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ANALYSIS OF RECYCLING CAR IN SERBIA AND REVIEW OF OPTIMAL TECHNOLOGY .

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Abstract. *The recycling process makes use of various methods and devices for providing the final product. These methods and devices are already used in mineral processing. Car recycling involves different procedures (manual separation, shredding and physical separation methods) which allow us to obtain the final product, floricane materials (metals, plastics, rubber, glass) suitable for the production of new material goods. Recycling is used to make economic gains, and gains in reducing pollution. The use of the recycled materials saves natural resources and energy. Recycling creates less air and water pollution than the primary production of raw materials. Recycling saves storage space, creates new jobs in companies engaged in the collection, production and distribution of secondary raw materials and saves considerable resources and the environment.*

The paper discusses the problems of recycling of motor vehicles at the end of their life cycle. It analyzes the motor vehicle recycling situation and provides an overview of optimal technologies. In recent years, in Serbia, there is a need to build a network of centers for dismantling and recycling at the end of the life cycle (ELV). The reasons for this are sustainable industries, environmental protection, harmonization of legislation with the EU, and so on. In this situation it is necessary to define the centers that have striking features of flexibility and adaptability, i.e. that are able to overcome the challenges of business during normal and emergency situations

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1 INTRODUCTION

With the start of mass production of cars and the creation of waste from vehicles that marked the end of the century, an idea occurred that certain parts of such vehicles can be reused (as spares). However, the number of these parts is so small that they appeared large dump cars. These affect the landfill environment, and, on the other hand, represent a large amount of recyclable materials that could lead to a processing technology that is re-utilized for various purposes.

So in recent years in developed countries (USA, Japan, UK.) large corporations have taken this task. One of the major contributions of this new industry is the reduction of environmental pollution. Moreover, car recycling has led to employment of a large number of workers.

These problems occur in all parts of the world; it means that they will also occur in the countries that need the companies dealing with the recycling of old cars. Thus, the problem will not surely bypass our country which means that many people will soon be employed in this industry [30, 32, 33].

Recycling of motor vehicles at the end of the life cycle (ELV), in developed countries is a regulated process that has led to the development of new industries. It has multiple effects related to environmental protection, sustainable use of natural resources, energy saving, labor intensive employment, improving economic performance and the achievement of significant profits, as well as the realization of sustainable development of the entire automobile industry. The actual condition of recycling of motor vehicles in Serbia is not even close to the situation in developed countries. To overcome this problem within the overall technological development, we have developed a model of integrated and sustainable system of ELV recycling, which is defined by a network of centers for the collection and removal, as well as the network of centers for the recycling of materials and materials obtained from waste motor vehicles. This model is made in accordance with the requirements of EU directives relating to the ELV. In this way the model is expected to offer solutions for recycling 95% by weight of ELVs till the year of 2015 and to provide for a significant employment growth in the recycling of motor vehicles [15].

Also, the model defines the impact of ELV recycling in the development of new motor vehicles, leading to the final goal in the coming decades: ELV recycling without reserve and without any waste [1]. Huge amounts of waste automobile present a major problem in all countries. It is something that our state faces, too. It is estimated that in the Republic of Serbia there is currently in use around 1.6 million cars, with an average age between 16 and 17. Serbia will soon face the problems and the amount of approximately 1.6 million tons of waste materials of various kinds, among which there are hazardous substances. Generation of automotive waste takes place successively, through the dynamics of fleet renewal and certainly generating waste in the exploitation of maintaining a car. In any case, it is a very large quantity of waste which would optimize the utilization of the need to plan.

In Serbia there is not a regulation system that would create the conditions for the development of recycling cars. One consequence of this is a slow pace of the industry development. The experience in the rest of the world shows that the recycling of materials is one of the most dynamic industries in developed countries [13].

To ensure the successful recycling of motor vehicles it is necessary to create an appropriate legal framework as well as basic infrastructure requirements, which would undoubtedly contribute to its development by attracting investment and the establishment of technological resources in accordance with the regulations. Also, the introduction of system solutions in the field of automobile recycling contributes to the renewal of the fleet and consequently reduces emissions of harmful substances, increases road safety and saves energy and raw material resources. The current situation in Serbia can be characterized as the lack of organization in the field of recycling metals with the exception of collecting and recycling its initial forms (selection, cutting and crushing). Unfortunately, all hazardous materials, plastic parts, rubber and other non-metal parts are not treated the same and are left in waste or green areas [11, 12].

