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INTERNATIONAL APPROACH OF SCRAPPING PROGRAMS

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Abstract: The concept of sustainable development means all forms and methods of socio-economic development, whose basic is to establish a balance between the socio-economic systems and the elements of natural capital. One of the general objectives of the EU Sustainable Development Strategy is to prevent climate change from limiting emissions of greenhouse gases and their negative effects upon society and the environment. In automotive projection, Green design means vehicles that cause less damage throughout their lifetime to the environment. In order to reduce the negative impact of environmental products and industrial processes in the past years there are engineering tasks referring to development of targeted strategies on the process, and recently the product strategies imply, studying product throughout its life cycle, from design to disposal - end of life vehicle. The "Cash for Clunkers" is a government funded program to promote the replacement of old vehicles with modern ones. Scrappage schemes have generally dual purpose: to stimulate the automotive industry and to eliminate the inefficient road vehicles with high emissions of pollutants.

Keywords: scrapping program, non-polluting vehicles, recycling and recovery of materials

1. INTRODUCTION: LEGISLATION ABOUT DISPOSAL OF END OF LIFE VEHICLE (ELV)

Environmental concept should not be confused with that of nature, which is earlier and has a different content. Environment is a combination of natural elements, dynamically interrelated. Lately, the term is associated to environmental pollution, which is manifested as a perpetual aggression against its integrity, the main character deleterious action exerted by humans on the environment. Fuels are a main topic concerning pollution, they are source of energy but also a source of emissions of greenhouse gases (CO₂ and NO_x). Another category of factors with negative impact on the environment and humans' life are the harmful substances and chemical products, waste, noise from cars, planes, some of the industrial warehouses.

Table 1. The admitted limits of the vehicles' pollutant values in Romania

Euro	Fuel	Limited values, [g/km]					Available since:
		CO	HC	NO _x	HC+NO _x	Particles	
Euro-1	Gasoline	2.72	-	-	0.97	-	31.12.1992
	Diesel	2.72	-	-	0.97	0.14	
Euro-2	Gasoline	2.02	-	-	0.5	-	01.01.1997
	Diesel	1.0	-	-	0.7	0.08	
Euro-3	Gasoline	2.3	0.2	0.15	-	-	01.01.2001
	Diesel	0.64	-	0.5	0.56	0.05	
Euro-4	Gasoline	1.0	0.1	0.08	-	-	01.01.2006
	Diesel	0.5	-	0.25	0.3	0.025	
Euro-5	Gasoline	0.8	0.07	0.06	-	-	01.01.2009
	Diesel	0.4	-	0.2	0.25	0.02	
Euro 6*	Gasoline	0.8	0.07	0.05	-	-	01.09.2014
	Diesel	0.4	-	0.08	0.17	0.0025	

*All diesel-powered vehicles will be required to significantly reduce emissions of nitrogen oxides with the entry into force of Euro 6. For example, emissions from cars and other vehicles for the transport will be limited to 80 mg / km (i.e., a reduction of more than 50% of the Euro 5). The combined emissions of hydrocarbons and nitrogen oxides from diesel vehicles will also be reduced, in order to be limited, e.g. to 170 mg / km in terms of machinery and other vehicles for transport.

Human activity generates numerous emissions of gaseous pollutants in the atmosphere, a large number of vehicles emitting pollutants, international studies enabling quantification of pollutants emitted by road traffic. The vehicle is a factor with an aggressive nuisance, especially in urban

areas, where it has about 60% share of pollutant emissions [2]. Green design vehicles has to use less polluting materials, to choose materials that can be recycled in a very short time, to eliminate non-recyclable or difficult to recycle materials and to reduce the amount of waste products. These strategies have brought about the design of vehicles whose influences on the environment have been reduced. The life cycle of a vehicle is the initial step in accomplishing materials processing by-products / semi-continuous components, followed by assembly and packaging of the final product. Following the sale of the vehicle, it enters stage use. After completing the period of use to get to the last stage - the decommissioning where the vehicle is directed to phase reuse, recycling, waste processing etc.

2. GUIDELINES

Due to the risks posed by various pollutants on human health, on fauna and flora were adopted national and international regulations specifying breakpoints pollutants.

