Waste Treatment and Recycling Technology

VDMA

Supplier's Guide
Waste Management

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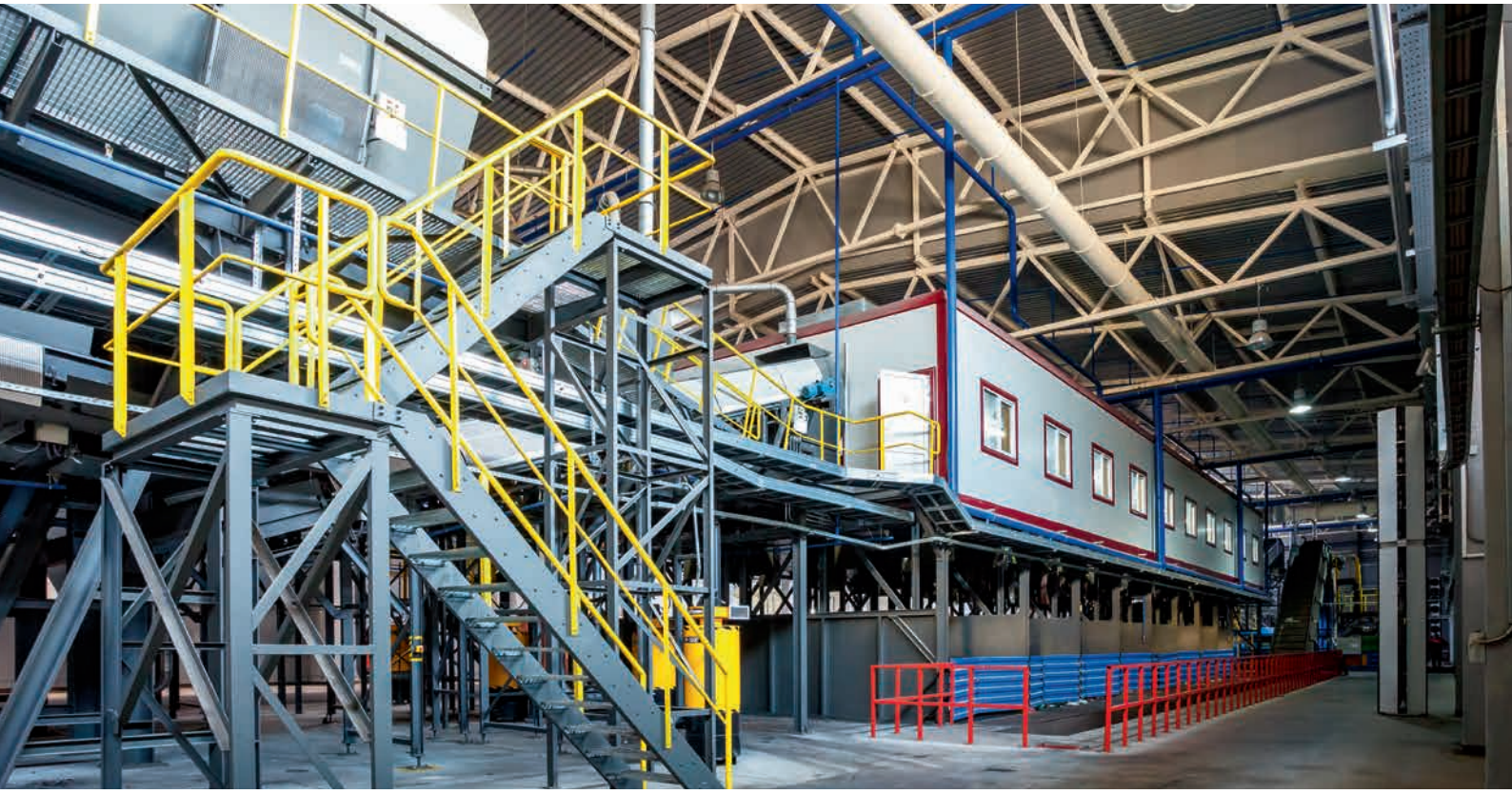
Supplier's Guide for Waste Management



Green Technology

Waste management is one of the oldest branches of industry in the world. Formerly, it was primarily a matter of eliminating undesirable residual materials. A new understanding of the environment, limited raw material reserves, increasing raw material prices and the political dependencies of some or material suppliers have led to a new approach. In the course of the last 30 years, waste management has developed into recycling management, at least in Europe. At the present time, this industrial sector is also understood to be a secondary raw materials industry.

In Europe, the proportion of materials disposed of has been decreasing continuously for years due to legislative regulations (such as a landfill ban) in favour of utilization. For all types of waste (such as mixed municipal waste, biological waste and plastics), there is a series of proven utilization technologies, commencing with the processing into refuse-derived fuels and extending up to recycling methods for new products.

Nevertheless, the disposal of waste in landfills continues to be the main path of disposal outside of Europe. However, even Europe still has a large number of shut down, as well as operational, landfills. The environmentally compatible operation of landfills is an important task for reducing the climate-damaging emissions of methane. In this field, European manufacturers have many years of experience.

Secondary Raw Materials and Climate Protection – the Future through Mechanical Engineering and Plant Construction

No political objectives of the past, the present and the future are possible without the corresponding, innovative technology. The member companies of the VDMA Association Waste Treatment and Recycling Technology, project, build and deliver plants for the environmentally compatible disposal of waste, for the recovery of high-quality secondary raw materials and for generating renewable energy.

The complex field of the secondary raw materials industry presupposes that the manufacturers are in possession of bundled know-how and have the capacity to develop customer-oriented system concepts. European manufacturers are leaders in this area. An export rate of more than 70% says it all. From Europe to the whole world!

The present industry leader offers an overview of the technology suppliers, organized in the VDMA Association Waste Treatment and Recycling Technology, for machines and plants in the areas of

- waste wood
- scrap metal/end-of-life vehicles
- waste paper and paper documents
- used tyres
- ashes/slags
- battery recycling
- organic waste
- landfill gas technology (renewable energy/ climate protection)
- solid recovered fuels (renewable energy/ climate protection)
- Used electrical and electronic equipment and data carriers
- construction and demolition waste
- plastics
- mono-fractioned plastics
- municipal waste (including household waste)

This is followed by all participating suppliers of technology in alphabetical order.

Further information on the subject of waste and recycling technology may be found under **https://www.vdma.org/waste-treatment-recycling-technology** or can be requested from **art@vdma.org**.

vdma.org/waste-treatment-recycling-technology

Processing of waste wood

	Conveyors	Material handling	Feeders	Comminutors	Metal Deposition	Classifiers	Sorters	Sensor-Sorters	Sifters	Pelletizers	Press	Mixers	Dryers	Incinerators	Carbonizing/Pyrolysers	Material Utilization/ Recovery	Exhaust Air Purifier	Mobile Plant	Complete Plant
allmineral Aufbereitungstechnik GmbH & Co.KG						●	●						●					●	●
ALLRECO GmbH	●		●	●		●	●		●			●							●
Altenburger Maschinen Jäckering GmbH				●									●					●	●
ANDRITZ Feed & Biofuel B.V.										●									
ANDRITZ MeWa GmbH	●		●	●	●	●	●									●			●
awama GmbH													●						
Baljer & Zembrod GmbH & Co. KG		●																	
BRT HARTNER GmbH			●	●		●	●					●	●						
CBI Europe B.V.	●			●	●													●	●
DI MATTEO Group Germany	●					●	●		●				●	●		●		●	
Dieffenbacher GMBH Maschinen- und Anlagenbau	●	●	●	●	●	●	●	●	●		●	●	●	●		●	●		●
Doppstadt Umwelttechnik GmbH	●			●	●	●	●		●									●	●
Entsorgungstechnik BAVARIA GmbH	●		●	●	●	●	●	●									●		●
ERMAFA Sondermaschinen- und Anlagenbau GmbH	●		●	●			●												
Eschlböck Maschinenfabrik GmbH	●		●	●														●	
EVK DI Kerschhaggl GmbH					●	●		●											
HAAS Recycling-Systems	●		●	●	●	●	●	●	●									●	●
Haver & Boecker Drahtweberei						●													
HAVER Engineering																		●	
HEIN, LEHMANN GmbH	●		●			●	●												
Hellmich GmbH & Co. KG																	●		
JENZ GmbH	●		●	●	●													●	
JÖST GmbH + Co. KG	●		●			●	●		●				●						
Komptech GmbH				●	●	●	●		●									●	●
Lindner-Recyclingtech GmbH	●		●	●	●	●	●											●	●
Lödige Process Technology												●							●
Ludden & Mennekes Entsorgungs-Systeme GmbH											●								
MOCO Maschinen- und Apparatebau GmbH & Co. KG	●		●	●															
NEUE HERBOLD Maschinen- und Anlagenbau GmbH	●		●	●	●														●
Pallmann Maschinenfabrik GmbH	●		●	●		●			●						●	●	●		
Scheuch LIGNO GmbH	●										●					●			
Sesotec GmbH			●		●		●												
SPALECK GmbH & Co. KG	●		●			●	●											●	
STADLER Anlagenbau GmbH	●		●			●	●		●										●
STEINERT GmbH					●		●	●										●	
Sutco RecyclingTechnik GmbH	●		●			●	●		●		●	●							
Terex Ecotec	●		●	●	●	●	●		●									●	
UNTHA shredding technology GmbH	●		●	●	●													●	●
Vecoplan AG	●		●	●	●	●	●		●										●
Ventilatorenfabrik Oelde GmbH																	●		
WEIMA Maschinenbau GmbH	●		●	●	●						●								●
Wessel-Umwelttechnik GmbH																	●		
Xproducts Deutschland GmbH				●														●	●
Zemmler Siebanlagen GmbH						●												●	

Waste wood

Waste wood is a hotly contested material. There is much competition between biomass power plants, which use waste wood as fuel, and the wood and furniture industry, which utilize wood as a material. Taking Germany as an example, the volumes of waste wood for the German industry are by far not enough. The demand is met through imports from other countries.