2 Analysis of Relevant Materials and Method Findings

Energy consumption for production of secondary raw materials caused by the process of recycling is much smaller than that used for obtaining the material from the ore in the primary production [7], [21]. Recycling of used motor vehicles (ELV) in developed countries is very successful, especially after the introduction of Schroeder in the process of recycling of used cars. The rate of recycling in developed countries exceeds 90% of the total number of used motor vehicles. ELV Recycling helps protect the environment [6], [8]. Recycling industry as a whole is very diverse and includes a wide range of services and productive economic activity, ranging from collecting and processing, to those that provide reuse of used parts or provide new products from recycled materials [10], [12].

ELV recycling reduces the exploitation of minerals in natural environments and makes the source of raw materials to manufacture new products from recycled materials [9], [24]. Besides the economic benefits of recycling system of used motor vehicles, there is an important contribution to environment protection. The removal of environmentally harmful materials and parts, specially oils, brake fluid, antifreeze, air bags, mercury, Freon and similar substances requires a special treatment and an expertise in areas such as waste dismantling. In Germany, centers for dismantling vehicles covered by a circle whose radius is 50 kilometers. The country has about 1.4 million passenger and light commercial vehicles. The estimated number of waste generated per year is from 100.000 vehicles a year in Serbia, so that a larger number of operators are equipped for recycling. [14], [20].

A new model of recycling vehicles at the end of the life cycle involves recycling across the whole lifecycle of the vehicle. In this way it covers recycling of waste generated from production of raw materials to recycling and waste materials from motor vehicles by the end of their life cycle. This is a very important aspect of the model and design of new motor vehicles involving the use of environmentally friendly materials and their recycling. Also, special attention is paid to the energy intensity and energy efficiency, as well as to motor vehicles, and the whole cycle of production, utilization and recycling. This concept model drastically reduces the negative impact of motor vehicles on the environment, allows the use of clean and renewable energy sources, and ensures sustainable use of natural resources. Thus, recycling of ELV has a direct positive effect on the environment and the use of energy, and indeed significantly improves the objective quality of

life. On the other hand, it ensures the sustainable use of natural resources to secure a quality life for future generations, which is an essential condition for the survival of human communities [11, 12].

Recycling of used motor vehicles in the world is an efficient process by which recycling is done on more than 75% of the cars, the rate of used cars collected by 95%. In the U.S., it recycles about 11 million cars, representing $ 5 billion in revenue. Recycling of automobile industry in the United States employs more than 40,000 employees in more than 7.000 companies. In the EU, the number of recycled cars per year is reaching 9 millions, equivalent to 2.2 million tons of waste. As in the U.S., profit is largely generated through sales of used parts and metals. Based on the data of the Statistical Office, the number of used cars in Serbia is approximately about 100.000 a year.

Taking this estimate of the number of used cars in the Republic of Serbia, as well as the percentage of utilization of materials per vehicle we obtain 68 000 tons of ferrous metals, 6,000 tons of nonferrous metals, 8,000 tons of plastics and composites, 1,400 tons of fluid, 5,000 tons of tires, 3,500 tons of glass, 1,000 tons textiles, 1,000 tons of batteries, and 6100 tons of other waste from the used car. In the Republic of Serbia 14% recycling of used motor vehicles is done because the capacity for the industry is still underdeveloped. In the domestic market ELV recycling, the demand for recycled raw materials is high and the level of recycling from 14%, should increase to European levels of 75%. On this basis, the ELV recycling system, new investments are needed more than 20 million Euros in several plants with shredders and baled mobile presses, and increased network efficiency recyclers [17, 18].

3 SUMMARY OF OPTIMAL TECHNOLOGY RECYCLING CARS

Waste vehicles are vehicles for damage, wear and the like. A waste vehicle is considered hazardous because it contains materials such as antifreeze, brake fluids and oils which are among the hazardous waste. The procedure implies that firstly dismantling and separation of hazardous components are done so that the vehicle has become a non-hazardous waste and as such it is then sent for processing. There are no exact data on the quantities of waste generated by vehicles in the given year. In Serbia there are over one million vehicles whose average age is over 10 years. Collection and disposal of waste vehicles largely depends on supply and demand. Parts that have a use value are allocated to a negligible extent, expressed according to age and wear-life vehicles. The recycling cars in the world can be recycled for about 80% by weight of the car. The process of recycling vehicles is complex because of the variety of materials forming part of the car. Car of the middle class on average consists of: metals 76%, 8% plastic, rubber 4%, 6% of the fluid, 3% glass and other materials 3%, [28, 29].

