



STIFTUNG GRS BATTERIEN
**GEMEINSAMES
RÜCKNAHME
SYSTEM**



You and GRS Batterien:
the success of a strong partnership.

Annual Review 2015

Reporting in accordance with §15 (1) Batteriegesezt
(Batteries Act)



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Auditor 's certificate

Der Unterzeichnende hat die vorliegende Erfolgskontrolle 2015 der

Stiftung Gemeinsames Rücknahmesystem Batterien

Heidenkampsweg 44, 20097 Hamburg

auf Übereinstimmung mit § 15 (1) des Batteriegesetzes vom 25. Juni 2009 (zuletzt geändert am 20. November 2015) geprüft.

Da die Anforderungen des Batteriegesetzes vollumfänglich erfüllt sind und die Daten und Angaben ein verlässliches, glaubhaftes und wahrheitsgetreues Bild wiedergeben, wird die Erfolgskontrolle 2015 in der vorliegenden Fassung bestätigt.

Bexbach, 10. März 2016

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*Akkreditiert durch: DAU – Deutsche Akkreditierungs- und Zulassungsgesellschaft für Umweltgutachter mbH (Zulassungsnummer: DE-V-0179).

Foreword

+ Looking back, we can say that 2015 was a busy but most of all a successful year. The statutory collection rate of 45% will become legally binding in 2016, but we once again succeeded in achieving and exceeding this goal in advance of the change. Moreover, the increase witnessed in previous years continued, with the collection rate rising to 45.9%. This means that all of our affiliated users are in an excellent position for the coming reporting year.

In order to ensure that this target is achieved over the long term and to consolidate performance, GRS Batterien has worked with the national register for waste electric equipment (stiftung ear) and the central municipal associations – the German Association of Local Utilities (VKU), the Association of German Cities and the German County Association – to continue and complete the G2 communication project, which was launched in 2014. The aims of this pilot project were to identify what factors make for successful communication with users and to investigate the effectiveness of different communication tools and channels. Based on a scientific study, various forms of communication were developed and made available to partners in the four participating

pilot regions in the form of a ‘G2 toolkit’. These regions selected a range of tools featuring the campaign slogan ‘FROM OLD TO NEW’ and deployed them using different channels. Following a test phase, the effect of these communications was investigated in detail. Further action should now be taken based on the results in order to drive a sustained increase in the collection rate through strategic communications.

As expected, the number of lithium batteries brought into circulation rose once again in 2015, causing a direct increase in the number collected. This trend is set to continue, not least due to the latest amendments to the German Batteries Act (already applicable), which limit the exception for special NiCd batteries brought onto the market. GRS Batterien took early action to address the related increase in safety requirements by implementing the GRS safety standards. Work has been done to raise awareness among those working at collection points, and it is pleasing to note that a growing understanding of the safe and proper collection of high-energy batteries has led to the intensive application of our safety standards.

We are also encouraged by a rise in demand for our information services, which include bulletins and data sheets as well as our GRS safety forum and training opportunities. Against this background, we have every reason to be optimistic about the year ahead, and we are confident that we can build on the results of 2015 thanks to the positive relationship with our users and collection partners. —

Best regards,



Georgios Chryssos

*Managing Director
Stiftung GRS Batterien*

Hamburg, March 2016

Founded on cooperation:

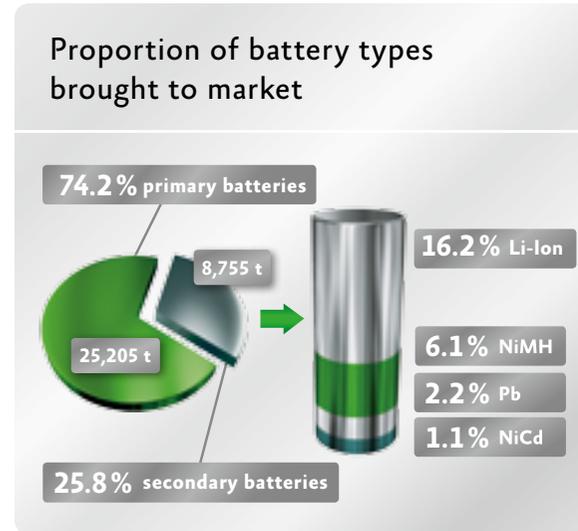
Our customers

✚ For more than 16 years, Stiftung GRS Batterien has acted as a non-profit company, providing a service to customers while taking on all the legal obligations of battery manufacturers. In addition to certain disclosure and reporting requirements to public authorities, these obligations mainly include the nationwide collection and recycling of used batteries in accordance with legislation and the disposal of non-recyclable batteries. The disclosure and reporting requirements set out in the German Batteries Act are primarily intended to assist the identification of so-called free riders – manufacturers and importers who evade their legal obligation to collect used batteries. We are proud to note that more than 3,000 manufacturers are using our system today. All of these companies can rely on our experience and expertise as well as on the high quality of our services.

In 2015, portable batteries weighing 33,960 tonnes in total were placed on the market by our users. Primary batteries continue to represent the largest share of this figure at 74.2%.

Turning to secondary batteries (rechargeable batteries), the proportion of Li-ion systems once again

increased, rising from 59.2% in the previous year to 62.8%.



GRS Batterien offers its customers tailored collection solutions for electric batteries – primary and secondary (rechargeable) batteries – as well as for industrial batteries.

For the manufacturers of industrial batteries, GRS Batterien has developed individual concepts as part

of its collection system that meet all the responsibilities of its users. There is a 'bring system' allowing users to drop off their used batteries to a defined collection point as well as a 'pick-up system' for collection at the point of origin. For some time, there has been a steady increase in the use of stationary battery systems to store renewable energy in residential buildings. The same is true for accumulators used on electric bicycles. As a result, industrial batteries (a classification that covers the two types mentioned above) are no longer found only among commercial users but also in private households. To tackle this development, GRS Batterien has developed specific solutions for both battery types in close cooperation with leading industry associations. Since 2010, manufacturers have been able to take advantage of the GRS solution for e-bikes developed in collaboration with the German Bicycle Industry Association (ZIV). In May 2015, GRS launched an industry solution for stationary energy storage that was developed in collaboration with the German Solar Industry Association (BSW), the Electrical and Electronic Manufacturers' Association (ZVEI) and the Central Association of German Electrical and IT Trades (ZVEH). —

Meeting future obligations today:

Our collection rate

+ In 2015, as in previous years, we once again managed to exceed the statutory collection rate of 45% that will become binding in the next reporting year and to register an increase over 2014. GRS Batterien consolidated its success by collecting and recycling 45.9% of the batteries brought into circulation (previous year: 45.3%). We owe this success first and foremost to the close, positive working relationship we share with our users and collection partners.

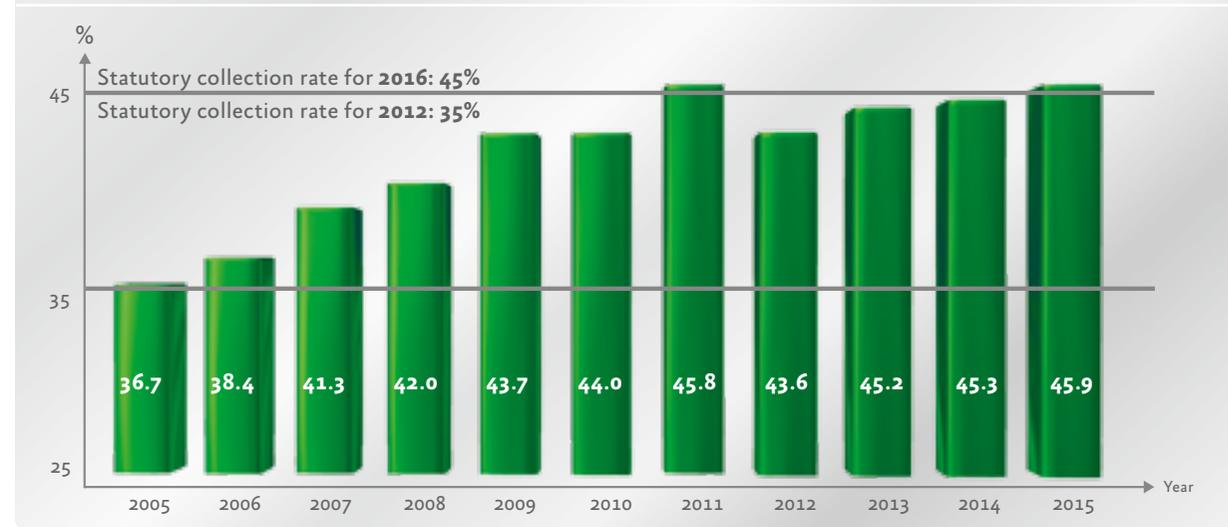
As a result of this collaboration, used electric batteries and accumulators weighing 15,384 tonnes in total were collected and recycled in compliance with all safety regulations. GRS Batterien thus continues to operate one of the most effective and pioneering collection systems for used batteries and accumulators in Europe in terms of the volume and percentage of collected units.