The permissible handling of waste wood in Germany is governed by the Waste Wood Regulation with its four waste wood categories, which depend on the pollution burden of the waste wood. In addition, the principle of the waste industry, "Use it before you dispose it", is to be found in the Recycling and Waste Law, as well as in the EU Waste Framework Directive. This principle applies also to waste wood.

Waste wood is converted into new wood products or insulating materials and environmentally friendly bioenergy!

Against the background of raw materials of limited availability and also from the point of view of climate protection, repeated utilization of waste wood is one of the cornerstones of a sustainable economic cycle. Waste wood can be utilized, for example, by high-quality processing for use in new products. Valuable primary materials are saved in this way

If it can no longer be used as a material, the energy from waste wood contributes significantly to attaining worldwide climate protection. After all, the combustion of waste wood is $C0_2$ neutral.

Regardless of whether it is to be used for energy or as a material, the waste wood must be processed suitably before the actual utilization or combustion process. This is accomplished mostly by size-reduction, sorting and classifying processes.

Processing of scrap metal

	Conveyors	Material Handling	Feeders	Comminutors	Classifiers	Sorters	Sifters	Press	Exhaust Air Purifier	Mobile Plant	Complete Plant
allmineral Aufbereitungstechnik GmbH & Co.KG					●	●				●	●
ALLRECO GmbH	●		●	●	●	●	●				●
Altenburger Maschinen Jäckering GmbH				●						●	●
ANDRITZ MeWa GmbH	●		●	●	●	●					●
Baljer & Zembrod GmbH & Co. KG		●									
BHS-Sonthofen GmbH	●		●	●	●	●	●				●
BRT HARTNER GmbH			●	●	●	●	●				
Doppstadt Umwelttechnik GmbH	●				●	●	●		●	●	
Entsorgungstechnik BAVARIA GmbH	●		●		●	●	●		●		●
ERMAFA Sondermaschinen- und Anlagenbau GmbH	●		●			●					
EVK DI Kerschhaggl GmbH						●					
GEA Group AG									●		
Haver & Boecker Drahtweberei					●						
HEIN, LEHMANN GmbH	●		●		●	●					
Hellmich GmbH & Co. KG									●		
Herding GmbH Filtertechnik									●		
JBF Maschinen GmbH	●		●	●				●	●	●	●
JÖST GmbH + Co. KG	●		●		●	●	●				
Lindner-Recyclingtech GmbH	●		●	●	●					●	●
MOCO Maschinen- und Apparatebau GmbH & Co. KG	●		●	●							
Pallmann Maschinenfabrik GmbH				●				●			
Recuperma Service GmbH	●		●	●							
Sesotec GmbH			●			●					
SPALECK GmbH & Co. KG	●		●		●	●				●	
STADLER Anlagenbau GmbH	●		●		●	●	●				●
STEINERT GmbH						●				●	
Sutco RecyclingTechnik GmbH	●										
Terex Ecotec	●						●			●	
unoTech GmbH								●			
UNTHA shredding technology GmbH	●		●	●						●	●
Ventilatorenfabrik Oelde GmbH	●						●		●		
WEIMA Maschinenbau GmbH	●		●	●				●			●
Wessel-Umwelttechnik GmbH									●		
Zemmler Siebanlagen GmbH					●					●	

Scrap metal/end-of-life vehicles

In ancient times, one material in particular was recycled: metal. Presumably, it is the oldest recycled product in the world. Relatively pure fractions of a particular metal or a metal mixture are referred to as scrap metal. Good examples are

- scrap copper,
- scrap cables,
- scrap steel.

In earlier years, it was already clear that so-called secondary metals for new production cost less than metals recovered from ores. Recycling metals also makes sense from an environmental point of view: recycling uses only about one third of the energy required for producing primary metal.

This benefits the climate and saves money. Where does scrap metal come from? Classical examples of this are end-of-life-vehicles, electric scrap and scrap cables. The potential of recyclable material just in end-of-life vehicles is enormous: Steel, aluminium, copper and lead. In the catalyst, there is platinum, palladium or rhodium.

Early on, legislators recognized the potential of recycling end-of-life vehicles and also of electrical scrap (see section: “Electric and Electronic Scrap“) and, with the European end-of-life vehicle directive (directive 2000/53/EC) and the German end-of-life vehicle law (2002, 2013 version), have established, for instance, the minimum recovery rate.

After a prior treatment, end-of-life vehicles are treated in so-called large shredder plants. Subsequently, at least nonferrous metals are separated from ferrous metals.

The main objective of all recycling plants for scrap metal is a quality scrap, with a high density, a substantial purity and a largely homogeneous particle size. The quality scrap is then used, for instance, in the steel industry.

Processing waste paper and paper documents

	Conveyors	Material Handling	Feeders	Data protection-compliant shredding of paper documents	Comminutors	Classifiers	(Sensor) Sorters	Sifters	Presses	Exhaust Air Purifier	Complete Plant
ALLRECO GmbH	●		●		●	●		●			●
AMANDUS KAHL & Co. KG									●		
ANDRITZ MeWa GmbH	●		●		●	●	●				●
Baljer & Zembrod GmbH & Co. KG		●									
BRT HARTNER GmbH			●		●	●		●			
DI MATTEO Group Germany	●							●			
Doppstadt Umwelttechnik GmbH	●				●	●		●			●
Entsorgungstechnik BAVARIA GmbH	●		●	●	●	●	●	●		●	●
ERMAFA Sondermaschinen- und Anlagenbau GmbH	●		●		●						
EVK DI Kerschhaggl GmbH						●	●				
HAAS Recycling-Systems	●		●		●	●		●			●
Haver & Boecker Drahtweberei						●					
HEIN, LEHMANN GmbH	●		●			●					
Hellmich GmbH & Co. KG										●	
Herbold Meckesheim GmbH					●						
JBF Maschinen GmbH	●		●	●	●				●	●	●
JÖST GmbH + Co. KG								●			
Lindner-Recyclingtech GmbH	●		●		●	●					
Ludden & Mennekes Entsorgungs-Systeme GmbH			●						●		
MOCO Maschinen- und Apparatebau GmbH & Co. KG	●		●	●	●						
Pallmann Maschinenfabrik GmbH	●		●		●			●	●	●	●
Scheuch LIGNO GmbH	●				●				●	●	
Sesotec GmbH							●				
SPALECK GmbH & Co. KG	●		●			●					
STADLER Anlagenbau GmbH	●		●			●		●			●
STEINERT GmbH							●				
Strautmann Umwelttechnik GmbH									●		
Sutco RecyclingTechnik GmbH	●		●			●		●	●		●
Terex Ecotec	●		●		●	●		●			
unoTech GmbH									●		
UNTHA shredding technology GmbH	●		●	●	●						●
Vecoplan AG	●		●	●	●	●	●	●			●
Ventilatorenfabrik Oelde GmbH	●							●		●	
Vogelsang GmbH & Co. KG					●						
WEIMA Maschinenbau GmbH	●		●		●				●		●
Welger Recycling Engineering GmbH									●		
Wessel-Umwelttechnik GmbH										●	
Xproducts Deutschland GmbH					●						●
Zemmler Siebanlagen GmbH						●					

Waste paper and paper documents

Wastepaper, cardboard and cardboard packaging waste are valuable raw materials for satisfying the demand for raw material for newspapers, packaging or tissues. Recycling paper/cardboard/cardboard packaging is one of the oldest recycling methods. The wastepaper utilization rate in the German pulp and paper industry was more than 79% in 2020. In 2020, a total of 56 million tonnes of paper were collected and recycled in Europe – this corresponds to a recycling rate of 74%. The EU recycling rate for paper/cardboard/cardboard packaging is around 72 per cent. So there is still room for improvement.

