

Problems connected with environment – friendly recycling of end-of-life vehicles

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Summary: The study presented in the paper concerns different aspects of car recycling in Poland. The main problems of development of the recycling network are identified. Different scenarios, which are characterized in detail to define changes in the number of cars recycled in Poland in the future, and environmental consequences of these scenarios, are analyzed. The main environmental impacts are classified in three general categories: human health, ecosystem quality, resources. Consequences of the average car recycling in Polish conditions are defined and potential improvements are suggested. Results illustrate the scale of environmental consequences of car recycling problem and they can support activities oriented towards finding the optimum environmental solution. Obtained results of detailed calculations are presented. They confirm that LCA tools may be helpful in evaluation of environmental consequences of end-of-life processes.

Key words: recycling, end-of-life vehicle, waste management, scenarios

1. Introduction

The motor vehicles, as technical objects consisting of various materials, are good example of mass products, which became inseparable component of contemporary human's life. In many cases negative effects accompany their entire life cycle. That is why transportation is an example of human activity, which is identified with the special degradation of natural environment. Recycling may be one of the possibilities of significantly diminishing destructive human activities in transportation sector.

Conditions specific for different fields of industrial processes, services and other areas of human activities promote or hinder implementation of different sustainable solutions. In developed countries a lot of attention was paid to waste management and recycling standards became the essential criteria for assessment in market economy. Thus recycling process is shown there as problem demanding combination of environmental, technical, economical and legal undertakings.

Now it is common knowledge through entrepreneurs that waste management demands taking into consideration not only economical but also legal, technical and environmental aspects. There is also known, that even the most valuable factors cannot cover ecological effects. Thus, the problems of car recycling become more and more perceived in Poland. But in spite of the fact, that regulations of directive 2000/53/EC are implemented into Polish law system, lack of unified system of car recycling, loopholes, lack of outside financing system, not too big number of well-equipped recycling stations and „twilight zone” effectively restrict development of recycling system and limit possibilities of significant improvements of this situation.

2. Recycling system in Poland

At present recycling system in Poland is composed of several industrial plants which are owners of car's shredders, close to one thousand legal disassembly stations and more then several hundred points of collecting end-of-life vehicles [1]. So, it should be not a problem to utilize wastes from every imported out-of-use vehicle. But there are some factors which hinder development of recycling system in Poland. The first problem is lack of shredders in some parts of Poland, e.g. in Eastern part of Poland.

In order to show the second problem, it is necessary to notice, that there was lack of legal regulations in Poland not to long ago. There were some acts concerning ways of deal with wastes, but there was not one document, which would describe a uniform way to proceed with out-of-use cars. Besides, one of currently been in force acts from 1st January of 2002, has admitted possibility of scrap incomplete vehicles. As a result, many scrapped cars were devoid of the most of valuable parts. According to estimation of Ambit Recycling System – one of the biggest recycling networks in Poland, more than 50% of end-of-life vehicles

delivered to recycling stations in 2004 were incomplete. So far a lot of incomplete vehicles are still delivered to disassembly station by last owners.

The biggest problem of recycling system in Poland is actual situation, in which not every out-of-use vehicles are delivered to disassembly stations and dismantled in harmony with environment. There is unquestionable fact, that many vehicles are dismantled in own range. But much more these ones are also dismantled by enterprises, which are not entitled to run a business connected with waste transformation. That is why „twilight zone” of this branch was developing just as quickly as legal recycling network. As a result there are a lot of illegal „recycling” enterprises, which intercept most of cars withdrawn from exploitation.

Each from above-mentioned reasons had serious influence on limited development of official recycling network, and all of them have been affected to current condition of recycling system in Poland. In the further part of the paper economical, logistic and legal conditions will be reviewed as a source of the data about actual situation and probable changes.

3. Scenarios

At present, there are some ideas of significant improvements of the recycling situation in Poland, which make up base to build possible event scenarios [1]. For requirements of these analyzes, there was assumption that more than 600 thousand end-of-life vehicles should be withdrawn from use, but nobody should believe, that all of them will be delivered to legal recycling network. Different scenarios are characterized in detail to define changes in the number of cars recycled in Poland in the future.

First scenario of policy concerning recycling issues in Poland is reflection of actual situation, that is only the twenty-five percent of total amount out-of-use vehicles will be recycled.

This scenario assumes:

- lack of unified approach to problems of cars recycling;
- lack of outside source of financing of recycling network;
- no change with reference to authorized recycling network (insufficient number of cars destined to recycling; poor condition of authorized stations, lack of possibilities of development);
- lack of last owner motivation (out-of-use vehicles might be left out or delivered to illegal „twilight zone”);
- quick development and increase of number of illegal „recycling stations”.