We apply two-car recycling technologies which differ in the way of sorting the material making up the car. The first technology is based on optical (manual) separation, and other technology uses multiple methods (grinding, gravity separation and special methods). A third possibility is that the whole car is in one piece pressed, baled with mobile presses [30, 31].

3.1 Optical method of separation

This technology is based on the fact that the optical method, i.e. manually separated components of the car (tires, glass, plastic, etc..), and metal parts remain in the end. Then the metal parts go to press in order to reduce volume and facilitate further transport. All parts are obtained by the methods of optical finished products of (the manual) separation, and as such they undergo further processing. This technology with the dominant manual labor is expensive; it slows down the procedure of recycling.

3.2 The combined method of separation

In the combined method of separation the whole car is crushed in a special impact crusher and subject to grinding; the resulting product is still treated by some method of separation applied in the treatment of primary resources (physical and special methods of concentration). The obtained products are finished products, the combined method of separation, and as such they go for further processing.

3.3 Mobile baled bale press for passenger cars

Mobile baled press is shown in Fig. 1. The press is completely portable; it has a landing gear, manual and remote control, air compressor with air tank 120 lit., hydraulic cylinders of diameter 200 mm, (the time of the gait cycle cylinders ~ 50 s.)

Powertrain - engine hydraulic pressure 200 bar. Dimensions of presses: length ~ 13.11m, width ~ 4.1m, height ~2.45m.

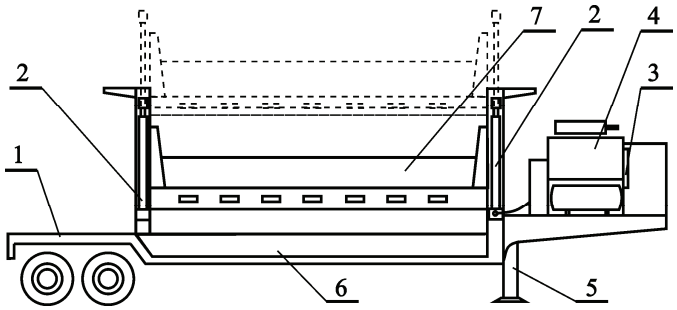


Fig. 1 Mobile baled press, 1-landing gear, 2-hydraulic cylinder, 3-control unit, 4-hydraulic power unit with the engine, 5-stabilizer, 6-bottom presses, 7-compression plate.

4 TECHNOLOGY RECYCLING WASTE TIRES

The market in the Republic of Serbia covers about 1.4 million pieces of new tires a year; the estimates are that it comes up with about 18.000 t (tons), of waste tires. One of the quantities is derived from domestic production and imports. It is estimated that the existing quantity of waste tires in the Republic of Serbia amounts to about 50.000 t, taking into account only dump of more than 500 tons. In the following year it is expected to increase to about 26.000 t of waste tires for the new Law on traffic safety. It is estimated

that, by 2014, the problem of the existing quantity of waste tires is to be solved. Legally organized collection and ultimate disposal for energy purposes (co-incineration), dealing with the cement, are licensed to use a maximum of 15.000t per year. There is also an organized collection and export of rubber chips generated in the process of retreating old tires. In the Republic of Serbia there exists installed capacity for recycling waste tires of different sizes that are currently at a level of around 18.000 t per year [3], [28].