The recycling rate for paper packaging is even higher. 83% of paper and cardboard packaging in Europe is recycled.

For technical reasons, waste paper can be recycled only to a limited extent, since the fibres become too short with increasing recycling. The advantage of using secondary paper, cardboard and cardboard packaging lies in the significantly less energy employed and in the CO_2 savings associated therewith, as well as in the conservation of timber reserves.

A portion of the paper, cardboard and cardboard packaging is collected together with other household or industrial waste and is not collected separately. From a technical point of view, separation is possible if the water content of the mixed waste is sufficiently low and the degree of contamination is slight. However, significantly higher qualities are attained if these materials are collected separately. Especially in the case of very high grade technical papers, this is the only solution.

Data in documents or on data carriers must be securely destroyed depending on the required protection class. DIN 66399 specifies six material levels and seven security levels for each material. The higher the security level, the greater the effort involved in the shredding process. The international standard ISO-IEC 21964 has adopted the contents of DIN 66399.

Processing used tyres

	Conveyors	Material Handling	Feeders	Comminutors	Classifiers	(Sensor) Sorters	Sifters	Grinders	Press	Exhaust Air Purifier	Mobile Plant	Complete Plant
ALLRECO GmbH	●		●	●	●		●					●
Altenburger Maschinen Jäckering GmbH				●				●			●	●
AMANDUS KAHL & Co. KG	●		●	●	●	●	●	●	●			●
ANDRITZ MeWa GmbH	●		●	●	●	●	●	●				●
Baljer & Zembrod GmbH & Co. KG		●										
BRT HARTNER GmbH			●		●		●					
DI MATTEO Group Germany	●											
Doppstadt Umwelttechnik GmbH	●			●	●		●				●	
ERMAFA Sondermaschinen- und Anlagenbau GmbH	●		●	●	●	●	●	●	●	●	●	●
Haver & Boecker Drahtweberei					●							
HEIN, LEHMANN GmbH	●		●		●							
Hellmich GmbH & Co. KG										●		
Herbold Meckesheim GmbH				●				●				
Herding GmbH Filtertechnik										●		
JBF Maschinen GmbH	●		●	●						●	●	●
JÖST GmbH + Co. KG	●		●		●		●					●
Komptech GmbH				●	●		●				●	●
Lindner-Recyclingtech GmbH	●		●	●	●						●	
MOCO Maschinen- und Apparatebau GmbH & Co. KG	●		●	●								
NEUE HERBOLD Maschinen- und Anlagenbau GmbH	●		●	●			●	●			●	●
Pallmann Maschinenfabrik GmbH	●		●	●			●	●		●		●
Scheuch LIGNO GmbH	●									●		
Sesotec GmbH						●						
SPALECK GmbH & Co. KG	●		●		●						●	
STADLER Anlagenbau GmbH	●		●									
STEINERT GmbH						●					●	
Terex Ecotec	●		●	●			●				●	
UNTHA shredding technology GmbH	●		●	●							●	●
Ventilatorenfabrik Oelde GmbH							●			●		
Vogelsang GmbH & Co. KG				●								
Wessel-Umwelttechnik GmbH										●		
Zemmler Siebanlagen GmbH					●						●	

Used tyres

In Germany alone, there are about 600,000 tons of used tyres per year and, in the EU, about 3.5 million tons. Aside from rubber, used tyres also contain large amounts of metal and textiles. If tyres no longer meet the requirements of street traffic, they must be disposed of properly. This can be done in various ways:

- Recycling
- Incinerating or co-incinerating.

New tyres or other products can be produced from old tyres. For producing 1 kg of secondary granulate, approximately 0.6 kWh is consumed; for primary material, 35 kWh are consumed – that is, 55 times as much. Around 700 kg of CO_2 emissions can be saved per tonne of used tyres that are recycled.

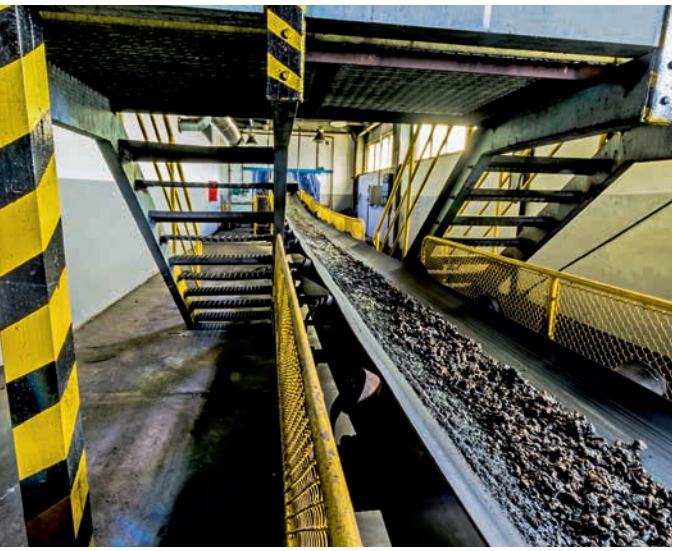
In principle, old tyres are comminuted by means of different units and, subsequently, the metal constituents as well as the textile and dust constituents are removed. Rubber granulates or powders of different particle sizes remain behind and are frequently subsequently processed into rubber powder.

However, this is not enough: The granulate is converted into floor coverings, insulating materials and moulded parts, for example, for the automobile industry, or the rubber flour is used as an additive in tyre production.

The companies, organized in the VDMA Waste Treatment and Recycling Technology Association, cover the complete range of products from individual units up to complete installations.

Processing of ashes/slag

	Slag Removers	Irrigation Technology	Ventilation Technology for dewatering	Conveyors	Feeders	Comminutors	(Sensor) Sorters	Sifters	Grinders	Washing Methods	Dryers	Mobile Plant	Complete Plant
allmineral Aufbereitungstechnik GmbH & Co.KG	●									●	●	●	●
ALLRECO GmbH				●	●	●	●	●		●	●		●
Altenburger Maschinen Jäckering GmbH						●			●		●	●	●
ANDRITZ MeWa GmbH				●	●	●	●						●
awama GmbH											●		
BHS-Sonthofen GmbH				●	●	●	●	●	●				●
BRT HARTNER GmbH								●			●		
Crush+Size Technology GmbH & Co. KG						●							
DI MATTEO Group Germany	●			●				●				●	
Doppstadt Umwelttechnik GmbH				●		●		●				●	
EVK DI Kerschhaggl GmbH							●						
HAAS Recycling-Systems				●	●	●		●				●	●
HAVER ENGINEERING GMBH												●	
HAVER NIAGARA GmbH				●	●							●	●
HEIN, LEHMANN GmbH				●	●								
JÖST GmbH + Co. KG				●	●			●	●	●	●		
MARTIN GmbH für Umwelt- und Energietechnik	●			●			●	●					●
Maschinenfabrik Gustav Eirich GmbH & Co. KG									●		●		
MOCO Maschinen- und Apparatebau GmbH & Co. KG				●	●	●							
Rockster Austria International GmbH						●						●	
Sesotec GmbH							●						
SKG Aufbereitungstechnik GmbH				●	●	●				●			●
SPALECK GmbH & Co. KG				●	●		●					●	
STADLER Anlagenbau GmbH				●	●			●					●
STEINERT GmbH							●						
STRABAG Umwelttechnik GmbH													●
Sutco RecyclingTechnik GmbH				●	●			●					●
Terex Ecotec				●				●				●	
Vecoplan AG				●									
Ventilatorenfabrik Oelde GmbH								●					
Vogelsang GmbH & Co. KG						●							
Zemmler Siebanlagen GmbH												●	



Ashes/slags from waste incinerators

Every incineration process produces solid residues, such as ash, slag and dust. These consist primarily of inorganic compounds. The slag, produced in the combustion space, is always discharged by means of a slag remover and cast into a water bath. Dust is eliminated in the course of cleaning the flue gas.

In the past, the mineral residues of combustion processes were frequently used as backfilling material or deposited in landfills. However, in recent years, the idea of processing ash and slag and subsequently using them for road and path construction or landfill (secondary building materials), has caught on increasingly. At the present time, about 90% of ash and slag is recovered in Germany.

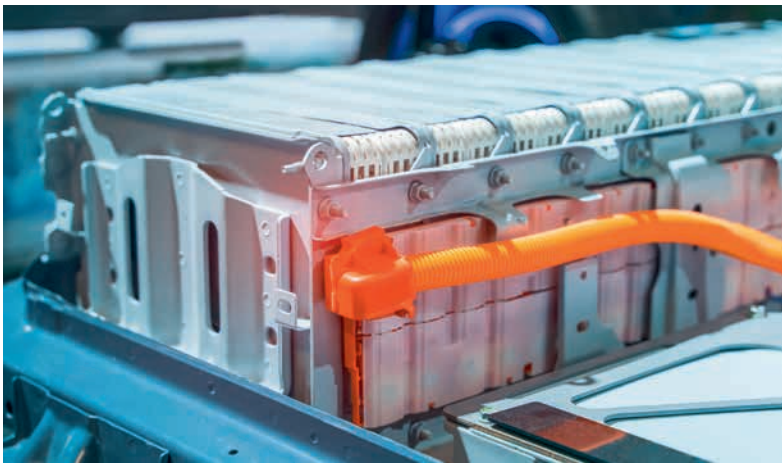
The objective of processing ash and slag is to remove and recover unburned portions, to immobilize pollutants, to recover ferrous and nonferrous metals and to produce secondary building materials.