Pollutants resulting from the combustion of fossil fuels in the internal combustion engine are diversified and have a different genesis mechanism, depending on the category of fuel. In Romania there are limits on the values admitted polluting vehicles - Table 1. Despite the lack of a national program for monitoring the concentration of pollutants in urban environments and a set of systematic measures, progressive training and equipping the national fleet to transition to an environmentally friendly traffic, the legislative proposal is extremely ambitious. [3, 4]

In the recent years vehicle manufacturers increasingly focus on reducing consumption and achieve the economic and ecological cars. It's not just about the engine, but also about other components of a modern car parts that can help achieve fuel economy and reduce environmental pollution. End of life vehicles Directive is addressed to auto products reached "end of life". Every year, old cars generate between 8 and 9 million tons of waste in the European Union.

The concept of prevention is based on four pillars. Firstly, the objective is to reduce hazardous substances in the manufacture of vehicles to minimize their release into the environment. Secondly, the vehicles should be designed to facilitate the removal and to allow the re-use of corresponding components, recycling and/or recovery of the material. Thirdly, producers (both vehicles and components) must increase the demand for recycled materials. Finally, some materials (lead, mercury, cadmium, hexavalent chromium) are prohibited, except for some with a specific term of skipping them.

Recycling vehicles emerged as one of the possibilities to limit waste and to use resources more efficiently. In order to ensure maintaining the car as a means of sustainable transport in the twenty-first century, it is necessary to act increasingly in reducing both environmental impact throughout its lifetime and after. The automotive recycling has not been addressed only as a phenomenon that occurs after disposal of the vehicle, but was foreshadowed in the design and use. The life cycle of a car includes many other important industries: the electronics industry, oil, steel, aluminum, synthetic fibers and glass.

The "Cash for Clunkers" is a government funded program to promote the replacement of old vehicles with modern vehicles. Scrapage programs have generally dual purpose: to stimulate the automotive industry and to eliminate the inefficient road vehicles with high emissions of pollutants. Many European countries have introduced large-scale scrapage programs to stimulate economic growth and demand in the industrial sector during the global recession that began in 2008.

Aspects of end of life vehicles began to be investigated thoroughly by the European Commission in the second half of 90', first through a series of studies [4], which showed both the size of the phenomenon (the number of vehicles scrapped in 15 EU states at that time being about 9 million per year) and that it is necessary to create a uniform and coherent legislation in the Member States. This legislation should provide performance criteria for ELV treatment, safe for the environment and human health, and achieve a high degree of reuse, recycling and energy recovery of materials

and components from dismantling of end of life vehicles. In addition, in order to facilitate the management of the ELV had to include those related to the manufacture of new vehicles, in particular with regard to the required encoding of the plastic components in order to facilitate the dismantling and restricting the use of heavy metals in the manufacture of vehicles.

The program aims to achieve the following environmental interest:

- a. reduction air pollution effects on the environment and human health caused by exhaust emissions from old vehicles;
- b. mitigation of soil and water pollution caused by leakage of hazardous substances from wasteful vehicles;
- c. prevention of generating waste and the waste recovery from scrapped vehicles.

Scrappage programs have different names, most referring to the benefit they bring to the environment. In the 1990s, many countries have introduced favorable tax schemes (subsidy) for new cars that meet modern emission standard, but with the Kyoto Protocol, some countries have made the public offer depend on scrapping old cars.

3. APPROACHING OF SCRAPPING PROGRAMS WORLDWIDE

3.1. Austria

The scrapping program of Austria was introduced on 1 April 2009 and allowed customers to receive 1,500€ in cash if the car was older than 13 years and the new car met Euro-4 emission criteria. There was a limit of 30,000 cars that could be sold by December 2009. A boost has been given to the new cars has been given after the government scrapping scheme cars. Statistik Austria reported that new car registrations increased by 4% in June 2009 compared with the same month of 2008. Despite the decrease in sales of 0.4 percent, Volkswagen models were the most popular in the first six months, with a market share of 20.3. Sales of Audi, Mercedes, Renault, BMW and Fiat rose in the first half of the year, while sales of Mazda, Opel, Peugeot and Ford declined. Economy Minister Reinhold Mitterlehner welcomed the scrapping program and ranked it as a success. The Minister said that the program helped suppliers and car distributors, has saved many jobs and "was especially friendly to the environment". The 1,500 € bonus for the old vehicle's removal could be returned with a request to the Ministry of Finance. [5]