In accordance with a prescribed hierarchy of waste tires provided for the ratio of (70:30)% in 2010. year, respectively (80:20)% from 2011, which refers to the preference of recycling in relation to their use for energy purposes. For the past 15 years, almost 3 times less rubber is deposited, a recycling rate has increased by as much as 4 times. Recycling of waste tires receives 60% recycled rubber, 35% steel wire cloth and 5% without adverse effects on the environment [12]. The following methods of recycling rubber waste are frequently used:

4.1 Cryogenic recycling process

In "cryogenic" process, the waste tire is cooled below the so-called "glass transition temperature" and is therefore a process called "cryogenic". At this temperature, the rubber becomes brittle and is easily crushed. The first stage in a process of cryogenic grinding the cutters, then rubber waste goes into the tunnel for cooling in liquid nitrogen to -120 °C and then is subject to the hammer crusher with a large number of revolutions. After hammer-grinding, the material goes to the secondary grinding to produce fine granules. The advantage of this type of fragmentation is less power consumption, smaller devices for chopping and easier separation of steel and fiber from the rubber, which gives results in a cleaner final product. The advantage of the cryogenic process is less polluting. The disadvantages are the additional costs for preparing and handling of liquid nitrogen, and the impossibility of obtaining larger rubber granules. Rubber granules in the form of threads and granules of different particle size distribution are very widely used in infrastructure, agriculture, construction and industry. They can be applied as additives to asphalt, coating surfaces and sports fields to play in the parks, as a base for roads in wet and contaminated areas, as well as friction materials for brake systems, the production range of rubber products for the household, as a raw material for producing new tires, etc.. Steel and textiles are also recycled into different products [29, 30].

4.2 Recycling of environmental action

In the "ambience", the fragmentation process is performed at room temperature and hence the term "ambience". The first stage of grinding takes place in shredders or cutters in the second stage of secondary granules and rapid rotary mills in several stages in order to obtain finer granules, which are more in demand in the market. The process of fragmentation leads to the liberation of steel and textiles. Separation of steel is achieved mainly by using a magnetic strip, separation of textiles using vibrating screens and air classifiers. The separation of pure rubber granules is achieved by using a vibrating screen.

The process is 100% environmentally friendly, i.e. it has no adverse impact on the environment. In this recycling process there is no further waste substance produced, everything is usable, and it is extremely important that there is no accompanying environmental pollution - of air, water or soil. Studies have shown that the mechanical recycling process

is much better for the environment and the nature of combustion for energy purposes. It is through the recycling of rubber granules, which enters the cycle of re-use, that natural resources are preserved. Solving the problem of accumulated waste tires is at the same time an environmental, energy and economic viability. Fig. 2 gives a technological tire recycling scheme. Fig. 3 presents data extraction machines for wire while Fig. 4 shows the machine to cut tires - Schreder [26, 27].

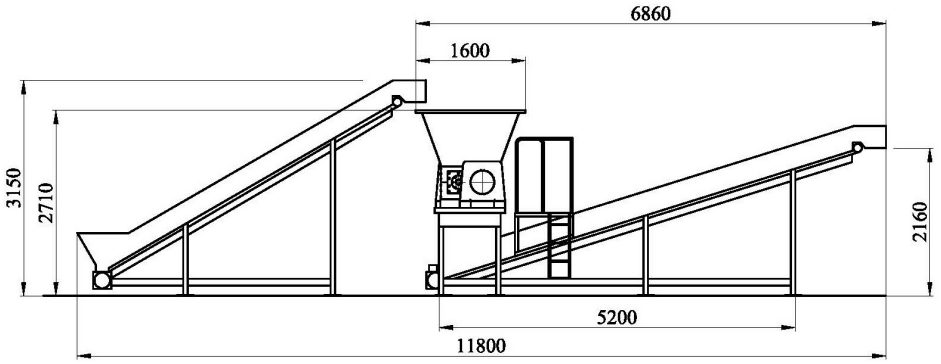
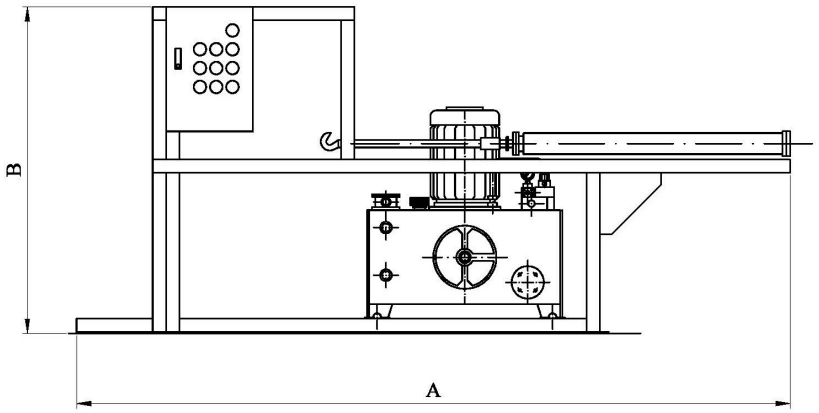
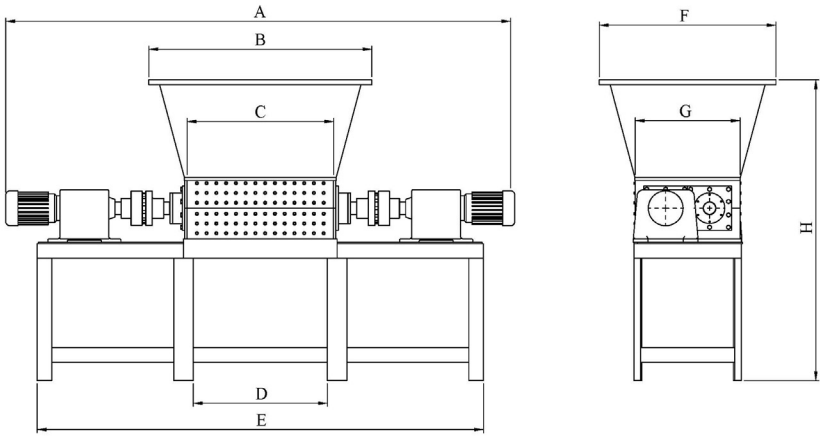


