).

The treatment of waste tires comprises their recycling as well as their use for energy production. The amount of recycling of waste tires should be at least 80%, whereas their use for energy production should not exceed 20% from the total amount of collected waste tires in the previous year (Article 10).

It is particularly worth mentioning that the Rules oblige relevant subjects (collectors, keepers and persons in charge of treatment) to keep daily evidence on the quantity, origin and delivery of waste tires only if the amount of these tires surpasses 1000 kg (Article 11). This means that any smaller quantity of collected, kept or processed waste tires remains unregistered, which leaves space for numerous irregularities and so-called "dark figures" in this area.

Regulation on the products that become special streams of waste after use, the form on daily evidence and quantity and type of produced

and imported products and annual report, means and terms of annual report delivery, compensation payment, criteria for calculation, sum and means of calculating and paying the compensation (hereinafter: Regulation on the products that become special streams of waste after use)

Regulation on the products that become special streams of waste after use (Official Gazette of RS, No. 54/2010, 86/2011, 15/2012 , 41/2013 - other regulation and 3/2014) is particularly relevant when it comes to determining the details about the quantity of waste tires in Serbia on an annual basis since it prescribes the obligation of all subjects involved with waste tyres collecting, keeping, processing etc. in the area of evidence keeping and reporting. The Regulation defines waste tires (in its Article 2 Paragraph 1 Point 1) in the same manner as the Law on Waste Management and specifies that waste tires are considered products that become special waste streams after use (Article 3 Paragraph 1 Point 1).

The Regulation obliges all subject who produce or import the products that become special streams of waste after use (including those who produce or import waste tires) to pay annual compensation (fee) for the management of special streams of waste (Article 2 Paragraph 1 Point 6). The amount of compensation for produced and imported tires that become special streams of waste after use is estimated so that it can cover the expenses of waste tires management (Article 7). It is determined for the following types of tires:

1) imported, produced and retreaded tires from motor vehicles (cars, buses, trucks motorcycles etc.), machines used in agriculture or construction, trailers, aircrafts, dragging machines, other machines and devices and similar products (20.400 RSD per t),

2) tires that are components of imported or produced buses, trucks, working machines, working and farm vehicles, airplanes and other aircrafts and wheel sets for:

- a) car trails (133 RSD per tire);
- b) farm vehicles (205 RSD per tire)⁷
- c) trucks, buses and forklifts (1142 RSD per tire)
- d) working machines used in construction (36 RSD/kg per tire on a vehicle)
- e) working machines used in agriculture (24 RSD/kg per tire on a vehicle)
- f) truck trails and dragged machines (24 RSD/kg per tire on a vehicle)

- g) other vehicles, transport devices and aircrafts (36 RSD/kg per tire on a vehicle).

The compensation is calculated and paid when the product is placed on the market for the first time, i.e. when a vehicle (containing tires as its integral element) is imported or placed on the market in the Republic of Serbia (Article 12).

CURRENT STATE REGARDING THE ISSUE OF WASTE TIRES DISPOSAL AND RECYCLING IN SERBIA

Findings from the reports of relevant bodies on current state of the waste tires in Serbia

Heavy industry in the Republic of Serbia is predominantly based on mining, whereas the production of tires comprises a smaller part of it, referred to as "other industrial production" (Waste Management Strategy for the period between 2010 and 2019). In the moment when Waste Management Strategy was adopted, there were altogether 14 business entities registered for waste tires treatment, whereas one company was registered for the use of waste tires as an alternative fuel source in the Republic of Serbia (Waste Management Strategy for the period between 2010 and 2019).

Available data (Veljković (ed.) 2019: 72) show that the total reported quantity of tires imported to the Republic of Serbia in the period between 2011 and 2018 was the largest in the first two years, whereas in the following years it was around 45305 pieces. The data on waste tires management indicate that altogether 46 t of waste tires were disposed in 2016, whereas in 2018 the total quantity of disposed waste tires was 177 t. The report does not contain information about the quantity of disposed waste tires in other years.