With more than 170,000 collection points, GRS Batterien provides a nationwide network that makes it quick and easy for consumers to dispose of their used batteries and accumulators. The retail sector is particularly well represented here, with approximately 140,000 collection points. In 2015, almost one in two batteries or accumulators was returned through a retail outlet. On average, each person living in the Federal Republic of Germany* throws away 189 grams of used batteries a year, corresponding to around eight units.

However, these encouraging figures shall not tempt us to rest on our laurels, but we see them as an incentive to continue increasing the collection rate. Given that some regional differences can be seen in people's habits when it comes to disposing of used batteries, we are focusing on the strategic use of communications in those areas where the collection volumes are below average. In this context, GRS Batterien attaches particular importance to information and education – and not without reason, as illustrated by the success of the GRS education initiative featuring Inspector Energy. Since 2012, the

Inspector has been visiting nursery schools around Germany to encourage children to take an interest in the issue of environmental protection through battery recycling and to get them on board. Working together with public waste management authorities and users, GRS Batterien has also initiated a range of communication projects. Such projects always aim to inform consumers and to raise their awareness of the importance of battery recycling in its various forms, thus increasing the collection rate in the long term. —

Collection rates from 2005 to 2015 (%)



* Population according to the Federal Statistical Office of Germany (31 December 2014): 81,197,500

Fast processes for perfectly coordinated logistics:

Our collection partners

+ Our close partnership with the GRS collection partners has been an important guarantee for the good results of our work over the years. With more than 170,000 collection points at retail outlets as well as in municipalities and the industrial and commercial sectors, we are able to provide consumers with a straightforward option for disposal that is close to their homes all over Germany. The quality and safety

of our services is a top priority in the work we do with our collection partners. We pay close attention to developments in the field of battery recycling. As a result, we can quickly identify any areas of action that are necessary in order to meet new requirements concerning the collection, transport and disposal of batteries. Generally in the form of pilot projects, GRS Batterien develops suitable processes or measures

which are then implemented following a successful test phase. The best example of such an approach are the GRS safety standards, which were considered pioneering when introduced in 2014 and now set the benchmark even beyond the borders of Germany. The GRS safety standards make it easier for everyone involved in the collection process to comply with the stringent transport regulations for dangerous goods defined in ADR. In addition to green collection containers for mixed batteries, GRS Batterien provides collection points with yellow transport containers for the separate collection of high-energy batteries. Used portable batteries are thus handed over to the collection system in three separate categories:

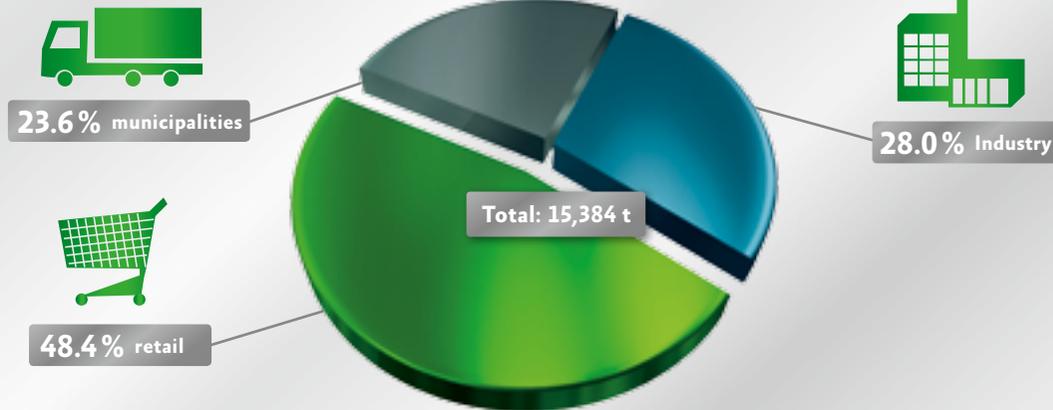
-  standard portable batteries
-  high-energy batteries
-  damaged high-energy batteries

Our online portal (www.grs-online.com) is an important tool for the quick and easy management of orders.