3.2. Canada

The Retire Your Ride program, administered by the Government of Canada, allows residents of Canada to trade in a vehicle made in 1995 or earlier for a wide range of rewards, such as a public transit pass or 300 C\$. On January 30, 2009, Jim Prentice, Minister of Environment, encouraged Canadians to take advantage of the new National Program "Retire Your Ride" issued by the Clean Air Foundation, a non-profit organization, with support from the Government of Canada. The program provides incentives for Canadians, which could change the old and highly polluting cars and also promote, sustainable transportation that reduce air pollution and emissions of greenhouse gases that accelerate climate change. The incentives include cuts in public transportation passes, bicycles, or 300 C\$ in cash.

"The Government of Canada remains committed to reducing air pollution and emissions of greenhouse gases to protect the health of Canadians and the environment." Government has ensured the providing the 92 million \$ to fund the program until 31 March 2011. As part of the Government's commitment to raise environmental standards, the program also included a National Code of Practice for recycling cars.

The bigger the program grew, the new partners joined to provide incentives. Since October 13, 2010, Retire Your Tire withdrew more than 101,000 vehicles, achieving the second goal took place six months earlier, ending in late May 2011. Over 350 recycling companies were involved and participated in the National Code of Good practice. National Code of Practice provides the best environmental practices for auto recycling industry - including the removal of hazardous materials (mercury, batteries, etc), removing engine parts resale (non - engine related) and how to avoid

from harmful leaks to the environment. This thing produced expanded capacity in the automotive recycling practices.

The program ended in March 2011. By January 2011, the program has exceeded its original objectives and finally withdrawn over 120,000 vehicles and have been reduced by thousands of tons of greenhouse gases. The program has been available in all provinces of Canada. Some car manufacturers have started their own programs for old cars, with enhanced facilities for shoppers in an overall effort to encourage sales of new vehicles in Canada. Rewarding people and promote cleaner alternatives have resulted in cleaner air and a healthier environment. The vehicles traded in this program have been recycled in an environmentally friendly way. [6]

3.3. *China*

In June 2009, a nationwide scrappage program was implemented offering discounts between 450 and 900 USD for trading old cars and trucks, heavy polluting for the new ones, program being carried out by 31 May 2010. The target of the program was to substitute 2,700,000 heavily polluting cars fleet nationwide.

Eligible vehicles included cars and trucks that did not meet the emissions standards imposed by the state. Government in Shanghai offered incentives 450 to 1.100\$ per vehicle for its residents who trade older vehicles, allowing the total grant to grow up to 2,000\$. After the success was limited in the first months, the government raised the compensation to 5000-18000 yuan, or about U.S. 732-2632 \$ for each qualified vehicle in late 2009. In June 2010 the program was announced to be extended by the end of 2010. [6]

3.4. *France*

As part of the French economic recovery plan in December 2008, France introduced a car scrappage scheme. According to the Ministry of Recovery the scheme intended:

- a) to support the activity of the automobile sector,
- b) to support the purchasing power of the consumers who are willing to buy a car,
- c) to be supportive of the environment.

A less generous scheme in France, worth 1,000 € for each car, has also boosted sales, prompting Renault to move production of a Clio model back to France and create 400 jobs. French scrappage scheme was introduced in January 19, 2009 for cars older than 10 years. The new car had to meet a certain standard of CO₂ emissions, the scrapping incentive increased from 1,000 € for cars with emissions of 160 g, up to 5,000€ for the purchase of cars with lower emissions of 60g/km or electric cars. French automobile manufacturers have benefited from a new car purchase in Ireland so that those who buy a French car can avail of a grant from both the French Government and the Irish Government. [6]

3.5. *Germany*

The German scrappage scheme was the largest so far. Every owner of a car older than nine years received a 2,500 € scrappage incentive (\$ 3.320) to buy a new car. When it was introduced (13 January 2009), the program was limited to no more than 600,000 cars and a budget of 1.5 billion €. However, the automotive market has exploded with a sudden increase of 40% (March 2009 compared to March 2008). The program was too short to provide a long-term incentive. On 25 March 2009, the government decided to continue the scrappage scheme, at least until the end of year. Germany afforded the most expensive scheme of all countries, the net impact of the program on the budget was estimated at a total volume of about 7 billion \$ (5 billion €).