Within the period analysed in the aforementioned Report (2011-2018), a total amount of 37516 t of waste tires was treated per year. Whereas the export of waste tires is not very common, a significant amount of whole waste tires was imported - in average 377 t per year (Waste Management Strategy for the period between 2010 and 2019; Veljković (ed.) 2019: 74).

The total quantity of tires as waste that becomes special stream of waste after use generated in 2018 was 12956 t, whereas the amount of waste vehicles was 617 t. These amounts of waste were reported to the Environmental Protection Agency of the Republic of Serbia by the

economic subjects that generate waste tires within the scope of their activities.

The reporting of the types and quantities of waste is conducted in accordance with the Regulation on the methodology for the creation of national and local register of the sources of pollution and on the methodology for the types, manners and timeframes for data collection (Official Gazette of RS, No. 91/2010, 10/2013 and 98/2016) and Regulation on the form for daily evidence and annual report on waste with the direction for its completion (Official Gazette of RS, No. 95/2010 and 88/2015). The types of waste are determined in accordance with the Catalogue of Waste (Appendix I of the Regulation on the categories, assessment and classification of waste, Official Gazette of RS, No. 56/2010 and 93/2019). However, the actual quantity of generated waste tires seems to be much larger since the Report on the State of the Environment for 2018. does not contain the amount of waste tires that the operators collected from individual persons (Lekić and Perunović Čulić 2019: 102).

The latest available data (for 2018) show that there are 1838 subjects that are obliged to pay the compensation for the management of waste tires as a special stream of waste. In that same year, the total amount of tires placed on the market was 47781 pieces, i.e. 35760,7 t, whereas 53340 t of waste tires were reused. Altogether 180t of this type of waste were imported and 177 t were disposed (Radovanović et al. 2019: 11).

The Report on the State of the Environment for 2018 (Lekić and Perunović Čulić 2019: 102) and Report on Waste Management in the period between 2011 and 2018 (Đorđević et al. 2019: 6) suggest the following:

- 1) the number of business subjects that generate waste tires has increased,
- 2) the use of waste tires has increased,
- 3) the number of companies that generate waste tires has increased,
- 4) the use of waste tires has expanded,
- 5) the quantity of imported waste tires have decreased,
- 6) the amount of treated waste from waste tires and cars has augmented.

These changes have been caused by the increase of industrial production in the last decade. For example, in 2018, the total share of industry in the production of non-hazardous waste was 1,3%, whereas its total share in

the production of hazardous waste was 10,3% (Krunić and Lazić (eds.) 2019: 7).

In accordance with the prescribed hierarchy in waste tires management in the Republic of Serbia, recycling has the advantage over the use of tires for energy production. Therefore, there are the capacities for the recycling of waste tires of different dimensions. At the moment when the Waste Management Strategy between 2010 and 2019 was adopted, these systems had the capacity to process 18 000 t of tires per year (Waste Management Strategy between 2010 and 2019).

The financial resources for environmental protection are insufficient and their total amount is less than 1% of state budget. For example, in 2008 a total of 270 million RSD were intended for 6 projects dealing with the issue of regional landfills (Waste Management Strategy between 2010 and 2019). According to the Law on the Budget of the Republic of Serbia for 2020 (Official Gazette of the RS, No. 84/2019), its Article 5, which prescribes an overview of planned capital expenditures of budget users, it is planned to allocate 270 million RSD to the Ministry of the Environmental protection in the current 2020 for the construction of the main collector for wastewater treatment plant in Leskovac city. No budget is planned for 2021 and 2022 years. Altogether, slightly more than 0.5% of the total budget expenditures were earmarked for the environmental protection. The annual budgetary increase required for environmental protection is about 1.2-1.4% of GDP (Fiskalni savet 2019).

EU legislation

An important umbrella document for the treatment of waste vehicles, which also regulates the treatment of waste tires in the EU, is the Directive 2000/53/EC on end-of-life vehicles.