It enables all GRS collection partners to place, review and track orders for collection and disposal at any time. —

Volume of collected batteries by origin

Retail outlets remained the most popular point of collection for used batteries in 2015.



The basis of clean recycling:

Our sorting operations

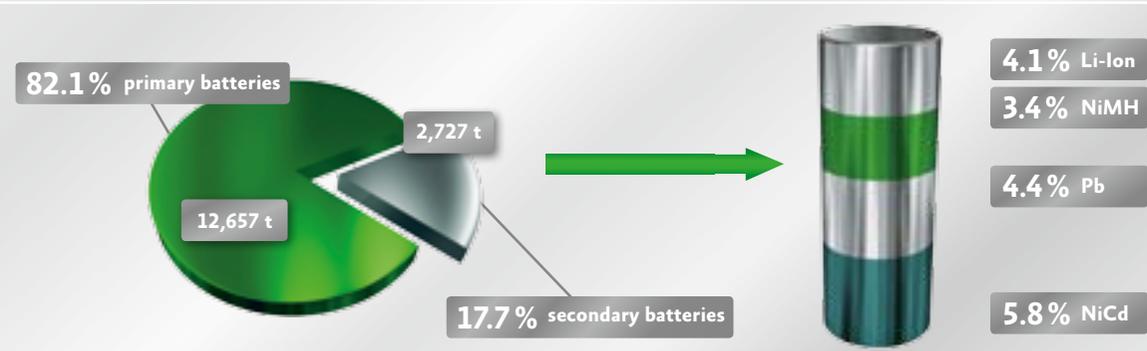
+ Following their return, the efficient and safe sorting of used batteries is crucial for the success of our collection system. Our logistics centres coordinate the transfer of used batteries from collection points to sorting plants, where they are first separated by size and electrochemical system. The reason for this approach is that there is a different recycling process for almost every battery system, dependent on its component compounds. Nowadays there are ten systems and hundreds of sizes on the market. Careful sorting by GRS Batterien is the prerequisite for optimal recycling.

Comparing the proportion of primary batteries to secondary batteries, it is clear that the former represents the vast majority. These are mainly systems such as alkaline-manganese and zinc-carbon batteries, whereas secondary batteries tend to be lead, nickel-cadmium and lithium accumulators. The long-standing trend towards high-performance energy storage systems that are independent of the grid continues to cause a rise in the collection volume of lithium batteries. Powerful, long-lasting battery systems are used in all kinds

of applications, from mobile phones and tablet computers to cordless drills and electric toothbrushes. Lithium batteries are still the system of choice because they can store a lot of energy in a small space. However, given their very high energy density and other particular characteristics, these batteries require special safety measures. The GRS safety standards meet all the safety requirements for

the carriage of dangerous goods set out in ADR, which means that we can always ensure the proper collection of used batteries. In order to continue providing users and collection partners with the highest level of quality, safety and confidence in the future, GRS Batterien is constantly working on ways to enhance the system in close cooperation with its partners. —

Composition of batteries by mass of collected systems in 2015



Proof of a successful system:

Our recycling results

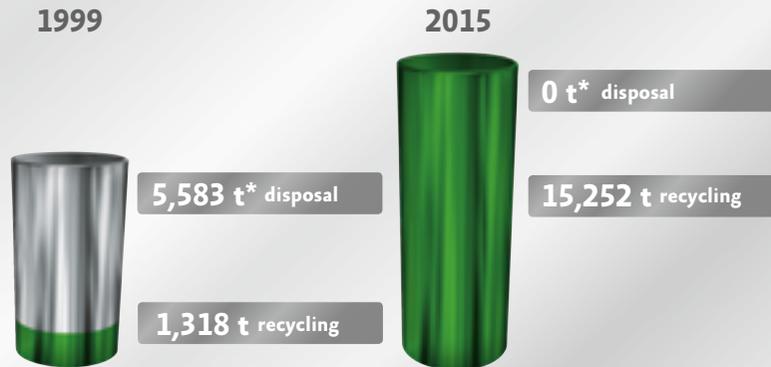
✚ In the final stage of our battery collection system, the presorted batteries and accumulators are delivered to recycling plants. Here, as throughout the process, we place great importance on performing work that is safe, high in quality and cost-effective. It goes without saying that we also take into account ecological aspects at all times, as only in this way can we meet our own standards for sustainability.