Second scenario assumes implementation of directive 2000/53/EC into Polish law system but in case of imprecise regulations on national ground, number of recycled cars should increase, but probably not too much. So, second scenario assumes some changes of law but lack of executive regulations, and in consequence:

- lack of sanctions for organizations omitted environmental regulations, what might lead to development of „twilight zone”;

- lack of outside financing of recycling network by necessity of bearing big investments in connection with the adaptation of disassembly stations to Directive requirements at the same time (limited possibilities of development for official recycling stations because of bigger and bigger investments);
- in extreme cases decreasing number of authorized disassembly station and increasing average distance between stations.

In second scenario, it is assumed insignificant increase of number of car recycled by legal network – 33% from all out-of-use vehicles.

Third scenario assumes implementation of directive 2000/53/EC into Polish law system as well as introduction of returnable deposit payment in order to motivate last owner to pass his end-of-life vehicle to recycling station. Last owner would win back the deposit payment, only after shown destruction certificate. Such source of financing gives some possibilities and financial standing of recycling network should be improved. So, third scenario assumes increase number of recycled cars up to 50% percent of total amount out-of-use vehicles, thanks to motivation of last owner to recover money, and in consequence limitation of „twilight zone” activity.

The biggest number of recycled cars, seventy five percent of total amount, is assumed in *fourth scenario*. Introduction of product payment and recycling payment, should involve producers and importers to organization recycling network. They could be supported for recycling stations and the cooperation between all entities could bring the best effects.

This scenario assumes:

- non-returnable product-payment concerns producer of cars, who do not achieve required recycling index;
- non-returnable recycling-payment concerns importers of cars;
- far more possibilities of financing of legal recycling stations (quick development of authorized recycling network);
- the biggest possibilities to limit the range of „twilight zone” activity.

It is assumed that the significant increase of number of recycled cars will occur in authorized network – 75% from all out-of-use vehicles in the fourth scenario.

4. The base of research

All these individual scenarios were characterized in detail to precise quantity of car recycled in future, according to estimate, supposing that 607 thousands cars will be withdrawn from exploitation (Fig. 1).

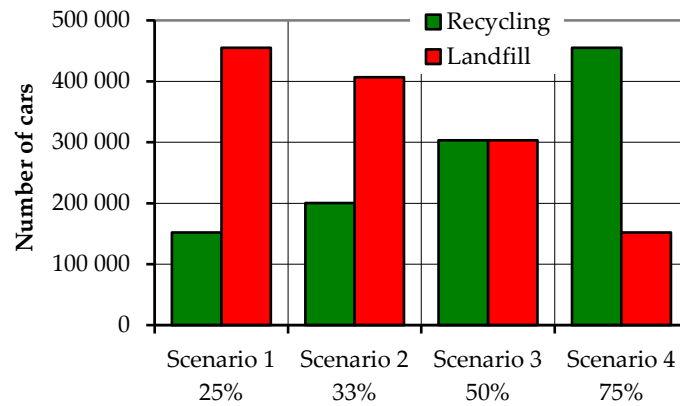


Fig. 1. Estimated number of recycled cars for different scenarios

The base of analysis is the car withdrawn from exploitation and average amount of materials, which is possible to gain from one end-of-life vehicle in Polish conditions. To the needs of analysis it is assumption that wastes possible to gain from the cars, which will not be delivered to official recycling network, will be treated as wastes stored on landfill site. In order to define the size of environmental consequences of scenarios and realized policy, number of cars recycled in Poland and the quantities of different materials obtained from out-of-use cars, were based on calculation. Ecological analysis of recycling processes was made on the base of Life Cycle Assessment method. The environmental consequences were studied using appropriate software.

5. Environmental aspects of realized policy

The results of detailed calculation expressed as environmental consequences are presented in the next figures. Figure 2 shows the comparison of total environmental indices.

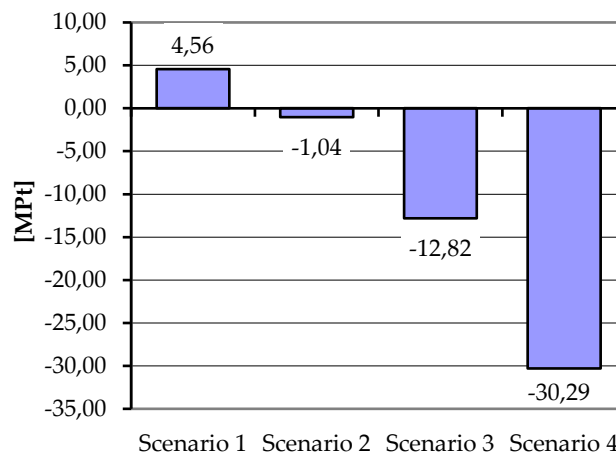


Fig. 2. Environmental indicators compared as the results of realize processes of recycling

As one can see in the (Fig. 2), from analyzed scenarios only completion of the first scenario causes negative impact. Realization of other analyzed scenarios is characterized by positive effects in environment. It is worth pointing out that

environmental benefits from realization of the fourth scenario are nearly thirty times more than in case of second scenario. Results expressed in the three main impact categories are presented in the (Fig. 3).