Until now, there has not been a uniform set of rules governing the quality requirements of secondary building materials in the European Union or in Germany. Basic regulations may be found in the European Landfill Directive. In Germany, the ordinance pertaining to the recovery of waste at surface landfills offers an appropriate framework for incorporation in landfills and the M20 leaflet of the Federal/State Waste Committee (Bund-/Länder-Arbeitsgemeinschaft Abfall) contains further regulations. The political goal, however, is to produce a substitute building materials ordinance.

Battery recycling

	Dismantling technology	Material Ablation	Unloading technology	Conveyors	Feeders	Comminutors	Gas cleaning	Dryers	Classifiers	Sifters	Bulk material filling	Exhaust Air Purifier	Pyrolysis	Hydrometallurgy	Exhaust gas treatment	Complete Plant
ALLRECO GmbH				●	●	●			●							
ANDRITZ Gouda B.V.								●								
ANDRITZ SEPARATION GmbH - Köln														●		
ANDRITZ Separation GmbH - Vierkirchen														●		
BHS-Sonthofen GmbH				●	●	●	●	●	●	●	●	●			●	●
Bosch Rexroth AG	●		●	●												
BRT HARTNER GmbH					●				●							
Entsorgungstechnik BAVARIA GmbH				●	●				●	●		●				●
ERMAFA Sondermaschinen und Anlagenbau GmbH	●		●	●	●	●	●	●	●	●	●	●			●	●
GEA Group AG							●					●		●	●	
HAVER ENGINEERING GmbH									●	●						●
HAVER NIAGARA GmbH									●							
HEIN, LEHMANN GmbH				●	●				●	●						
Hellmich GmbH & Co. KG							●					●			●	
Herbold Meckesheim GmbH						●		●		●	●					
Herding GmbH Filtertechnik							●					●			●	
JÖST GmbH + Co. KG			●		●			●	●	●	●					
Lödige Process Technology								●								
MOCO Maschinen und Apparatebau						●										
RET Reckelberg Environmental Technologies GmbH	●		●	●	●	●	●	●	●	●	●	●			●	●
Riedhammer GmbH					●	●			●	●			●		●	
SPALECK GmbH & Co. KG				●	●				●	●						
STADLER Anlagenbau GmbH				●	●	●	●	●	●	●	●	●			●	●
STEINERT GmbH										●						
TRUMPF Laser- und Systemtechnik GmbH	●	●						●								
UNTHA shredding technology GmbH	●	●	●	●	●	●	●	●	●	●	●	●				●
Ventilatorenfabrik Oelde GmbH								●	●			●				
Vogelsang GmbH & Co. KG						●										
WEIMA Maschinenbau GmbH				●	●	●										
Wessel-Umwelttechnik GmbH															●	
Zemmler Siebanlagen GmbH									●							

Battery recycling

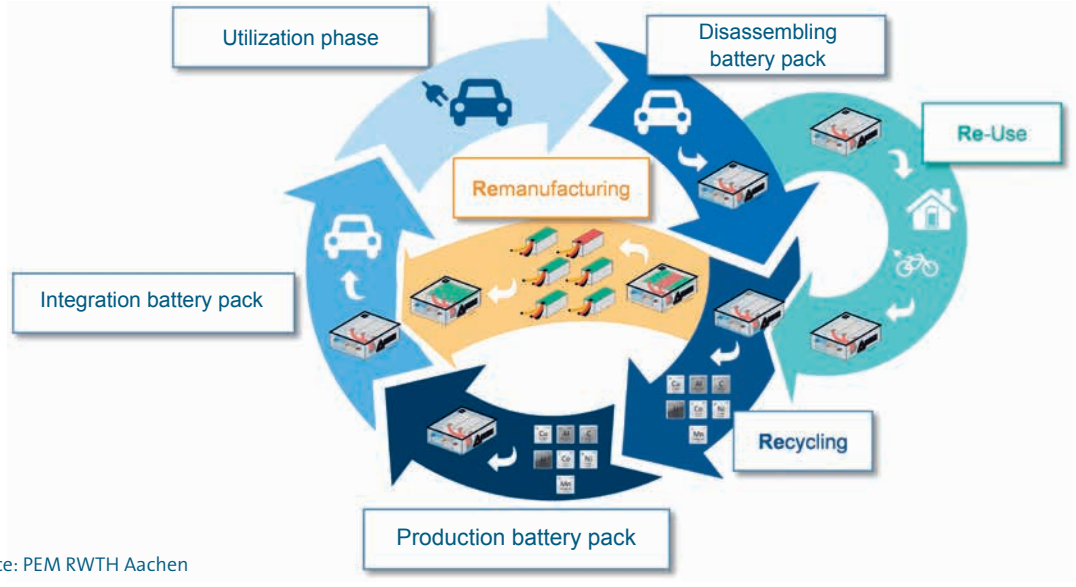


Due to the increasing popularity of battery electric vehicles, an enormous market for battery systems is developing in Europe, with approximately 2.5 megatons of new batteries expected to be produced in the EU by 2030. This leads to questions about the environmental footprint of vehicle batteries, but equally about raw material security and availability, and thus the competitiveness of German and European industries. In this context, local battery recycling and the return of raw materials is an important building block for a European circular economy. It is not only the development along the direct battery value chain that is of great importance for Germany's mechanical engineering locations.

Results of a study conducted by Fraunhofer ISI in 2021 on behalf of the IMPULS Foundation of the VDMA show: In Europe, the volume of end-of-life lithium-ion batteries and battery components to be recycled could amount to about 230 kilotons per year from 2030 and about 1,500 kilotons per year from 2040. These figures, already adjusted for potential vehicle and battery exports, imply annual growth in the recycling industry of more than 30 percent over the next few years. The return of traction batteries from electric vehicles will play the main role in the medium term.

German and European machinery and plant manufacturers are already active as development partners and suppliers for the growing recycling industry.

The gigafactories for the production of battery systems that are now emerging in Europe in particular offer great opportunities to position themselves permanently. In addition to end-of-life batteries, a high proportion of production waste is already generated during battery cell production. The proportion of rejects in production is up to 40 per cent and must also undergo a recycling process. Here, cooperation with local plant suppliers is crucial.



Source: PEM RWTH Aachen

Treatment and utilization of organic waste

	Conveyors	Material Handling	Feeders	Comminutors	Classifier	Sorters	Sifters	Press	Mixers	Dryers	Composters	Fermenters	Exhaust Air Purifier	Mobile Plant	Complete Plant
ALLRECO GmbH	●		●	●	●	●	●		●	●	●				●
AMANDUS KAHL & Co. KG				●				●	●	●					
ANDRITZ MeWa GmbH	●		●	●	●	●									●
awama GmbH			●							●				●	
Baljer & Zembrod GmbH & Co. KG		●													
BHS-Sonthofen GmbH				●											
BRT HARTNER GmbH			●	●	●	●	●		●	●					
CBI Europe B.V.				●										●	●
DI MATTEO Group Germany	●					●	●			●				●	●
Doppstadt Umwelttechnik GmbH	●			●	●	●	●				●			●	●
ERMAFA Sondermaschinen- und Anlagenbau GmbH	●		●	●		●									
EVK DI Kerschhaggl GmbH					●										
HAAS Recycling-Systems	●		●	●	●	●	●							●	●
Haver & Boecker Drahtweberei					●										
HAVER NIAGARA GmbH	●		●												
HEIN, LEHMANN GmbH	●		●		●	●									
Hellmich GmbH & Co. KG													●		
Herhof GmbH										●	●	●	●		●
JENZ GmbH	●		●	●										●	
JÖST GmbH + Co. KG	●		●		●		●								
Komptech GmbH				●	●	●	●		●		●	●		●	●
Lödige Process Technology									●		●				
Ludden & Mennekes Entsorgungs-Systeme GmbH	●							●							
MOCO Maschinen- und Apparatebau GmbH & Co. KG	●		●	●											
NEUE HERBOLD Maschinen- und Anlagen GmbH				●											
SPALECK GmbH & Co. KG	●		●		●	●								●	
STADLER Anlagenbau GmbH	●		●		●	●	●								●
STEINERT GmbH						●								●	
STRABAG Umwelttechnik GmbH										●	●	●		●	●
Sutco RecyclingTechnik GmbH	●		●		●	●	●	●	●	●	●	●			●
Terex Ecotec	●		●	●	●	●	●							●	
UGN-Umwelttechnik GmbH													●		
unoTech GmbH							●								
UNTHA shredding technology GmbH	●		●	●										●	
Vecoplan AG	●		●	●	●										
Ventilatorenfabrik Oelde GmbH							●						●		
Vogelsang GmbH & Co. KG				●				●	●					●	
WEIMA Maschinenbau GmbH	●		●	●				●							●
Wessel-Umwelttechnik GmbH													●		
Xproducts Deutschland GmbH				●										●	●
Zemmler Siebanlagen GmbH					●									●	

Organic waste

Organic waste is a speciality. It consists of organic material, which can be broken down by micro-organisms or enzymes. It is therefore outstandingly suitable for utilization.

