FOUNDATION AUTO RECYCLING SWITZERLAND

ANNUAL REPORT 2013

1. Retrospective and outlook

What exactly does the Foundation Auto Recycling Switzerland do? What are its tasks and objectives? Is it still on the right track? From time to time, these existential questions must be asked. The Foundation took the opportunity to discuss its future action with its founder, auto-schweiz - the Association of Swiss Automobile Importers. Agreement was reached on the fact that the original purpose, namely the construction of our own recycling facility for automobile shredder residue (ASR) could be shelved once and for all. Cooperation with the municipal waste incineration plants has proved successful in this area. We are convinced that thermal treatment will remain the best and most efficient solution for automobile shredder residue, even on a medium-term time scale. The composition of this type of waste is so heterogeneous that material separation is only possible with extreme effort, if at all. There is a high risk that the energy expended on processing will be greater than the saving made through material recycling. Nowadays, thermal waste treatment is no longer just a matter of incineration. It also involves the recovery of energy in the form of electricity and district heating and the recovery of secondary raw materials from the incineration residues. In both cases, considerable potential for optimisation remains. Demand for energy and raw materials will increase all over the world.

In future, the recycling of end-of-life vehicles (ELV) will become even more complex. Now that “light construction” has been adopted, all kinds of different materials are being combined and used in vehicle manufacture. Light construction is necessary to keep the constantly rising vehicle weight under control. Weight has a direct influence on fuel and energy consumption. The BMW i3 electric car is the first series-manufactured vehicle with carbon bodywork (carbon fibre reinforced plastic) on the market. This development can be expected to continue and will therefore influence vehicle recycling. However, these vehicles will not be sent for recycling for fifteen years or more. Be that as it may, the automobile manufacturers must already prove today when applying for type approval that such vehicles can be 95 per cent recycled. Appropriate solutions will be found.

The increasing electrification of drive systems involving purely electric cars and hybrid vehicles means that automobile recyclers must adopt a different approach. Firstly, this involves high voltage installations in which only experts with appropriate training are allowed to work and secondly it will make good sense to dismantle electrical and electronic components before shredding. The raw materials present in these components are valuable and should be recovered systematically.

In this connection, the question as to the trend of vehicle exports arises. It is perfectly possible that the complexity, especially in the area of electronics, will automatically put a brake on exports. Today, well over half of all relatively old and really old vehicles leave Switzerland. Most are sold to emerging and third world countries. Swiss vehicles are in demand as most of them are in relatively good technical condition. As a result, they continue to be driven for a number of years and cover many thousand more kilometres. They contribute to growing mobility in their destination countries without which economic growth is impossible. The negative aspect is the outflow of secondary raw materials and, in the end, less environmentally-friendly disposal.

2. Activities

a. Centre for Sustainable Waste and Resource Utilisation (ZAR)

The Foundation Auto Recycling Switzerland is now represented by its Managing Director on the Foundation Board of ZAR. The purpose of this commitment is to establish the recovery rate of raw materials from co-incineration of automobile shredder residue (ASR) in municipal waste incineration plants (MWIP). The Foundation Auto Recycling Switzerland has been involved since 2010 in this particularly interesting and innovative project. Up to now, the processing of fine slag from waste incineration plants has been implemented and optimized in the 0.2 to 5 mm range. In 2013, a practical test was run with 65 tonnes of ASR in the Zurich Oberland Waste Recycling plant (KEZO) at Hinwil. The conclusion was reached that the quantity of non-ferrous metals separated from the fine slag did not change with the addition of ASR. That is astonishing because ASR demonstrably has a higher metal content in the fine slag component than normal waste. This leads us to conclude that fine slag and its metals are discharged in the form of slag lumps with the coarse slag. However, this coarse slag cannot be handled until the coarse slag processing facility has been set up. This will be built in 2014 and commissioned in 2015 by ZAV Recycling AG.

ZAR is building a second centre of expertise for the recovery of valuable materials by a wet chemical process at the Kehrichtbeseitigungs-AG (KEBAG) in Zuchwil. KEBAG operates the FLUREC technique to process fly ash from waste incineration plants and is recovering pure marketable zinc in this way. Cooperation is therefore a worthwhile proposition for both sides.

Further areas of activity include the extraction of a valuable mineral material from the slag for use in the construction industry and the recovery of phosphorus from sewage sludge ash. In other words, development opportunities do exist.

b. Vehicle electronics study

In the middle of the year, the Swiss Federal Laboratories for Materials Science and Technology (EMPA) was able to present the results of the two investigations. In one case, various electrical and electronic components were dismantled from cars and analysed to determine the content of rare technical metals – 31 metals in all; in the other, a shredder trial was run and all the output fractions investigated to determine the presence of the same elements. The results clearly show that a large part of the investigated metals is either present in the ASR or bound into the iron scrap. The material flows show some major differences between the input and output volumes which need to be investigated further.