An empirical evaluation of the German program of accelerated scrapping of vehicles, which was implemented in January 2009 to stimulate automobile consumption, led to the conclusion that it was good for sales of small and very small cars (84% of total sales new cars registered) at the expense of larger cylinder capacity. The results suggest that the policy has been successful in creating additional demand for new cars during the implementation of the government program. There was also a small contraction in sales in the automotive market for small cars segment after

the end of program. The German program only requires ELV to be sent to Junkyards, allowing illegal exports. [6]

3.6. Greece

Greece launched in 2011 a program to dispose of old cars to support the market after a fall of new cars registrations by 37% due to the economic crisis (AFP). Owners of vehicles that could change old vehicles that purchased new ones by 20 December 2011 were free from the total or part payment of registration [10]. The amount allocated to each new vehicle was between 960-2800 €, depending on the cylindrical capacity. Car dealers have welcomed the move to revive the Greek market, affected by drastic austerity measures imposed by the government. In all, Greece registered in 2010, 153,000 new or used car, compared to 244,000 last year. According to the Federation of importers and dealers of cars, the Greek car market returned to 1990 level, and the economic crisis has cost 15,000 automotive jobs in two years. Decision granting a scrapping in a country that is not producing vehicles was for the benefit of the European automotive market.

3.7. Italy

In Italy there was a scrappage scheme from 1 January 2007 to 31 December 2008. Program beneficiaries received 700 € and a tax discount. A new scheme came into force in 2009: new cars must meet a minimum Euro 4 and maximum CO₂ emissions of 130 g / km (diesel) or 140 g / km (the other fuels). Incentive for scrapping premium was 1,500 € but may increase by another 1,500 € for a new car that runs on LPG, electricity or hydrogen, when the car was emitting 120 g / km and 3,500 € if less than 120 g / km emitting. Clunkers program ended in December 2009 with the delivery of the vehicle until March 2010. [6]

3.8. Ireland

The first Irish scrappage scheme was implemented in 1990. A second scheme was introduced in December 2009 and offered 1,500 € for cars older than 10 years. Scrapping premium may be used only if purchased cars had emitting less than 140g/km. In 2010 the amount of the disposal has been reduced to 1,250 €, taking the program ended in June 30, 2011 [6].

3.9. Japon

Japan introduced the scrappage program from April 2009 until March 31, 2010 (or until the end of budget), offering 250,000 yen (~ 2,500 U.S. \$) to change cars older than 13 years with cars "environmentally friendly", which had to meet certain criteria set by government, regarding their environment. The government also introduced a tax exemption for hybrid cars and other vehicles, including trucks with low emissions, allocating \$ 3.7 billion program. [6]

3.10. Luxembourg

In Luxembourg, a scrappage scheme was introduced in January 2009 that allows for a premium if the old car was older than 10 years and the new car to meet CO₂ < 150 g/km (1,500 €) or CO₂ < 120 g/km (2,500 €). [6]

3.11. The Netherlands

The Dutch government provides a premium of 750 € or 1,000€ in association with the car industry. The city of Amsterdam provides an additional premium of between 250 € and 1,000 €. [6]

3.12. Spain

The Spanish government is implementing in 2014 the fifth edition of efficient vehicle subsidy program (PIVE) to encourage sales of cars and light commercial vehicles. The latest version provides 175 million € (239 million\$) in incentives for purchasing energy-efficient vehicles and aims to remove about 175,000 vehicles older than 10 years for cars and older than 7 years for light commercial vehicles. Buyers benefit from 2,000 € to purchase a new car, half of the funding coming from the government and half by the car manufacturer. [7]

3.13. United Kingdom

United Kingdom introduced an incentive scheme by first scrapping in 2009. Scrapping an old car (registered on or before 31 July 1999) allowed for a 2,000 £ cash incentive - the money burden was

shared, with 1,000 £ funded by the government and 1,000 £ funded by the automobile industry. The amount of government investment was initially limited to 300 million £ in benefits to almost 300,000 customers. Many dealers took part in the program gave more than the recommended amount of 1,000 £, some 2,000 £ or even 3,000 £. Scheme in the UK was intended to provide financial support for the automotive industry. Most of the new cars included an environmental benefit, but it was considered as a secondary issue. On 28 September 2009, confirmed an additional investment from the government for cars registered before 29 February 2000. Program ended March 31, 2010.