In our recycling plants, components of all used batteries are put back into the production cycle. For example, steel and zinc are recovered from alkaline-manganese and zinc-carbon batteries in electric steel furnaces. Electric-arc furnaces are also used – one of the most advanced recycling methods available. By recovering raw materials such as cobalt, nickel, zinc and iron, we are playing an active role in protecting the environ-

ment and natural resources.

The recycling rate has risen significantly since we began our work, and it is now established at a very high level. In order to maintain and consolidate these results, we have been involved in numerous research and development projects for many years. —

Amount of batteries that could be recycled



* Non-recyclable mixed batteries.



Conserving raw materials for the future: **Our recycling activities**

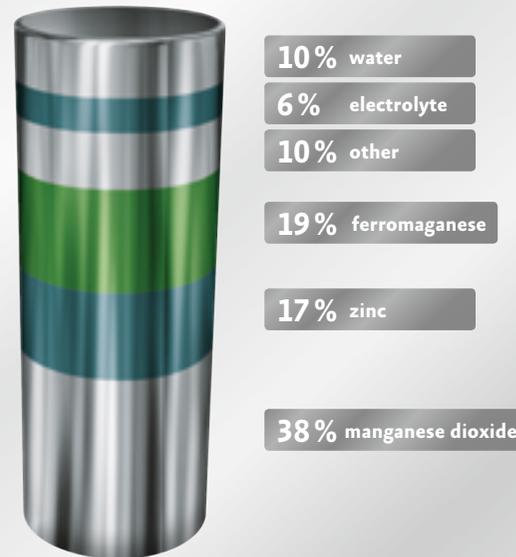
✚ In November 2015, amendments to the German battery act resulted in more stringent conditions associated with the ban on bringing into circulation any portable batteries containing more than 0.002% cadmium by weight.

According to present legislation, portable batteries intended for cordless power tools that are placed on the market after 1 January 2017 must adhere to the same limit. Such batteries were previously excluded from the regulation. Industrial batteries used in emergency and alarm systems, such as emergency lighting and medical equipment, are still exempt. The proportion of NiCd batteries among portable batteries brought into circulation has been decreasing for years, and under the new regulation this trend will continue.

The heavy metal cadmium contained in NiCd batteries is distilled off in our recycling process before it is used in the production of new batteries. Lithium primary batteries and rechargeable systems, in contrast, are subject to a metallurgical recycling process. This makes it possible to obtain valuable raw materials such as nickel-containing iron and ferromanganese from primary batteries as well as cobalt, nickel and copper from accumulators. As in previous years, the most commonly used batteries were alkaline-manganese and zinc-carbon batteries, with

Typical composition of an alkaline-manganese battery

Many battery metals can be recycled in a blast furnace or electric steel furnace. This makes it possible to save valuable raw materials.



a combined share of 80.5%. If they contain no mercury, they are sometimes processed in a blast furnace or electric steel furnace, resulting in recycling of the highest quality. The raw materials remaining at the end of the process are manganese containing pig iron and zinc concentrate.

In a controlled process, the steel content of the manganese-dioxide mass – which also contains a proportion of zinc – is separated after the batteries have been crushed. The pure steel that is obtained as a result can then be sold. Zinc oxide is obtained from the manganese-dioxide mass in a rotary kiln.

More detailed information about our various recycling processes and the different kinds of electrochemical battery systems are presented in our brochure „The World of Batteries“. Additional publications and videos about the collection, sorting and recycling of electrical batteries can be downloaded for free from the GRS website (www.grs-batterien.de). —

Our image as a strong partner:

Our communications

+ Following the implementation of the new electrical and electronic equipment act (ElektroG) and the amendments to the German Batteries Act in 2015, the challenges facing battery manufacturers, importers, distributors and sellers have increased once again. In order to tackle these challenges successfully, GRS Batterien is also active in the field of communication, initiating different projects and developing appropriate strategic measures. On this front, we always work in close cooperation with experts and key stakeholders from the sectors concerned.