The Directive requires harmonization of the treatment of end-of-life-vehicles (ELV) first in minimizing environmental impact, and second in avoiding distortions of competition in the Community. In order to ensure coherence among the Parties' legislatures and activities, Community-wide framework is necessary, particularly in regulating the design of vehicles for recycling, recovery, collection and treatment facilities, respecting the principle of subsidiarity and polluter-pays. Economic operators are in charge for the collection, treatment and recovery of end-of-life vehicles, with the obligation to avoid waste generation as much as possible. By Directive (Annex 1, Article 6 of Directive 2000/53/EC), end-of life vehicles, components or materials shall

be stripped before further treatment, all the operations and storage shall be carried out in such a way as to ensure the suitability of vehicle components for reuse and recovery, and in particular for recycling, in order to reduce any adverse impact on the environment. Also, treatment operations for de-pollution of end-of-life vehicles shall be carried out as soon as possible. Minimum technical requirements for used tires include removal, appropriate storage, prevention of fire hazards and excessive stockpiling.

According to the Council Directive 1999/31/EC, whole used tires je forbidden to dispose on landfills, excluding tires used as engineering material, shredded used tires (excluding bicycle tires and those with an outside diameter above 1400 mm) (Article 5 - Waste and treatment not acceptable in landfills, Council Directive 1999/31/EC)

First objective of the Directive 2000/53/EC on end-of life vehicles is to lay down measures which aim at the prevention of waste from vehicles, reuse, recycling and recovery of ELV and their components, among which are tires, so as to reduce the disposal of waste (Article 1) as much as possible (Directive 2000/53/EC).

EU practice

The main producers of ELT are mechanical workshops and vehicle breakers who take the vehicle for demolition. Many tires were accumulated in various forms in and around urban areas (Torretta et al. 2015).

Members of EU generate 8 – 9 million tonnes of waste from end-of-life vehicles yearly (Directive 2000/53/EC). Of this amount of waste, ELT represent 2.6 million tonnes. i.e. 28.9 % approximately (Steca 2015-2018).

Waste tire treatment is done according to Life Cycle Assessment (LCA) in EU in recent years (Tillman 2000; Curry et al. 2011; Torretta et al. 2015). Limitations on the application of LCA depend on the economic and social situation in the country and are mostly well assessed and that is why the various stakeholders are involved in the management system of ELT in EU (Torretta et al. 2015). For example, in Italy ELT are collected from more than 30,000 points: tire dealers, auto repair shops, service stations and offices of public or private fleets. Grinding is the most usual recycling method and material is mostly used for sport surfaces (31 %) and energy recovery (Torretta et al. 2015).

Tires can often be an object of illegal -unofficial activities (flows and treatment), which makes it difficult to assess the actual situation and

the role of recycling in some EU countries. Fortunately, this situation has been changing for the better lately, and waste tires landfills decreasing in Europe (Torretta et al. 2015).

Investment for Research and Development (R&D) into design for end-of-life should strengthen the implementation of legislation that prescribes proper treatment of waste tires in EU. European automakers use much of R&D budgets to meet emissions standards, but still R&D expenditure on waste management and environmental protection does not increasing (Gerrard and Kandlikar 2007: 20).

In order to meet legislative, economic, technological and societal factors, new types of materials are used, such as plastics and aluminium, because of their suitable properties in car industry (Gerrard and Kandlikar 2007: 20). Plastic was particularly widely used in past two decades (Waste Watch & Recoup 2003: 80), but nowadays trend is in reducing the number of different plastics for easier recycling (Gerrard and Kandlikar 2007: 26)

The implementation of the ELV legislation has led to improvements in recycling methods and reduction in toxic substance use in EU, but still that is not a high priority for car manufacturers in relation to economic imperatives in automotive design (Gerrard and Kandlikar 2007: 26).