3.14. United States of America

Cash-for-Clunkers program, officially launched on July, 2009, provided eligible consumers a \$ 3,500 \$ or 4,500 \$ rebate when trading in an old vehicle (which would then be dismantled) and purchasing or leasing a new vehicle. Originally, the program was planned as a \$1 billion program with an end date of November 1st, 2009. The funding was exhausted within a week and an additional \$2 billion was swiftly allocated to program.

At the end of the program Toyota accounted for 19.4% of sales, followed by General Motors with 17.6%, Ford 14.4%, 13.0% Honda and Nissan by 8.7%.

Department of Transportation also reported a 58% improvement in fuel efficiency of new cars purchased. [6]

3.15. Fleet renewal în România

After 1990, the national park car has increased considerably, and referring to the bus fleet in major cities only partially renewable with non-polluting vehicles, due to the high cost of procurement the local budgets have been able to cover a small extent. Residents use their own cars rather detrimental to local transport services, bicycle or walking.

On the other hand, the national car fleet is one of the oldest in Europe, with an average age of 13.5 years. According to the National Agency for Environmental Protection in Romania are recorded more than 1.2 million vehicles with an age of 12 years.

In Romania the scrappage scheme for cars was introduced in 2005 and allowed buyers to trade a car older than 10 years in exchange for 3800 lei (1€ = 4.2 lei). There have been no restrictions requested on new car pollution standards. In 2010, a person could scrap up three old cars, with the appropriate amount of 3 vouchers. The situation of motor vehicles in the program for the period 2005-2010 is shown in Table 2.

Table 2. Number of cars entered in the program

Year	Scrapped cars	Sold cars	Rebate (lei) (subsidy)	Costs (millions lei)	Total volume	Used volume (%)
2005	14,607	14,607	3,000	43,8	15,000	97.4
2006	15,110	15,110	3,000	45,3	16,500	91,6
2007	16,444	16,444	3,000	49,3	16,500	99,7
2008	30,466	30,466	3,000	91,4	30,466	100
2009	32,327	32,327	3,800	122,8	60,000	53,9
2010	189,323	62,550	3,800	719,4	190,000	99,6
2011	116,644	40,000	3,800	342,544	60,000	66,6
2012	44,857	15,149	3,800	171	15,170	99,86
2013	19,900	13,400	6,500	145	19,900	67,73

In most European Union countries, manufacturers and importers of vehicles must ensure collection of scrapped vehicles through a network of well-organized collection. Dacia has created her own network of collection vehicles scrapped. In Romania there is at least one collection center approved by Dacia in each county and in Bucharest there are three such centers.

» *Piloting scrapping program "RABLA" 2013*

As in previous years, Stimulation Program fleet renewal has been supported by the Ministry of Environment preceding to remove old cars traffic. April 22, both owners of old cars and car dealers could submit files to REMAT offices across the country, May 15 being the date of beginning the distribution of the vouchers. In 2013, the program "Remat" brought some changes.

Voucher that one received in 2013 for an old car owner now had the value of 6,500 lei, being unique, transferable and available only 45 days to submit a file to a dealership in order to purchase a new car. After these 45 days, the voucher could not be used. The deadline in which a vehicle owner could obtain certificate of destruction, cancellation and ticket, was of 10 days. Those who wanted to buy a 100% electric car enjoyed a so-called "ECO-Ticket" voucher with a value of 2,500 lei. Moreover, another facility was to add to a common ticket a sum of 6,500 lei (1.500 €), resulting a total discount of 4,000 € to buy electric cars, meaning over 10% of the total amount of an electric cars. The customer buying a new Euro 6 car also benefits of an eco-bonus of 500 lei, the total amount of discount for cars with Euro 6 is 7,000 lei. The sum of 500 lei was available only for a lower amount of emissions of 100g/km cars. Hybrid cars had an ECO-Bonus of 1,000 lei (2 tickets of 500 lei each) in addition to scrapping premium. "Rabla" Program 2013 took place in one stage and ended on November 20. Data Directorate for Driving Licenses and Vehicle Registration (DRPCIV) shows that the national fleet in Romania reached about 5.98 million units at the end of 2013, increasing with 4.73% in the same period, in 2012. [8]