In the 100,000 ELV on average which go for recycling in Switzerland, the study establishes the presence of some 20 kg of gold with a value of in excess of 800,000 francs. 365 kg of silver are present with an overall value of 230,000 francs. The total rare earth elements content were 736 kg, i.e. 7.36 g per vehicle. 17 elements of the periodic system

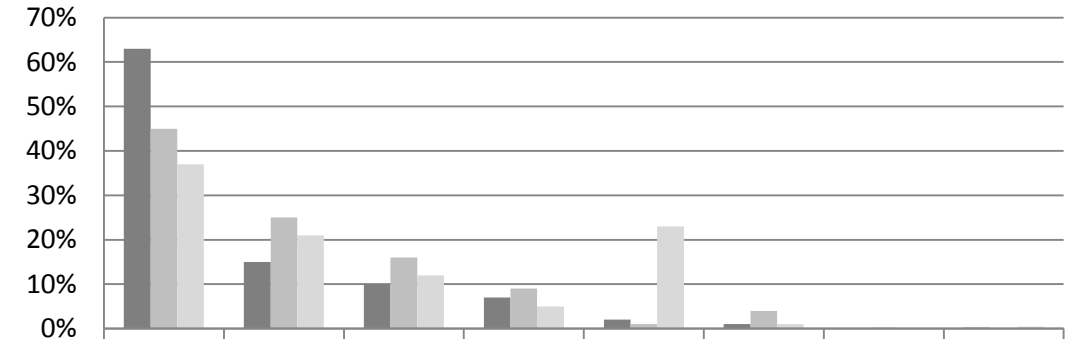
are designated as rare earth elements. However, the name is misleading because these metals are not uncommonly found in the earth's crust. Only their extraction is rendered more difficult by the fact that deposits are smaller and widely dispersed. The difficulty of recovery resides in the fact that the precious metals are distributed in ultra-fine form across the fractions, making them extremely difficult to sort out.

The German Federal Office for the Environment has now started a similar study which is partly complementary. The aim is to compare the results and arrive at a better overview.

c. Recycling end-of-life vehicles and automobile shredder residue

Last year, the shredder plants processed some 107,000 end-of-life vehicles (7.9 per cent more than in the previous year) and extracted more than 75,000 tonnes of metal from them. That was the largest number of vehicles processed since 2006. Swiss automobiles are sought after abroad because they are still in relatively good condition. In 2013, 125,300 previously used cars left Switzerland: 63% went to Africa, 15% to Eastern Europe while 10% remained in Western Europe. Ten years ago "just" 37 per cent went to Africa with 21 per cent taken by East European countries and 2 per cent by the Middle East. Incidentally, exports do not represent a cheap disposal solution because these vehicles are often driven for twice the distance and contribute to mobility without which no national economy can develop.

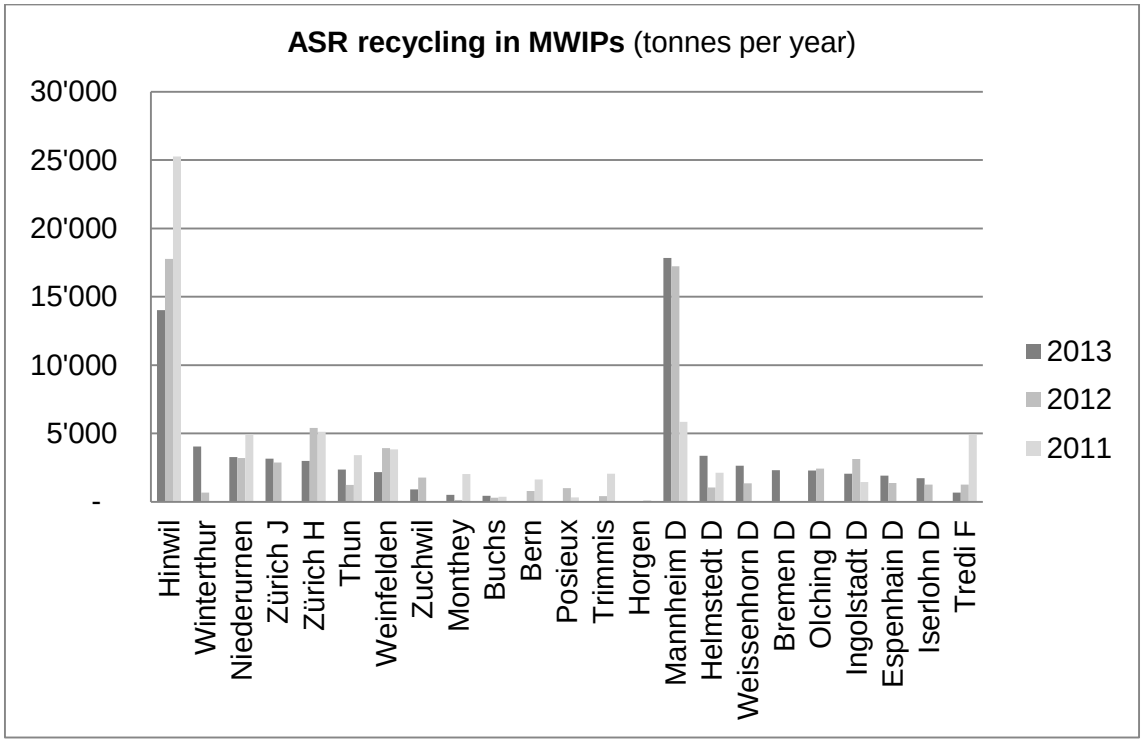
Vehicle exports by regions (percentage figures)