It is not only for this reason that the Landfill Directives of the European Union codifies that certain organically degradable waste can no longer be disposed of or be disposed of only in certain proportions on landfills. The EU Waste Framework Directive also follows the principle of “Use it before you dispose of it”.

Organic waste constitutes more than 39% of municipal waste. This potential is to be utilized. In 2020, almost 15,4 million tons of biological waste per year are collected separately and subsequently utilized in Germany.

This can be carried out from a material as well as from an energy point of view, or as a combination of the two. Organic waste is converted into valuable, quality compost in composting plants. Microorganisms produce biogas in fermentation plants (biogas plants) and this gas, in turn, is used to produce electricity and heat.

Bioenergy contributes significantly to achieving the goals of worldwide climate protection. However, biomass can be used for purposes other than energy. Against the background of raw materials of limited availability and also from the point of view of climate protection, repeated material utilization of organic waste is one of the cornerstones of a sustainable economic cycle. The consistent, sustainable orientation of economic processes, meanwhile, is a component of many political programs in Germany, as well as in the rest of the world.

Regardless of whether it is to be used as energy or as a material, organic waste must be processed in a suitable manner before the actual utilization process. This is accomplished mostly by comminuting, sorting and manufacturing processes.

Landfill gas technology

	Landfill Gas Conveying Technology	Gas Collecting Stations	Gas Preparation and Purification	Gas Conveying and Compression Technology	Landfill Gas Utilization Technology	CHP/Lean Gas Optimization	CHP/Gas Internal Combustion Engines	Heat Generating Plants	Landfill Treatment Technology	High Temperature Flare	Lean Gas Flare	Regenerative Thermal Oxidation	Flameless Thermal Oxidation (FLOX)	Thermal Post Combustion	Biofilter	Services	Mobile Plant	Complete Plant
GEA Group AG			●															
Green Gas Germany GmbH						●												
LAMBDA Gesellschaft für Klimaschutz und regenerative Energien mbH	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
UGN-Umwelttechnik GmbH			●												●	●		
Wessel-Umwelttechnik GmbH										●	●	●	●	●	●			

Landfill gas technology

Landfill gas is formed when waste is deposited in landfills. The predominant portion of landfill gas is methane, a gas with a high greenhouse potential. If it is not collected appropriately, the gas escapes unhindered into the atmosphere and contributes appreciably to changing the climate. Landfills emit gas for more than 25 years.

In spite of all political declarations of intent to the contrary, waste is still being disposed of primarily in landfills worldwide. It is therefore important to optimize landfills also with respect to protecting the climate. Technologies for achieving this exist.

The first step consists of collecting the gas by means of gas collecting stations, gas preparation and gas purification, conveying and aggregation technology. The second step is the utilization of the energy content of the landfill gas for producing renewable energies. For this purpose, combined heat and power plants and heat generating plants are offered.

In the event that conversion into electricity is not possible (for example, landfill gas of low quality or in a small amount), thermal and biological systems are used for treating the landfill gas. High temperature flares, lean gas flares, thermal post combustion, flameless thermal oxidation, bio-filters and also heat generating plants are available for this purpose.

Landfill technologies for actively protecting the climate are offered on the world market by German manufacturers. Climate protection on landfills is a sensible investment from an economic and climatic point of view.

Further information about landfill gas utilization technology may be obtained in the VDMA Supplier's Guide "Active climate protection – treatment and recycling of methane. Technologies for landfill, mine and sewage gas".

Solid recovered fuels

	Conveyors	Material Handling	Feeding Equipment	Comminutors	Classifiers	(Sensor) Sorters	Sifters	Mixers	Dryers	Packing (Pressing, Pelletizing, etc.)	Mechanical-Biological Treatment Plant	Exhaust Air Purifiers	Mobile Plant	Waste-to-Energy Plant (Complete Plant)
ALLRECO GmbH	●		●	●	●	●	●	●	●		●			●
Altenburger Maschinen Jäckering GmbH				●					●				●	●
AMANDUS KAHL & Co. KG				●				●	●	●				
ANDRITZ Feed & Biofuel B.V.										●				
ANDRITZ MeWa GmbH	●		●	●	●	●								●
awama GmbH			●						●		●		●	
Baljer & Zembrod GmbH & Co. KG		●												
BHS-Sonthofen GmbH				●										
BRT HARTNER GmbH			●	●	●		●	●	●					
CBI Europe B.V.				●									●	
Dieffenbacher GMBH Maschinen- und Anlagenbau														●
DI MATTEO Group Germany	●				●		●						●	●
Doppstadt Umwelttechnik GmbH	●			●	●		●						●	●
Entsorgungstechnik BAVARIA GmbH	●		●	●	●	●	●					●		●
EVK DI Kerschhaggl GmbH					●	●								
HAAS Recycling-Systems	●		●	●	●		●						●	●
Haver & Boecker Drahtweberei					●									
HEIN, LEHMANN GmbH	●		●		●									
Hellmich GmbH & Co. KG												●		
Herding GmbH Filtertechnik												●		
Herhof GmbH									●		●	●		●
JÖST GmbH + Co. KG	●		●		●		●		●					
Komptech GmbH				●	●		●	●			●		●	●
Lindner-Recyclingtech GmbH	●		●	●	●	●	●						●	●
Lödige Process Technology								●		●				●
Ludden & Mennekes Entsorgungs-Systeme GmbH										●				
MARTIN GmbH für Umwelt- und Energietechnik														●
Maschinenfabrik Gustav Eirich GmbH & Co. KG								●	●	●				
MOCO Maschinen- und Apparatebau GmbH & Co. KG	●		●	●										
NEUE HERBOLD Maschinen- und Anlagen GmbH	●		●	●			●		●			●	●	●
Pallmann Maschinenfabrik GmbH	●		●	●	●		●	●				●		●
Scheuch LIGNO GmbH	●											●		
Sesotec GmbH						●								
SPALECK GmbH & Co. KG	●		●		●	●							●	
STADLER Anlagenbau GmbH	●		●		●		●	●			●			●
STEINERT GmbH						●								
STRABAG Umwelttechnik GmbH									●		●		●	●
Terex Ecotec	●		●	●	●		●						●	
UNTHA shredding technology GmbH	●		●	●									●	●
Vecoplan AG	●		●	●	●	●	●	●	●					●
Ventilatorenfabrik Oelde GmbH							●					●		
Vogelsang GmbH & Co. KG				●										
WEIMA Maschinenbau GmbH	●		●	●		●	●			●				●
Wessel-Umwelttechnik GmbH												●		
Xproducts Deutschland GmbH				●									●	●
Zemmler Siebanlagen GmbH					●								●	

Solid recovered fuels

As early as 1980, the first concepts for solid recovered fuels were developed in Germany. At that time, it was given the somewhat unwieldy name of “BRAM”. Today, the name “solid recovered fuels” is in use.

Solid recovered fuels may result, for example, from the processing of

- bulky waste,
- commercial waste,
- household waste.

The depth of preparation depends on the use made of the solid recovered fuels, that is, on the different quality requirements of the thermal method, in which these are used. Frequently, the size of the pieces of solid recovered fuels and the proportion of contaminating materials are of decisive importance. Furthermore, the calorific value, the moisture content, as well as the percentages of heavy metals and chlorine play a role, since even the solid recovered fuels must satisfy increasing demands on quality.

Solid recovered fuels are a substitute for primary fuels either in co-incinerators or mono-incinerators. These may be industrial furnaces, large-scale power plants or special power plants using solid recovered fuels.

In comparison to primary fuels, a high CO_2-savings potential is an advantage of solid recovered fuels. This potential lies between 350 and 1000 kg of carbon dioxide equivalents per ton. Moreover, the generation of energy from waste does not rely solely on limited primary fuels and frequently uses waste streams obtained locally. Accordingly, in-house power plants, which use solid recovered fuels, have been established in many energy intensive industries, such as paper mills.

How is waste converted into solid recovered fuels? This is a question which the VDMA member companies are competent to answer and do so gladly.

It does not matter whether the solid recovered fuels are to be produced with the help of a mechanical-biological plant from household waste or with the help of a processing plant from commercial waste. Machinery and Plant Construction is happy to help.