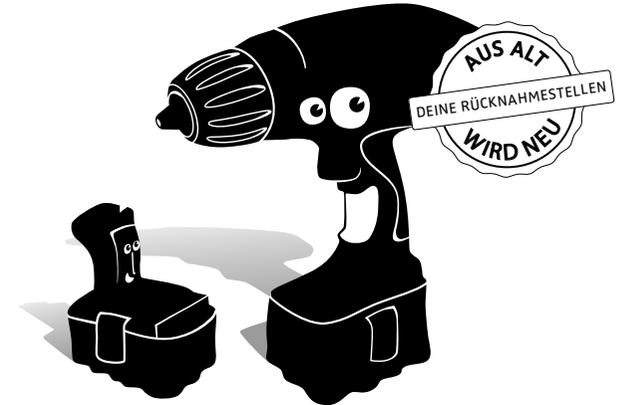
One of the main activities in the last two years was the G2 communication project, which GRS Batterien organised and implemented together with the German Association of Local Utilities (VKU), the Association of German Cities, the German County

Association and stiftung ear (the national register for waste electric equipment).

The aim of the pilot project was to improve the collection rate of waste electrical and electronic equipment and used batteries through purposeful control and communication measures. To this end, work was done to identify what factors make for successful communication and to study the impact of different communication activities and channels.

This led to the development of the 'G2 toolkit' featuring the slogan 'FROM OLD TO NEW' – originally part of the project but now being further developed with additional content for general use. Building on the insights and recommendations presented at the final advisory board meeting in October, GRS Batterien will continue to introduce appropriate measures. It is intended that the project advisory board will remain closely involved in developments, drawing on the knowledge and opinions of representatives from environmental and economic ministries, municipalities, and consumer and industry associations, among others. As demonstrated once again by the results of the G2

project, taking regional factors into account is crucial for the success of our communication. Against this background, GRS Batterien continued its positive work with public waste management authorities and local authorities in 2015, building on established cooperation from previous years. The very successful GRS education initiative featuring „Inspektor Energie“ is an excellent example of such collaboration. —



Taking responsibility for battery disposal:

Our foundation

+ Stiftung GRS Batterien was founded in 1998 by leading battery manufacturers and the German Electrical and Electronic Manufacturers' Association (ZVEI). Operating the 'joint collection system' established by the Federal Ministry for the Environment under § 6 of the Batteries Act, the foundation ensures the safe and environmentally friendly disposal of used batteries in all regions of Germany. It takes care of the collection, logistics, sorting and recycling of batteries on behalf of its customers. At the same time, GRS Batterien has always strived to organize processes in the best possible way and to optimise its operations.

Both collection rates and recycling volumes rose again in 2015. Nevertheless, as in previous years, GRS Batterien once again managed to maintain stable prices and to pass on cost benefits to its users as a non-profit company. In order to ensure the greatest level of transparency, incurred costs are always itemised.

The foundation operates a management system that has been certified according to ISO 9001:2008 and ISO 14001:2004.

Our work is characterised by high standards of quality and safety in our services, which are now provided to more than 3,000 customers. Thanks to the excellent relationship we share with our collection partners, we have a network of 170,000 collection

points in total, through which we managed to collect 15,384 tonnes of used portable batteries in 2015. As a result, Stiftung GRS Batterien was able to retain its position in 2015 as the most effective battery collection system in Europe. —





Mass and volume of batteries placed on the market (§ 15 (1) no. 1 of the Batteries Act)

			Volume	
			2015	
			t	%
Primary batteries	Round cells	ZnC	1,786	5.3
		AlMn	22,152	65.2
		Zn-air	16	< 0.1
		Li, primary	491	1.4
	Button cells	AgO	64	0.2
		AlMn	169	0.5
		Zn-air	125	0.4
		Li, primary	402	1.2
		Subtotal	25,205	74.2
Secondary batteries	Round cells	AlMn	29	0.1
		Li-Ion	5,500	16.2
		NiMH	2,086	6.1
		Pb	750	2.2
		NiCd	366	1.1
	Button cells	Li-Ion	10	< 0.1
		NiMH	14	< 0.1
		NiCd	0	< 0.1
	Subtotal	8,755	25.8	
Total	33,960	100.0		