	Africa	Eastern Europe	Western Europe	Balkans	Middle East	CIS	Asia	America
2013	63%	15%	10%	7%	2%	1%	0.1%	0.2%
2008	45%	25%	16%	9%	1%	4%	0.2%	0.1%
2003	37%	21%	12%	5%	23%	1%	0.1%	0.4%

The shredded vehicles yielded 23,400 tonnes of automobile shredder residue (ASR), which were thermally recycled in waste incineration plants. In addition to energy produc-

tion (electricity, district heating), the focus is increasingly being placed on slag processing. The aim is to recover as many valuable materials as possible from the waste incineration residues and to return them to the materials cycle (see chapter 2a). Out of the total ASR which occurred, one-half was recycled in German waste incineration plants. In Germany, competition between waste incineration plants, alternative fuel power plants and mechanical-biological treatment facilities is particularly keen. This creates massive overcapacities accompanied by low acceptance prices. The Foundation is endeavouring to shift the relationship in favour of Swiss facilities. The average disposal costs including transport are CHF 187.- per tonne (previous year CHF 198.-).



In order to gain an idea of the costs of vehicle recycling, the Foundation commissioned a dissertation at Bern University of Applied Sciences. This work is being done by a student in two parts: part 1 covers the vehicle recycling activity and part 2 that of the shredder plant. The studies will be completed in 2014.

d. Media relations

- Folding brochure: the Foundation produced an instructive flyer to provide general information about vehicle recycling in Switzerland. This flyer can be handed out at events.

- Exposition “Umwelt Arena”, Spreitenbach

The Umwelt Arena was inaugurated in Spreitenbach in 2012 at the initiative and under the management of Walter Schmid. In numerous interactive displays, the themes of sustainability, renewable energy and nature are demonstrated in the areas of energy, mobility and housing. The presentation of vehicle disposal with a high rate of recycling fits in admirably with this environment. For a better understanding, various fractions which occur at the vehicle recycling facility and shredder plant are on display. In addition, a short video describing the shredder process has been produced in cooperation with Wiederkehr Recycling AG and can be viewed on a monitor.

- Department for the Environment and Energy of the Canton of Basel-Stadt; newsletter

The Cantonal Department has produced an “Energy Detective” newsletter for children of school age. The Foundation supplied the information on vehicle recycling.

- Miscellaneous information

The Foundation once again gave a great deal of information about vehicle recycling. There were requests from journalists, students and school pupils for statistical data and about the vehicle recycling process in general.

3. Laws and regulations

a. Chemical Risk Reduction Ordinance (ORR Chem)

The handling of batteries is dealt with in Annex 2.15 to ORR Chem. There are three types of batteries in vehicles: starter batteries (lead batteries), drive batteries in hybrid and electric vehicles (nickel-metal-hydride or lithium-ion batteries) and button cell batteries which are used for instance in keys. In principle, batteries are liable for fees and compulsory notification. The automobile branch has managed to obtain a release from the fee payment obligation but notification is still compulsory. To cover the expenditure of the Inobat organisation, which has been set up by the Federal Department for the Environment, 16 centimes must be paid per vehicle. The fee regulation is temporary for the time being and due to expire in 2016.

b. Technical Ordinance on Waste (TOW)