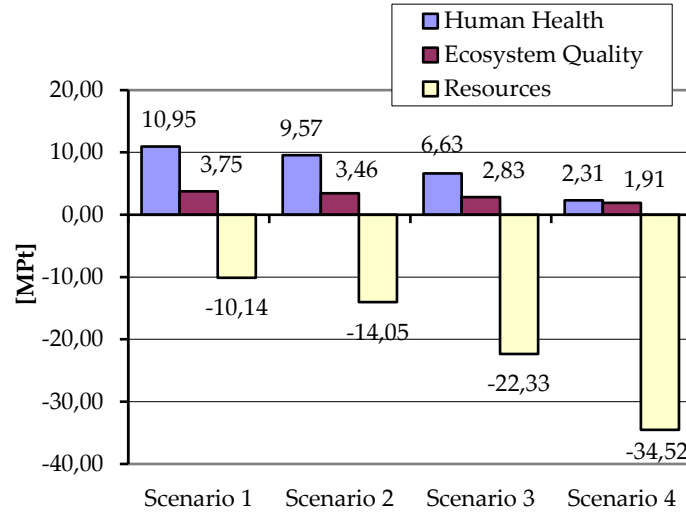


Fig. 3. Environmental impacts of analyzed recycling scenarios - 3 impact categories

They show that impacts connected with categories of human health and ecosystem quality cause the negative influence on environment, while impacts related to category of resources are characterized by positive effects in every scenario. Environmental impacts gathered in 11 impact categories are presented in the (Fig. 4).

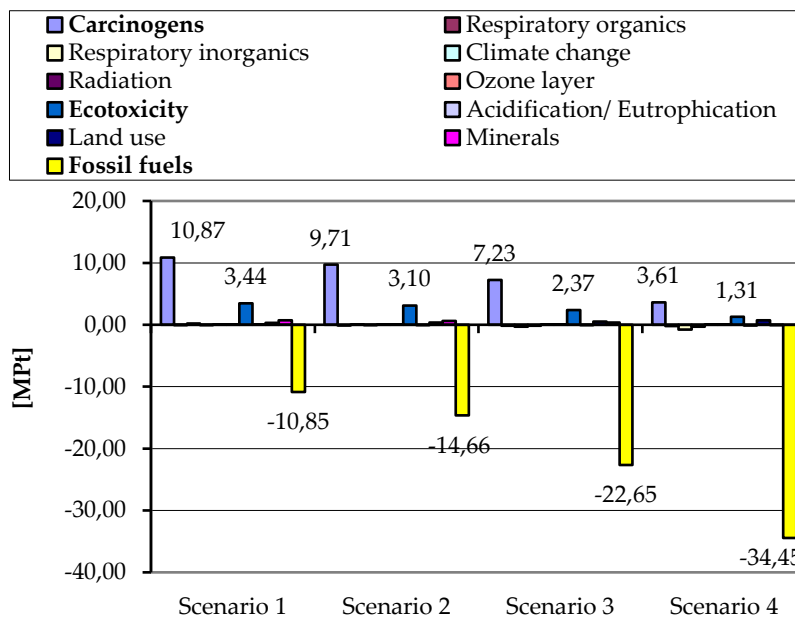


Fig. 4. Environmental impacts of analyzed recycling scenarios – 11 impact categories

The biggest influence onto human health is caused by carcinogens. Irrespective of scenario, carcinogens impacts are characterized by negative factors. In case of categories: respiratory organics and climate change, there are impacts identified as environmental benefits in all analyzed scenarios. Unfortunately the size of these impacts is significantly less and impossible to balance negative influence carcinogens onto human health. Impacts connected with ecotoxicity and land use are dominating categories in terms of influence on ecosystem quality. The main benefits of recycling are connected with impact category of fossil fuels.

6. Conclusions

On the basis of presented results one can say that environmental benefits from recycling can be significant and recycling of vehicles may be effective way to restrict destructive human activity in transportation sphere. Thanks to use LCA method to evaluate consequences of car recycling in Poland, it was possible to show the scale of environmental problems of improper proceeding with end-of-life vehicles. The analysis of above gathered materials made possible to notice potential improvements of recycling network in Polish conditions. So, organizing the efficient system of waste collection and recycling network should contribute to reduce the scale of negative environmental impacts.

Bibliography

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