			Volume	
			2015	
			Units (000)	%
Primary batteries	Round cells	ZnC	47,646	2.9
		AlMn	964,884	59.2
		Zn-air	661	< 0.1
		Li, primary	30,787	1.9
	Button cells	AgO	28,552	1.7
		AlMn	92,445	5.7
		Zn-air	179,558	11.0
		Li, primary	129,693	8.0
		Subtotal	1,474,226	90.4
Secondary batteries	Round cells	AlMn	1,675	0.1
		Li-Ion	58,602	3.6
		NiMH	87,469	5.3
		Pb	1,310	0.1
		NiCd	1,513	0.1
	Button cells	Li-Ion	2,935	0.2
		NiMH	2,898	0.2
		NiCd	122	< 0.1
	Subtotal	156,525	9.6	
Total	1,630,751	100.0		

Mass of batteries collected by type group and system (§ 15 (1) no. 2 and no. 4 of the Batteries Act)

	Type group	System	Return amount (t) ¹
Primary batteries	Round cells	ZnC/Zn-air	1,143
		AlMn ²	11,253
		Li	127
	Button cells ²	AgO	134
		AlMn	
		Zn-air	
		Li	
Secondary batteries	Round cells	Li-Ion	631
		NiMH	523
		NiCd	887
		AlMn ²	-
	Button cells ²	NiCd	-
		Li-Ion	
		NiMH	
Small lead batteries		686	
Total			15,384

The quantity collected – 15,384 tonnes – corresponds to a collection rate of 45.9% according to the calculation used in the Batteries Act (§ 2 (19) BattG).

¹ Composition based on the results of sorting.

² If sorting is not possible, these results include both primary and secondary batteries.

Mass of batteries recycled (§ 15 (1) nos. 3, 5 and 6 of the Batteries Act) Qualitative and quantitative results of recycling and disposal

			Mass of used batteries sent for material recycling (t) ¹	Mass of used batteries not falling within the scope of the Batteries Act (t) ¹	Mass of used batteries sent for material recycling outside the scope of the Batteries Act (t) ¹	
Primary batteries	Round cells and block batteries	ZnC/Zn-air	1,537	290	290	
		AlMn ²	11,027	1,521	1,521	
		Li	183			
	Button cells ²	AgO	143			
		AlMn				
		Zn-air				
		Li				
Subtotal I			12,890	1,811	1,811	
Secondary batteries	Round cells, prismatic cells and block batteries	AlMn ²	-			
		Li-Ion	707	12	12	
		NiMH	294			
		NiCd	749	126	126	
		Pb	612			
	Button cells ²	Li-Ion	-			
		NiMH				
Subtotal II			2,362	138	138	
Total			15,252	1,949	1,949	

System	Input mass (t)	Output mass (t)	Recycling efficiency (%)
Pb	572.2	471.2	82
NiCd	660.2	526.3	80
„Other“	11,455.4	8,993.2	79
	12,687.8	9,990.7	

Taking into account the stock carried over from one year to the next, the result is a recycling rate of 99.1% according to § 15 (1) no. 5 of the Batteries Act.

¹Composition based on results of sorting and established rules governing quality assurance in statistics.

²If sorting is not possible, these results include both primary and secondary batteries.



Abbreviations, definitions and sources

ADR: The European agreement concerning the international carriage of dangerous goods by road

AgO: Silver oxide

AIMn: Alkaline manganese

Battery mixture: Batteries are collected as a mixture under the spent catalogue number 200133.* They are then sorted and subdivided under the numbers 160601* to 160605, 191211* or 191212 respectively.

BattG: Act concerning the placing on the market, collection and environmentally compatible disposal of batteries and accumulators

Cd: Cadmium

ElektroG: Act concerning the placing on the market, collection and environmentally compatible disposal of electrical and electronic equipment

Hg: Mercury

Li, primary: Lithium, non-rechargeable lithium system

Li-ion and Li-polymer: Lithium-ion and lithium-polymer, rechargeable lithium system

NiCd: Nickel-cadmium

NiMH: Nickel-metal hydride

Pb: Lead

Primary batteries: Non-rechargeable batteries

Secondary batteries: Rechargeable batteries (accumulators)

Zn-air: Zinc-air

Image credits: VARTA, Hanover/VALDI, Feurs (France)

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