A hearing on the total review of the TOW is scheduled in the third quarter of 2014. Entry into force is therefore unlikely until the end of 2015. In the vehicle recycling sector, there will be a chapter on automobile shredder residue. Before thermal treatment, in future, metal pieces which are larger than 20 mm will have to be removed from the shredder residue and sent for material recycling. Metals must likewise be removed from the residues of thermal treatment. These criteria are already being met in large measure.

c. Ordinance on the return, recovery and disposal of electrical and electronic devices (VREG)

The Federal Department for the Environment has opened a hearing on the draft text of the revised VREG. The aim of this revision is to include the online trade and other dealers in the electronic branch who do not participate in any collection system for end-of-life electrical and electronic devices. The previous financing system with recycling contributions paid in advance for the system providers SENS and SWICO is to be placed on a secure basis. A further aim of the review is to achieve improved recovery of valuable materials by creating the basis for determination of the state of the art in recycling. In future, electrical and electronic devices from vehicles will also fall within the scope of application of the ordinance. The Foundation opposed this solution in its response because no benefit will be derived at present (see chapter 2b) and the expenditure for dismantling such components is well known to be high. As a matter of principle, there is not yet any representative database covering the potential of rare technical metals in vehicles. Moreover, vehicles are explicitly excluded from the EU Directive (WEEE).

d. Ordinance on the Movement of Waste (VeVA)

The Foundation was able to state a position at the hearing on the revision of the VeVA. Firstly, in certain specific cases, special waste can be accepted at the site of the delivering enterprise by the authorised disposal company; secondly, the obligation to pay a security deposit in favour of the Federal Department for the Environment has been stipulated when waste is exported. The Foundation signified its agreement to both these points.

e. Federal Act on the Protection of the Environment (USG)

With the revised text of the USG, the Federal Council presented an indirect counterproposal to the popular initiative on a sustainable and resource-efficient economy, also known as the green economy. Supplementing the existing principles for protection of the environment, the new USG aims to reduce the consumption of resources to a natural level. The ecological footprint of Switzerland is 2.8 earths. In other words, we consume 2.8 times more natural resources than nature can deliver. The Foundation submitted an opinion although vehicle recycling is not directly affected. We called attention to the major efforts made by the automobile industry in the area of the prudent use of resources in production, vehicle operation and in the recycling of end-of-life vehicles. In principle, the Federal Council's endeavour to verify and implement potential measures in close cooperation with the branch concerned is to be welcomed.

4. Events

- International Automobile Recycling Congress (IARC) in Brussels

IARC was held for the 13th time already and once again provided a good overview of the state of recycling of end-of-life vehicles and their component parts. Federico Karrer, a member of the Foundation Board Committee until June 2013, was represented on the Steering Committee for the last time. Daniel Christen, Managing Director of the Foundation Auto Recycling Switzerland, will take his seat on this body in 2014. He was elected in October 2013.

- Green Forum / WASTEvision, UMTEC Rapperswil

The UMTEC conference on the theme of "Metals from waste – Environment, Technology, Costs" provided an opportunity for interesting presentations. The subject was discussed from various angles. For example, the difference between resources and reserves was explained. Resources designate the overall availability of a raw material while the re-

serve means the quantity which can be extracted with the means available today. A further relationship between the market price of a raw material and its environmental burden was illustrated. The higher the price, the greater the environmental burden created by extraction. The price depends in fact in large measure on the raw material content in the ore.

- VBSA conference

The Federation of the Operators of Swiss Waste Treatment Plants (VBSA) organises a professional conference each year. This time, the topic was plastics. The benefits of using plastic materials in the product can create problems at the recycling stage. The variety of materials, similar physical properties and low prices make efficient and cost-effective recycling difficult. There are exceptions for the collection of particular types of plastic, as shown by the example of PET. When it comes to the ecological balance, plastics often perform better than other materials as they are more energy and resource-efficient. With the review of the Act on the Protection of the Environment, the Swiss Confederation wishes to lay the bases for improved material recycling of plastics.

- Various swisscleantech workshops

The Foundation Auto Recycling Switzerland attends all the workshops organized by the "Urban Mining & Recycling" focus group of Swisscleantech. At these workshops, recycling issues, more specifically the review of the Act on the Protection of the Environment, are examined in depth.

- Various seminars dealing with the investment of assets

For the purpose of advanced training and to obtain information about market trends in asset investment, the Managing Director of the Foundation regularly attends seminars for institutional investors.