A brief comparison between Serbian and EU legislation in this area

Harmonization of waste tire treatment practices with the European one is reflected in the implementation of activities and institutional responsibilities related to the Council Directive 2008/98/EC on waste, superseding and amending framework Directive 75/442/EEC and Directive 2006/12/EC, as long-term priorities. Special waste streams management system needs to be created in order to meet 4 kg per capita separately collected waste (from electric and electronic equipment from households by 2023 and minimum 45 % of batteries and accumulator by 2026). This waste also includes waste tires (Transposition and Implementation of Environmental and Climate Change Acquis - Chapter 27: Status and Plans 2015).

Rules on the manner and procedure regarding the treatment of waste tires (Official Gazette of RS No. 104/2009 and 81/2010) are in line with the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (1989) and the requirements of Directive 2006/12/EC on waste, Directive 99/31/EC on the landfill of waste, Directive 2000/76/EC on the incineration of waste and Directive 2000/53/EC on end-of life vehicles.

KEY PROBLEMS IN THE MANAGEMENT OF WASTE TIRES IN THE REPUBLIC OF SERBIA

There appear to be several issues related to the management of waste tires in Serbia. A precise and accurate evidence on the quantities and streams of this particular type of waste seem to be missing; numerous disposal sites are located on private properties, waste tires are frequently disposed in an inappropriate manner or illegally incinerated on unsuitable locations etc. As Energy Sector Development Strategy of the Republic of Serbia for the period by 2025 with projections by 2030 (Official Gazette RS, No. 101/2015) adopted in 2015, emphasizes, transparency and accessibility of information, as well as public registers maintained by individual institutions, is not adequately made available to third parties.

Despite some announcements made by state officials in the media several months ago, the new Waste Management Strategy for the Republic of Serbia for the period between 2019 and 2024 has not been adopted yet. Moreover, its draft version is not available online. Moreover, there is no precise evidence on the streams of waste tires owned by individuals.

These circumstances require the application of prompt and adequate measures aimed to ensure an efficient application of current laws and regulations relevant to this issue and much better control of these streams of waste. Moreover, it is necessary to ensure that the owners of waste tires disposal sites receive proper education and guidelines about proper disposal of waste tires.

CONCLUSION

Perspectives of waste tires recycling in Serbia

Waste tires have great potentials as a recyclable material and can be used for several purposes with the aim to prevent environmental pollution and facilitate sustainable use of energy. However, it seems that the benefits of the use of this specific type of waste have not yet been fully recognised in Serbia. The number of companies involved with waste tires recycling seems to be increasing, but, at the same time there are many individuals who collect tires illegally and store/incinerate them in an inappropriate manner. That is the reason why the information about this type of waste is not completely reliable, which has negative impacts on the planning of further activities in this area.

Suggestions for improvement:

1. Investments that would increase the quantity of recyclable ELT need to be planned.
2. Incentives to factories which can use the energy of processed waste tires (in the process of energy recovery), as well as the cooperation of all sectors that are associated with the treatment of tires, in order to facilitate and improve the efficient recycling of old tires.
3. Well assessed and clearly defined limitations on the application of LCA, which depends on the economic and social situation in the country, which also depends on the efficiency of recycling of waste tires.
4. Legislatively and practically prevent illegal activities related to the treatment of ELT in order to assess the actual situation and proper treatment of this particular type of waste.
5. Policy instruments need to have an influence on choices in technological innovations and material selection that would increase the environmental quality and affect other industries, such as the case in EU.
6. Reconstruction and innovation of existing technological processes, as well as the introduction of the best available techniques and environmental management measures, must be mandatory for waste tire processing companies.
7. The possession of certified environmental management systems must be mandatory in installations dealing with the management of specific types of waste, including waste tires.
8. Increase the allocation for environmental protection, i.e. to reach the level of new EU member states from 1.5 to 2.5% of GDP per year for the Republic of Serbia; significant funds need to be invested in waste management and remediation of uncontrolled landfills.
9. Implement stricter penal policy and more intensive inspection in the management of special waste streams, including waste tires.

All the above mentioned suggestions for improving the situation of waste tire treatment should be mutually compatible, with mandatory communication and cooperation of all relevant stakeholders, which is a particular challenge in the Republic of Serbia.

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