Utilization of used data carriers, electrical and electronic equipment and refrigeration equipment

	Conveyors	Material Handling	Feeders	Data protection-compliant shredding of data carriers	Comminutors	Facilities for manual sorting / sorting cabin	Classifier	(Sensor) Sorters	Sifters	Packing (Pelletizing, Pressing, etc.)	Exhaust Air Purifier	Complete Plant
ALLRECO GmbH	●		●		●	●	●	●	●			●
Altenburger Maschinen Jäckering GmbH					●							●
AMANDUS KAHL & Co. KG										●		
ANDRITZ Feed & Biofuel B.V.										●		
ANDRITZ MeWa GmbH	●		●		●	●	●	●	●			●
Baljer & Zembrod GmbH & Co. KG		●										
BHS-Sonthofen GmbH	●		●		●	●	●	●	●		●	●
BRT HARTNER GmbH			●		●		●		●			
Doppstadt Umwelttechnik GmbH	●				●	●	●		●			
ERMAFA Sondermaschinen- und Anlagenbau GmbH	●		●		●	●						
GEA Group AG											●	
HAAS Recycling-Systems	●				●	●			●			●
Haver & Boecker Drahtweberei							●					
HEIN, LEHMANN GmbH	●		●				●					
Hellmich GmbH & Co. KG											●	
Herbold Meckesheim GmbH	●		●		●		●		●		●	●
Herding GmbH Filtertechnik											●	
JBF Maschinen GmbH	●		●	●	●						●	●
JÖST GmbH + Co. KG	●		●				●		●			
Lindner-Recyclingtech GmbH	●		●		●							
MOCO Maschinen- und Apparatebau GmbH & Co. KG	●			●	●							
NEUE HERBOLD Maschinen- und Anlagen GmbH	●		●		●				●		●	●
Pallmann Maschinenfabrik GmbH	●		●		●		●		●		●	●
Recuperma Service GmbH	●		●		●							
Sesotec GmbH			●					●				
SPALECK GmbH & Co. KG	●		●				●					
STADLER Anlagenbau GmbH	●		●		●	●	●	●	●		●	●
STEINERT GmbH								●				
Strautmann Umwelttechnik GmbH										●		
Terex Ecotec	●		●		●				●			
UNTHA shredding technology GmbH	●		●	●	●							●
Vecoplan AG	●		●	●	●		●	●	●			●
Ventilatorenfabrik Oelde GmbH									●		●	
WEIMA Maschinenbau GmbH	●		●		●							
Wessel-Umwelttechnik GmbH											●	
Xproducts Deutschland GmbH					●							●
Zemmler Siebanlagen GmbH							●					

Used electrical and electronic equipment and data carriers

Political decision-makers have been discussing used electrical and electronic equipment since the end of the last century. Until then, used equipment, at best, ended up with the bulky waste. There were no separate procedures for disposing of discarded refrigeration equipment, etc.

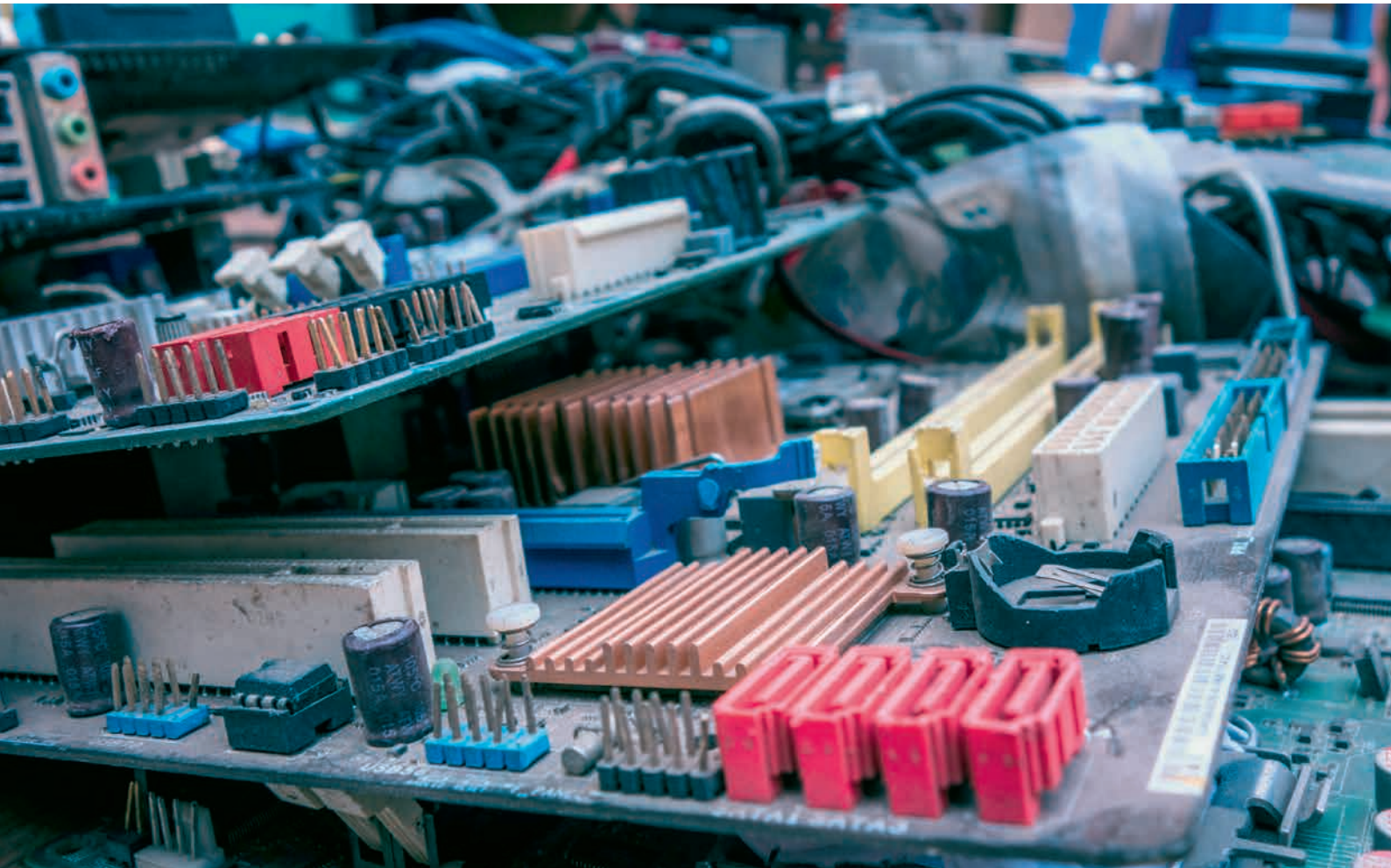
Early in the 1990s, the first national regulations for the environmentally compatible disposal of refrigeration equipment were created in Germany, Switzerland, the Netherlands and Austria.

The WEEE Directive 2012/19/EU currently regulates the sale, take-back and proper disposal of used electrical and electronic equipment within the European currency area. It came into force on 13 August 2012 and is an amendment to the WEEE Directive 2002/96/EC.

Refrigeration equipment, if disposed of improperly, has a particularly high potential for damaging the environment because of the propellant it contains. The proper handling of a refrigerator avoids the emission of 2,000 tons of carbon dioxide. Moreover, the recycling of electric and electronic devices helps to obtain secondary raw materials, such as plastics or metals.

Depending on the required protection class, data carriers must be securely destroyed. DIN 66399 specifies six material levels and seven security levels for each material. The higher the security level, the greater the effort involved in the shredding process. The international standard ISO-IEC 21964 has adopted the contents of DIN 66399.

The VDMA member companies are also experienced in the area of treating electric scrap due to many years of experience and the reliable conversion of the requirements of environmental law.