Fig. 2 Technological scheme of recycling automobile tires using the Schreder



Model no.	PTH-1200	PTH 800
Maximum pressure (MPa)	15	15
Maximum tire diameter (mm)	1200	800
Capacity (pcs / h)	15	60
Engine power (kW)	18.5	11
Weight (kg)	2500	2300

Fig. 3 Machine for removing wires from tires



Model	PT 7.5	PT 22	PT 37	PT 45
Engine power (kW)	7.5 + 7.5	22 + 22	37 + 37	45 + 45
Total weight (kg)	3.000	6.300	12.500	13.700
Capacity (kg / h)	500	1.200	2.000	2.500

Fig. 4 Schreder - cutting machine tires

Feedstock consists of passenger tires, delivery, freight, labor and similar vehicles of expired service life due to wear or damage; they can no longer be used for the purpose they are intended for. Tires of the working machines whose dimensions are larger than the above can also be processed but it is necessary to pre-cut them.

4.3 Products of the recycling process

The primary product of the recycling process is a rubber granule, so this process is often called a granulation process. The standard size of granules ranges from 1 mm to 4 mm. Granule size is determined by settings on the equipment and it is possible to produce granules of different sizes than the above. Purity of the obtained granules is 99.9%, i.e. the rubber granulate obtained is 99.9% cleared of liberated steel and textiles. The mass of the obtained granules is (55 to 65)% of the mass entrance of tires.

Secondary product of this process is a steel wire which makes (25 to 30)% by weight of the tire. Separation takes place by a magnet which separates short pieces of wire that are caused by cutting and further fragmentation of the tire during the process.

The third product of the process of the textile fibers comprises about 10% by weight of the tire. Separation of textile fibers is performed using a powerful hood. Filtration of air aspiration system is derived from the bag filter and subsystem for self-cleaning filter and the quality of the air is discharged into the atmosphere (10 mg/m^3 maximum dust) in accordance with the current EU regulations.

Tire granulation process is mechanical processing - cutting. The process assumes that several stages of cutting are performed, i.e. cutting which is the beginning of the tire gradually decreasing (chopped) to the size of granules. Steel wire and textiles forming part of the tire are also fragmented in the process and separated from each other and from the primary product (rubber granules). Separation of components is done by magnets and the effect of the influence of air currents.

The main and virtually the only energy source that this process uses is electricity. Moreover, the process is performed without using any chemical reagents or thermal reaction, so there are no unwanted by-products of such processing. To put it simply, the tire is separated into its component parts (rubber, steel and textiles) without affecting the physical and chemical properties of the constituent elements [30, 31].