» *Piloting scrapping program "RABLA" 2014*

Car producers, importers and distributors have submitted applications for validation in the "Rabla" program, which allocated 17,000 tickets for individuals and 3,000 for businesses and public institutions. Tickets were allocated in an electronic system managed by the Environment Fund Administration.

This year, those who want to radiate their more than eight year car should be present directly to the car dealer to qualify for a discount of 6,500 lei to purchase a new car. This year the distribution of scrapping vouchers will not be done in each county, according to the age of the car fleet in each territorial unit, but depending on demand, electronic tickets to be drawn from a national database of auto dealers validated, as Registrants applicants. However, unlike last year, tickets will not be distributed in stages, but they will be all available since the launch program. After the dealer's registration, the applicant will have 30 days at disposal for removal the old car and purchase the new one. Unless the conditions of the program development are obeyed the electronic ticket returns to the national database and there will be a possibility to be extracted by another trader.







In order to stimulate the purchase of environmentally friendly vehicles it will be provided the facility to grant, except for the scrapping subsidy, an eco-bonus of 500 lei. This facility is given in the following situations: purchasing a new Euro 6 vehicle, purchasing a new vehicle whose engine generates no CO₂ emissions of less than 100g/km, or with a hybrid propulsion system. The budget for this year has been 140 million lei. [12]

4. CONCLUSIONS

A comparative analysis of the effects of scrapping program for different countries in 2010 is presented in table 3. Nielsen Global Automotive, a leading global provider of information and perspectives, conducted a study which surveyed more than 30,000 online respondents in 60 countries to identify the demand for cars and to reveal the emotional and financial reasons the influential in purchasing a new car. 65% of online consumers worldwide intend to purchase a new car or second hand in the next two years. Auto demand will be strongest in Latin America (75%), Middle East/Africa (75%) and Asia-Pacific (72%), while more than half of online consumers in North America (56%) and 50 percent in Europe expect to buy a new or used car in the next 24 months. The study results were published in April 2014 in New York. [9]

Granting huge discounts to a new, observable group of customers who could be distinguished from the old and loyal ones based on the scrapping prime information offered a one-time opportunity to increase profits for large-car manufacturers and dealers by increasing sales. Subsidized buyers of large cars eventually received extra discounts on top of the scrapping subsidy amount. Under scrapping subsidy programs, the scrap value could be different according to the characteristics of the trade-in and new vehicles. [1].

Table 3. Comparison among selected countries for 2010

Country	Maximum incentive	Required age	Emissions requirement	Cost to the government
 United States Of America	\$4500 (~€3167)	Under 25 years old	N0 ⁽¹⁾	3 billion \$
 Germany	2500€ (~3552\$)	Over 9 years old	N0	7,1 billion \$
 United Kingdom	2000£ (~3336\$)	Over 10 years old	N0 ⁽²⁾	500 million \$
 France	1000€ (~1421\$)	Over 10 years old	Yes ⁽³⁾	554 million \$
 Italy	3500€ (~5024\$)	Over 10 years old	Yes ⁽³⁾	-
 Romania	3x 3800 lei (~2700€)	Over 10 years old	No	180 million \$

Source: The Economist. Notes:

⁽¹⁾ The U.S. program does not have an emission requirement but instead set a fuel efficiency requirement.⁽²⁾ The U.K. incentive is split between government and the dealer.⁽³⁾ Italy and France required that new cars do not emit more than 160 grams of carbon dioxide per km

The environmental benefits from these programs are commonly viewed as co-benefits to economic stimulus, and thus are employed to garner public support for the stimulus programs. The severity of economic downturn and the lack of coordinated international efforts to address climate change make green stimulus programs particularly attractive given their promises of achieving the twin objectives. Given their popularity amongst policy makers and consumers, similar programs are likely to be adopted in the future.

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