Construction and demolition waste

	Conveyors	Material Handling	Feeders	Pre-screen	Comminutors	Jaw crusher	Impact crusher/Impact mill	Cone crusher	Hammer mill	Roll crusher	Classifiers	Trommel screen	Oscillating screen	Sorters	Magnet separator	Air classifier	Float-sink treatment	Dust-suppression systems	Pneumatic and hydraulic tools	Mobile plant	Complete plant
allmineral Aufbereitungstechnik GmbH & Co.KG											●			●	●				●	●	●
ALLRECO GmbH	●		●	●	●						●	●	●	●		●	●				●
Altenburger Maschinen Jäckering GmbH					●		●													●	●
ANDRITZ MeWa GmbH	●		●		●																
Baljer & Zembrod GmbH & Co. KG		●																			
BHS-Sonthofen GmbH					●		●														
BRT HARTNER GmbH			●	●	●						●	●		●		●					
CBI Europe B.V.					●															●	●
Crush+Size Technology GmbH & Co. KG					●				●	●											
Doppstadt Umwelttechnik GmbH	●			●	●					●	●	●		●	●	●				●	●
Entsorgungstechnik BAVARIA GmbH	●		●	●							●		●	●	●	●					●
EVK DI Kerschhaggl GmbH											●										
HAAS Recycling-Systems	●		●		●						●					●					●
Haver & Boecker Drahtweberei											●										
HEIN, LEHMANN GmbH	●		●								●			●							
Hellmich GmbH & Co. KG																		●			
JÖST GmbH + Co. KG	●		●	●							●		●	●		●					
Komptech GmbH				●	●						●	●		●	●	●				●	●
Lindner-Recyclingtech GmbH	●		●		●						●				●					●	
MOCO Maschinen- und Apparatebau GmbH & Co. KG					●																
NEUE HERBOLD Maschinen- und Anlagen GmbH	●			●	●	●	●		●	●		●	●								●
Rockster Austria International GmbH					●	●	●				●	●	●		●	●				●	●
Sesotec GmbH														●							
SKG Aufbereitungstechnik GmbH	●		●	●	●	●	●	●			●		●	●	●		●				●
SPALECK GmbH & Co. KG	●		●	●							●		●	●						●	
STADLER Anlagenbau GmbH	●		●	●							●	●		●							●
STEINERT GmbH														●	●						
Terex Ecotec	●		●	●	●							●		●	●					●	
UNTHA shredding technology GmbH					●															●	
Vecoplan AG	●		●	●	●						●	●	●		●	●					●
Zemmler Siebanlagen GmbH												●								●	

Construction and demolition waste

Recycling of building materials is not a modern invention – even in the ancient world, recycling of building materials was practiced. Against the background of increasingly limited landfill capacities and rising costs for raw materials, orderly dismantling and recycling are playing an increasingly important role. Buildings that are no longer needed, or those that no longer meet the requirements of the users as well as the technical requirements, are dismantled to make room for something new or simply give nature back its terrain.

The resulting mineral waste can be divided into three qualities:

- Building rubble (from building construction): mainly mineral material (concrete, reinforced concrete, brickwork, bricks, sand-lime brick, mortar, tiles, ceramics, natural stone, gypsum) of mixed, with low proportion of impurities (wood, plastics, metals, paper), or of unmixed quality.
- Road construction waste: asphalt and concrete pavements, paving, curbs, gravel, grit.
- Construction waste (mixed construction waste): wood, plastics, glass, metals, plaster, cardboard, paint, composites.

The “source” is large - in 2020, the total amount of waste across the EU was 2,153 million tonnes. Almost two thirds of all waste in the EU in 2020 was important mineral waste. In Germany, this ratio is almost identical.

The companies organized within the VDMA Waste Treatment and Recycling Technology association have their own individual machines to generate high-quality recycled building materials (aggregates) from respective minerals. Their areas of application are:

- base courses and antifreeze layers in road and path construction (RC roads, RC paths),
- Dam building materials, backfill materials (sewer and pipeline construction),
- Asphalt road construction (RC asphalt),
- vegetation layers (porous soil substrates),
- Concrete aggregate for concrete products, concrete blocks, non-constructive and structural concrete components (RC concrete).

Recycling of plastics

	Conveyors	Material Handling	Feeders	Bag Opener	Comminutors	(Sensor) Sorter	Wet Separators	Classifiers	Sifters	Fine Grinding (Pulverizing)	Agglomerating	Briquetting	Presses	Washers	Dryers	Mixers	Exhaust Air Purifiers	Complete Plants, Plastics Processing
allmineral Aufbereitungstechnik GmbH & Co.KG							●	●						●	●			●
ALLRECO GmbH	●		●	●	●		●	●	●					●		●		●
Altenburger Maschinen Jäckering GmbH					●					●					●			●
AMANDUS KAHL & Co. KG					●								●		●			
ANDRITZ Feed & Biofuel B.V.													●					
ANDRITZ MeWa GmbH	●		●		●	●												
ANDRITZ SEPARATION GmbH - Köln							●	●						●	●			●
Baljer & Zembrod GmbH & Co. KG		●																
BRT HARTNER GmbH			●	●	●			●	●									
DI MATTEO Group Germany	●		●						●									
Doppstadt Umwelttechnik GmbH	●			●	●			●	●									
Entsorgungstechnik BAVARIA GmbH	●		●	●	●	●		●	●								●	●
ERMAFA Sondermaschinen- und Anlagenbau GmbH	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
EVK DI Kerschhaggl GmbH						●		●										
GEA Group AG																	●	
HAAS Recycling-Systems	●		●		●			●	●									●
Haver & Boecker Drahtweberei								●										
HEIN, LEHMANN GmbH	●		●					●										
Hellmich GmbH & Co. KG																	●	
Herbold Meckesheim GmbH	●		●	●	●		●	●	●	●	●		●	●	●	●	●	●
Herding GmbH Filtertechnik																	●	
JBF Maschinen GmbH	●		●	●	●					●							●	●
JÖST GmbH + Co. KG	●		●					●	●						●			
KEYCYCLE GmbH	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●
Komptech GmbH				●	●			●	●									●
KraussMaffei Extrusion GmbH																●	●	●
Lindner-Recyclingtech GmbH	●		●	●	●	●	●	●	●	●				●	●	●		●
Lödige Process Technology														●		●		
Ludden & Mennekes Entsorgungs-Systeme GmbH													●					
MOCO Maschinen- und Apparatebau GmbH & Co. KG	●		●	●	●													
NEUE HERBOLD Maschinen- und Anlagen GmbH	●		●		●		●		●	●				●	●		●	●
Scheuch LIGNO GmbH	●								●			●			●		●	
Sesotec GmbH	●		●			●		●	●									●
SPALECK GmbH & Co. KG	●		●					●										
STADLER Anlagenbau GmbH	●		●					●	●					●	●	●		●
STEINERT GmbH						●												
Strautmann Umwelttechnik GmbH												●	●					
Terex Ecotec	●		●	●	●			●	●									
UNTHA shredding technology GmbH	●		●	●	●													●
Vecoplan AG	●		●	●	●	●	●	●	●					●	●			●
Ventilatorenfabrik Oelde GmbH	●								●								●	
Vogelsang GmbH & Co. KG					●								●					
WEIMA Maschinenbau GmbH	●		●		●				●			●	●	●				●
Welger Recycling Engineering GmbH													●					
Wessel-Umwelttechnik GmbH																	●	
Xproducts Deutschland GmbH					●													
Zemmler Siebanlagen GmbH								●										

Plastics

The correct utilization of plastics is an important contribution to environmental safety. Plastics play their part in almost all areas of life and their proportion is particularly high in the packaging and building industries. They also constitute a high proportion of electric equipment.

With the exception of bio-based products, plastics are produced from the finite resource, crude oil. Recycling and, optionally, energetic utilization, are technically mature possibilities to be sustained in the long term. The use of one ton of recycled plastic saves 2.5 tons of carbon dioxide and, in addition, spares existing crude oil reserves.

Political approaches for achieving higher collection and utilization rates may be found, for instance, in the European Packaging Directive or also in the Used Electrical Equipment Directive. High-grade recycling is easier if the materials collected are separated. For this reason, many users of secondary plastics work with their own collection systems and, in this way, ensure the quality of the secondary material required is achieved without an expensive sorting process.

It is also not a problem if separate collection is not possible. A large number of manufacturers on the world market offer sorting techniques, which have been tested for many years, such as sensor sorting.

Because of their high energy content, plastics are also suitable for generating energy.

Plastic waste is being processed into solid recovered fuels (see chapter dealing with into solid recovered fuels) for use in incineration plants.

The manufacturers, organized in the VDMA Waste Treatment and Recycling Technology, offer technologies for all stages of processing before a material is recycled.

Make new things from old things! The areas, in which secondary plastics can be used, are numerous: From the automobile sector, to rubbish bins and even textiles for construction.

Further information concerning technologies for producing plastics can be requested from **https://www.vdma.org/plastics-rubber-machinery**.