5. Results and Discussion

Recycling of motor vehicles at the end of their life cycle in Serbia is still at an early stage. It does not engage a significant number of workers. The research within the project of technological development is defined by a model of integrated and sustainable recycling of motor vehicles at the end of the life cycle of Serbia [15]. In this way they set fundamentals for developing new industries, and thus for creating real conditions for the intensive recruitment of recycling business. These operations include the collection and transport of waste motor vehicles, their removal, the selection of components and materials, recovery of components for reuse, crushing shells and chassis, material separation, recycling of materials, final disposal of waste. All this requires a different structure of professional personnel, various recycling technologies and different composition of objects and the appropriate requirements for their location [1, 2].

The basic principle is to minimize waste in all life stages of the vehicle. During the period of research and development installation of the basic requirements of "green" materials that are completely recyclable, easy to disassemble, use of alternative facilities, the maximum reduction of waste, sustainable recycling, repair and reuse of parts and components and aggregates. The integrity of recycling is reflected in the development of a complete infrastructure in the country, for the full and complex recycling of motor vehicles at the end of the life cycle [13].

The originality of the project of an integrated recycling system of motor vehicles at the end of the life cycle is reflected in the development of the first national information system based on WEB technology-base, which aims to record and monitor the motor vehicle during the entire life cycle of the momentum out of the vehicle. Serbia has so far not joined any systemic solution to the problem of environmental and social, economic problems, even when it comes to preserving the natural resources of our country. The project objective is to launch a potential disposal of motor vehicles in Serbia that can be recycled or used for energy. The most important thing is to determine the scope and structure of the permanent disposal of motor vehicles in Serbia, especially hazardous wastes as well as to propose measures for their removal and safe storage [15, 16, 17].

Project [15] is intended to form the corresponding centers dismantling of used motor vehicles in the respective regions. The partner on this project is the factory Zastava Automobili, which provides data on the number of cars to be recorded as appropriate of Zastava models that are at the moment on the market. At the same time it gives the flag and instructions on how to make dismantling easier for vehicles belonging to their program. The importance of the project for Serbia is great because our country is quite deficient in terms of resources. If we know now that about 120 thousand cars a year are out of use and thus ready for the recycling process, the weight of each vehicle is over 1 tons, of which approximately 70% are ferrous-magnetic materials, there are non-ferrous metals, plastics, rubber; we can not imagine how it is stored resources.

In the process of the development of science and technology, man has created for its own purposes a large number of materials of complex chemical composition. Such materials, due to their complexity, can degrade naturally or during their decomposition can be considered infinite. Depositing such material on groomed or wild landfill causes environmental pollution. The recycling of these materials, in addition to economic benefits, protects the environment, resulting in a higher quality and healthier life. Obtaining metals from recycling leads to energy savings. Electrical are as follows: steel 74%, 95% of aluminum, copper 85%, 65% lead. Obtaining metals recycling reduces water consumption by 40%, reduces water pollution by 76% and 86% air.

In developed countries (35 to 45)% of steel is obtained by recycling [31]. Recycling is the future to solve the problem of waste motor vehicles, in terms of sustainable development. A clear example that proves the previous statement is given in Table 1 [30]:

Table 1 Saving energy by using recycled materials

Materials	(%)
Copper	85
Lead	65
Zinc	60
Aluminum	95
Iron and steel	74
Magnesium	98
Titanium	58
Paper	64
Plastic	80

As shown in Table 1, the energy savings by using recycled materials is very important. Investment costs for construction of waste processing and metal production are only (16 to 20)% of the cost required for construction of a primary processing of raw materials - minerals. In addition, production technology based on the processing of secondary metals is much easier and more acceptable for the environment, which is the example of iron and steel clearly evident in Table 2.

Table 2 The benefits of using iron and steel from waste materials

Benefits	(%)
Energy savings	74
Saving material from ore	90
Reducing air pollution	86
Reduction of water consumption	40
The reduction of water pollution	76
Reduction of mining waste (tailings)	97

Due to the complex composition of the car, recycling it successfully is possible only with the proper treatment of all parts and components that make it up. The technology of processing of these materials is complex but the economy and the environment justify the means and effort. Due to these factors, in the future there will be expansion and development of recycling technologies, both worldwide and in our country.