5. Developments in other countries

With effect from 2015, a reprocessing rate of 95 per cent and a recycling rate of 85 per cent will apply to end-of-life vehicles in the EU Member States. The difference resides in the use of energy, which by definition cannot be counted as part of recycling. As more than twenty per cent of an end-of-life vehicle consists of shredder residue, material processing of this waste material is urgently necessary. With a few exceptions, such as the ASR recycling facility operated by ARN in the Netherlands, no all-round processing tech-

niques exist at present. Many shredder plants are endeavouring to optimise specific aspects of ASR processing. It must be assumed that a large proportion of the fractions are still being disposed of in Europe by dumping, either to backfill mines or as covering material for surface landfills. These are not good solutions.

On the product side, we have already noted the trend towards light construction and electrification. Compound materials and the increasing use of electronics and battery technology call for alternative recycling routes. Additional requirements are then placed on vehicle recyclers. The shredder plants must adjust to a situation in which the quantity of metal which can be recovered from end-of-life vehicles is constantly falling. This trend will be further intensified by the tendency towards engine downsizing. However, the value of the metals which are used will increase.

6. Swiss vehicle statistics

At 307,885, the number of new vehicles registered (-6.2 per cent compared to 2012 - information provided by auto-schweiz) declined, as had been expected. The situation regarding previously used vehicles is different. The number of ownership changes increased to 851,883 (+2.8 per cent, figures provided by AGVS/Eurotax). That may be one reason why the number of vehicles to be disposed of increased.

Statistics of passenger cars in Switzerland:

Year	New registrations	Total on road	Taken off road[1)]	Exports	Vehicles cancelled in CH	Shredded
	(FEDRO)	(FSO/FEDRO)		(CD)		
2000	315,398	3,545,247	237,426	73,404	164,022	
2001	317,126	3,629,713	232,660	83,319	149,341	
2002	295,109	3,700,951	223,871	89,851	134,020	
2003	271,541	3,753,890	218,602	94,682	123,920	
2004	269,211	3,811,351	211,750	108,235	103,515	
2005	259,426	3,864,994	205,783	90,354	115,429	
2006	269,421	3,899,917	234,498	106,857	127,641	104,600
2007	284,674	4,002,584	182,007	131,695	50,312	88,261
2008	288,525	4,031,205	259,904	108,205	151,699	82,195
2009	266,018	4,051,832	245,391	82,967	162,424	58,279
2010	294,239	4,119,384	226,687	91,965	134,722	78,657
2011	318,958	4,209,672	228,670	96,430	132,240	90,338
2012	328,139	4,300,036	237,775	127,806	109,969	99,448
2013	307,885	4,366,895	241,026	125,325	115,701	107,282

FEDRO: Federal Roads Office (status as of 30 September)

FSO: Federal Statistics Office (from 2008 FEDRO and no longer FSO)

CD: Federal Customs Administration (foreign trade statistics)

[1)] Calculated: new registrations less increase in number of vehicles on road

Exports of previously use vehicles in 2013 (source: Federal Foreign Trade Statistics)

	Country	Exports (CD)	Value of vehicles CHF/veh.
1	Libya	31,031	1,209
2	Benin	16,177	1,320
3	Niger	14,861	1,048
4	Poland	12,328	1,377
5	Togo	7,403	1,094
6	Germany	6,369	8,511
7	Bulgaria	5,526	858
8	France	4,509	4,877
9	Lithuania	4,454	3,312
10	Nigeria	4,148	1,445
11	Turkey	2,198	1,743
12	Cameroon	1,394	1,388
13	Czech Re-public	1,360	3,348
14	Macedonia	801	1,026
	…	…	…
148	Countries	125,325	2,621

Annex

Documentation

Publications such as press releases, annual reports, INFO newspapers etc. can be consulted on the Foundation's website: www.stiftung-autorecycling.ch

Membership of the Foundation Board

Foundation Board President	Dr. iur. Hermann Bürgi*
auto-schweiz	Christine Ungricht, Vice President* Max Nötzli* Walter Frey Andreas Burgener Tobias Lukas
Automobile Club of Switzerland	Niklaus Zürcher
Motor Trade Association of Switzerland	Urs Wernli
Swiss Commercial Vehicles Association	Dr. Michael Gehrken
Expert in motor vehicle disposal	Federico Karrer (* until 10.06.2013)
Department of the Environment, Aargau Canton	Dr. Peter Kuhn
Swiss Shredder Association	Dr. Tobias Thommen (* from 10.06.2013)
Touring Club of Switzerland	Christoph Erb*

* Members of the Foundation Board Committee

Business office	Daniel Christen, Managing Director Urs Eberle, Administration