Recovering sorted regranulate

	Optical Sifting	Conveyors	Metal Detectors	Pre-Comminutors	Sensor Sorting	Wet Separation	Classifiers	Washers	Dryers	Extruders	Sinter Presses	Melt Filtration	Pelletizers	Granulators	Exhaust Air Purifiers	Complete Plant
allmineral Aufbereitungstechnik GmbH & Co.KG						●	●	●	●							
ALLRECO GmbH				●												
AMANDUS KAHL & Co. KG									●				●			
ANDRITZ Feed & Biofuel B.V.													●			
ANDRITZ MeWa GmbH		●		●				●								
ANDRITZ SEPARATION GmbH - Köln						●	●	●	●							●
BRT HARTNER GmbH				●			●									
DI MATTEO Group Germany		●					●		●							●
Doppstadt Umwelttechnik GmbH		●		●			●									
Entsorgungstechnik BAVARIA GmbH	●	●	●	●	●		●								●	●
EREMA Engineering Recycling Maschinen und Anlagen Ges.m.b.H										●		●	●	●		
ERMAFA Sondermaschinen- und Anlagenbau GmbH	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
EVK DI Kerschhaggl GmbH			●		●		●									
HAAS Recycling-Systems		●		●												
Haver & Boecker Drahtweberei							●									
HEIN, LEHMANN GmbH		●					●									
Hellmich GmbH & Co. KG															●	
Herbold Meckesheim GmbH	●	●	●	●		●	●	●	●	●		●	●	●	●	●
Herding GmbH Filtertechnik															●	
JÖST GmbH + Co. KG		●					●		●							
Komptech GmbH				●			●									
KraussMaffei Extrusion GmbH										●		●	●	●		●
Lindner-Recyclingtech GmbH	●	●	●	●	●	●	●	●	●					●		●
MOCO Maschinen- und Apparatebau GmbH & Co. KG		●		●										●		
NEUE HERBOLD Maschinen- und Anlagen GmbH		●	●	●		●		●	●					●	●	●
Pallmann Maschinenfabrik GmbH		●	●	●			●	●	●				●	●	●	●
Scheuch LIGNO GmbH		●							●						●	
Sesotec GmbH	●	●	●		●		●									●
SPALECK GmbH & Co. KG		●				●	●									
STADLER Anlagenbau GmbH	●	●	●	●	●											●
STEINERT GmbH					●											
Terex Ecotec		●		●												
UNTHA shredding technology GmbH				●												
Vecoplan AG	●	●	●	●	●	●	●	●	●							●
Ventilatorenfabrik Oelde GmbH															●	
Vogelsang GmbH & Co. KG				●												
WEIMA Maschinenbau GmbH	●	●	●	●	●			●						●		●
Wessel-Umwelttechnik GmbH															●	
Zemmler Siebanlagen GmbH							●									

Mono-fractioned plastics

Basically, recycling methods can be divided into two categories

- Mechanical recycling
- Feedstock recycling.

Recycling of materials enables a secondary raw material to be obtained from the used plastic.

The recycling technologies of today ensure that a qualitatively high-grade material is produced from mixed plastic waste. In order to convert them into mono-sorted plastics, mixed plastics are comminuted, washed and sorted in modern recycling plants. The sorting and classifying is taken care of, at the present time, in automatic plants.

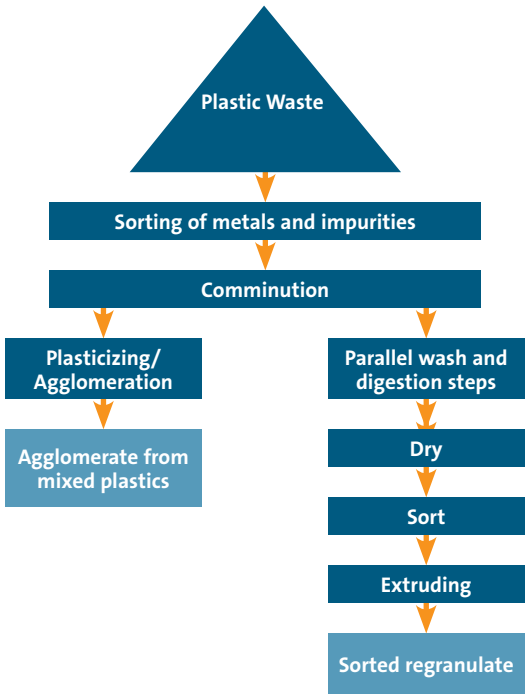
The sorted regranulates are made available to the plastics-producing industry for producing new, high-grade plastic products.

Since mixing with other types of plastics is largely excluded, sorted regranulates can be obtained easily from production waste, transport packaging, agricultural films and waste plastic windows.

Different preparation and processing techniques are required for plastics waste, depending on the sorting purity and the degree of contamination. The manufacturers, organized in the VDMA Waste Treatment and Recycling Technology Association, cover the whole spectrum of offerings, from individual components up to complete plants.

Further information concerning technologies for producing plastics can be requested from **https://www.vdma.org/plastics-rubber-machinery**.

Diagram of the process of sorted regranulate



Symbol	Name	Possible use
04 PE-LD	Low-Density Polyethylene	Plastic pockets, buckets, soap-dispensing bottles, plastic tubes
02 PE-HD	High-Density Polyethylene	Plastic bottles, plastic pockets, garbage cans, plastic pipes, artificial wood
5 PP	Polypropylene	Food packaging, medical devices, bumper bars, interior panelling, industrial fibres
3 PVC	Polyvinyl chloride	Window frames, floor coverings, seals, artificial leather, wallpaper, clothing
1 PET	Polyethylene terephthalate	Safety belts, films, bottles, parts of household and kitchen devices, computers, machinery components
7 OTHER	E.g. plexiglass, polycarbonate, nylon, ABS, fibreglass	Heat-resistant drinking vessels, dishes suitable for microwave, household containers

Disposal of municipal waste

	Conveyors	Material Handling	Feeders	Comminutors	Classifiers	(Sensors) Sorters	Sifters	Mixers	Dryers	Presses	Mechanical-Biological Treatment Plant	Composters	Fermenters	Incinerators	Exhaust Air Purifier	Complete Plant
ALLRECO GmbH	●		●	●	●	●	●	●	●	●	●	●				●
AMANDUS KAHL & Co. KG				●				●	●	●						
ANDRITZ MeWa GmbH	●		●	●	●	●										●
awama GmbH			●	●				●	●		●					
Baljer & Zembrod GmbH & Co. KG		●														
BHS-Sonthofen GmbH				●												
Bloom Engineering (Europa) GmbH														●		
BRT HARTNER GmbH			●	●	●		●									
DI MATTEO Group Germany	●				●		●									
Doppstadt Umwelttechnik GmbH	●			●	●		●				●	●				
Entsorgungstechnik BAVARIA GmbH	●		●	●	●	●	●								●	●
EVK DI Kerschhaggl GmbH					●	●										
HAAS Recycling-Systems	●		●	●	●		●									●
Haver & Boecker Drahtweberei					●											
HEIN, LEHMANN GmbH	●		●		●											
Hellmich GmbH & Co. KG															●	
Herbold Meckesheim GmbH	●		●	●			●		●	●					●	●
Herhof GmbH									●		●	●	●		●	●
JÖST GmbH + Co. KG	●		●		●		●		●							
Komptech GmbH				●	●		●	●			●	●	●			●
Lindner-Recyclingtech GmbH	●		●	●	●											●
Lödige Process Technology								●								
Ludden & Mennekes Entsorgungs-Systeme GmbH										●						
MARTIN GmbH für Umwelt- und Energietechnik			●											●		●
MOCO Maschinen- und Apparatebau GmbH & Co. KG	●		●	●												
NEUE HERBOLD Maschinen- und Anlagenbau GmbH	●			●			●		●							
Pallmann Maschinenfabrik GmbH	●		●	●			●									
Sesotec GmbH						●										
SPALECK GmbH & Co. KG	●		●		●											
STADLER Anlagenbau GmbH	●		●		●		●	●			●					●
STEINERT GmbH						●										
STRABAG Umwelttechnik GmbH									●		●	●	●			●
Strautmann Umwelttechnik GmbH										●						
Terex Ecotec	●		●	●	●		●									
UGN-Umwelttechnik GmbH															●	
UNTHA shredding technology GmbH	●		●	●												●
Vecoplan AG	●		●	●	●	●										●
Ventilatorenfabrik Oelde GmbH							●								●	
Vogelsang GmbH & Co. KG				●												
WEIMA Maschinenbau GmbH	●		●	●		●	●			●						●
Welger Recycling Engineering GmbH										●						
Wessel-Umwelttechnik GmbH															●	
Xproducts Deutschland GmbH				●												●
Zemmler Siebanlagen GmbH					●											

Municipal waste

There is always waste in households and industry as well as in commerce. The so-called household waste constitutes about a third of the total municipal waste. The special feature of household waste is that it occurs in every household and every commercial undertaking (as commercial waste-like household waste). Special collection logistics and a special cost system are therefore necessary.

Many countries in the world have taken this into account and introduced responsibilities for collection and disposal and, in addition, have introduced fee systems. The selection from a large number of possible disposal methods is frequently also discussed at the political level. Previously, dumping in landfills was the favourite disposal method. Meanwhile, many countries have gone over to giving preference to material or energetic methods of utilization.

The selection of a disposal method depends, for instance, on the composition and the amount of the waste. For waste with a high biogenic portion, composting or fermentation, for example, are available. For mixed municipal waste, it is possible to resort to mechanical-biological treatment plants, often in conjunction with solid recovered fuel plants. Incinerators are also used for the energetic utilization or elimination of municipal waste.

The members of the VDMA Waste Treatment and Recycling Technology Association have many years of experience in selecting sensible methods and subsequently planning and setting up appropriate plants.

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