6 CONCLUSION

Recycling of motor vehicles at the end of the life cycle of the proposed model is based on the principles of sustainable development [15]. The establishment of this model in Serbia, in addition to environmental and economic effects should provide for a high level of employment, which is very important for social policy of the state. Thus the number of employees in the entire cycle of recycling vehicles at the end of the life cycle ranges from 6.000 to 20.000 employees. Number of employees varies as a function of:

- the available number of ELV in the current year,
- the degree of recyclability,
- level of dismantling motor vehicles,
- recycling of existing technologies,
- production of new products from materials provided by the ELV.

Of course that includes as a factor in employment gross national income per capita, because of the wealth of the country or the population depending on the size of the fleet, and therefore, on the number of motor vehicles at the end of the life cycle in one year. In addition, the state remains the recycling of motor vehicles in order to develop fully and in accordance with the proposed model a new profitable industry [1], [25].

The Republic of Serbia also faces the problem of used motor vehicles. For now, their recycling is done sporadically and in the way which is very disorganized and incidental to the environment. The way to overcome this situation is to adopt adequate legislation and implementation of integrated models and sustainable recycling of motor vehicles at the end of its life cycle. The introduction of order into this area, in addition to improving the quality of the environment, and to accomplishing other important effects for the country [13] means to:

- meet international regulations for the export of motor vehicles,
- achieve economic gains using the proposed model for recycling,
- provide for high quality raw materials through recycling of used motor vehicles,
- minimize permanent, above all, hazardous waste, and,
- develop motor vehicle recycling industry and job creation.

Each of the used motor vehicles poses a major problem for the environment regarding the volume of waste and hazardous substances and their number. That is the main reason why the developed countries make and implement adequate legal solutions to run an organized recycling of motor vehicles at the end of its life cycle. Moreover, it is necessary to develop models for managing waste resulting from motor vehicle during the entire life cycle, which are based on the principles of sustainable development. In this way, we can minimize waste and maximize recycling of materials and reuse of parts, assemblies and aggregates [11, 12].

It is planned to establish operators on the territory of Serbia; the citizens can submit their old cars at the nearest recycling center and for this they will be given certificates that imply some benefits for the purchase of new cars. Thus, the action will involve all those who are engaged in recycling of batteries, processing of waste oil, antifreeze, glass, plastic and anything else that makes a car; it is necessary to invest a total of over 20 million Euros. [20], [22, 23].

Consumption of metals and energy in the world is on the rise. The reserves are rapidly being spent. Scrap Metal is a very important secondary resource, whose capture and return to the process of re-processing significantly reduces the consumption of primary raw materials, extends the life of their reserves and reduces environmental pollution. The re-use of metals from waste and the general re-use of other materials is of great economic justification.

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ANALIZA RECIKLIRANIH KOLA U SRBIJI I PREGLED OPTIMALNE TEHNOLOGIJE

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U procesu recikliranja se koriste razne metode i uređaji za obezbeđivanje završnog proizvoda. Te metode i uređaji se već koriste u obradi minerala. Reciklirana kola sadrže različite postupke (ručno odvajanje, pulverizacija i metode fizičkog odvajanja) koji omogućavaju dobijanje završnog proizvoda, florikanskih materijala (metale, plastike, gumu, staklo) pogodnih za proizvodnju novih materijalnih proizvoda. Reciklaža se vrši radi ekonomskih dobitaka kao i dobitaka u smanjenju zagađenja. Korišćenje recikliranog radi očuvanja prirodnih resursa i uštede energije. Reciklaža stvara manje zagađenja vode i vazduha nego primarna proizvodnja sirovina. Reciklaža štedi magacinski prostor, stvara nove poslove u kompanijama angažovanim na prikupljanju, proizvodnji i distribuciji sekundarnih sirovina uz uštede značajnih resursa i sredine. U ovom radu se razmatraju problemi reciklaže motornih vozila. On daje pregled optimalnih tehnologija. Poslednjih godina u Srbiji se javlja potreba za izgradnju mreže centara za demontiranje i reciklažu na kraju veka trajanja (ELV). Razlozi za to su održive industrije, zaštita životne sredine i usklađivanje sa zakonima EU i tako dalje. U toj situaciji je neophodno definisati centre koji imaju značajne odlike fleksibilnosti i adaptabilnosti, to jest, koji su sposobni da prevaziđu izazove biznisa u normalnim i urgentnim situacijama.

Ključne reči: *reciklaža, automobilska, otimalna tehnologija, analiza situacije*