

In 2014, around 88 million tonnes of waste (municipal, commercial and industrial) were treated in Waste-to-Energy plants in Europe. The combustion process produced approximately 18 million tonnes of bottom ash, which is the incombustible residual part of the incinerated waste. Important quantities of metals and minerals are present in these residues and offer many opportunities for recycling.

Composition of bottom ash

Bottom ash is composed of inert, non-combustible materials that are left over after the combustion process: sand, stones, ashes from burnt material. It also contains metals that are embedded in the residual waste – such as thin aluminium foils – and therefore could not be separately collected. The metals can be extracted from the ashes and further used as secondary raw material – such as scrap aluminium – at a lesser environmental cost than the production of virgin metal. Metals such as steel, aluminium, copper and zinc can be recycled from the bottom ash. Metal recycling from bottom ash helps to reduce greenhouse gas emissions. Emissions of 2,000 kg of CO₂-equivalent are saved for each tonne of metal recycled from bottom ash¹. Yearly, at the European level, metal recycling from bottom ash therefore saves around 3.2 million tonnes of CO₂ eq.

Key facts on bottom ash (BA)

- Yearly production (EU, 2014): circa 18 million tonnes of bottom ash
- Composition of bottom ash:
 - Mineral fraction: 80-85%
 - Metals: 10-12% (steel and non-ferrous metals)
 - Non-ferrous metals: 2-5% (of which 2/3 aluminium)
- Greenhouse Gas (GHG) savings due to metal recycling: 2,000 kg of CO₂ eq. per tonne recycled metal and in total ca. 3.2 million tonnes of CO₂ equivalent
- The amount of iron that can be recycled from European bottom ash equals about 26 cruise ships²
- In 2014, respectively 20,000 and 17,000 tonnes of aluminium were recovered from bottom ash in the Netherlands³ and in France⁴. This metal was mainly used in castings for the automotive industry (engine blocks, etc.)
- Uses of the remaining part, after the metal recycling: construction materials

Treatment of bottom ash

The scrap metal recovery rate depends on the waste composition and the technology used. In state-of-the-art cases the recovery rate can reach about 80% of the metals embedded in the bottom ash.

In order to extract the valuable metals, bottom ash is processed either on site or in specialised facilities. Usually, the first step is to use a magnet in order to extract ferrous metals from the ash. Bottom ash is then sorted in different fractions based on the size of the residues.

This allows for a more accurate separation of the various non-ferrous metals with the eddy current separation technique. This technique involves a conveyor belt that expulses non-ferrous metals such as aluminium at different distances according to their reaction to changing magnetic fields.

¹ EdDE-Dokumentation 17, *Metallrückgewinnung*, October 2015

² In average cruise ships have a displacement of 52,815 tonnes; 8% of iron can be recycled from bottom ash, generating an amount of around 1.4 million tonnes of iron.

³ Dutch Waste Management Association, <http://www.verenigingafvalbedrijven.nl/>

⁴ Rapport d'activités éco-emballages et adelphe, 2014

Use of the inert fraction

After 6 to 20 weeks of ageing following metal recovery, the bottom ash is stable and suitable for utilisation. It can be used in road construction, or act as aggregate for concrete. Many European countries are using bottom ash as an alternative to virgin material such as gravel and sand. In Denmark, the legislation has allowed bottom ash to be used in road construction for many years, and increased the scope of its use to high load roads in 2012. Around 99% of the bottom ash produced in the country is hence recovered. Bottom ash aggregate is also present in road construction in Belgium, France, Germany, Netherlands, Portugal, United Kingdom and Spain.

Gravel from bottom ash can be crushed and used as aggregate for concrete manufacturing, as done by the BSB plant in Noceto, Italy.

In the Netherlands and in Germany, bottom ash aggregates are also used in the construction of roads, flyover for high ways and noise barriers. They were for instance the primary material for building more than 1 km of noise barrier along the A12 highway in the Netherlands. In Switzerland the finer fraction of bottom ash is used as a cement substitute in fly ash stabilisation.

In the United Kingdom, bottom ash aggregate was part of the construction of infrastructure for the London Olympics in 2012. In the Stratford Olympic Village, 30,000 tonnes of bottom ash were used as backfill for the structure and 2,000 tonnes as capping for pavement. 5,000 tonnes were used as sub-base for the extension of the car-park of the Excel Exhibition and Convention Centre, which hosted various competitions during the games.

In the Netherlands, all operators of Waste-to-Energy plants signed a “Green Deal Bottom Ash” with the Dutch Government. The main items of this green deal are: 1) more than 75% recovery of all non-ferrous metals > 6 mm present in the bottom ash and 2) as from 2020 granulates must be so clean that they can be 100% applied for useful purposes.

With this green deal, which is a good example for Public-Private partnership, the Dutch Government and the Waste-to-Energy operators strive for processing bottom ash into a clean and 100% applicable secondary building material which can be used in road construction, bridge and flyover embankments, sound walls etc. Some may even use this clean bottom ash granulate in concrete products such as bricks, kerbstones, etc.

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For more information:



Association of European Producers of Steel for Packaging
www.apeal.org



Confederation of European Waste-to-Energy Plants
www.cewep.eu



European Suppliers of Waste-to-Energy Technology
www.eswet.eu



European Aluminium
www.european-aluminium.eu



Fédération Internationale du Recyclage
www.fir-recycling.com



Municipal Waste Europe
www.municipalwasteurope.eu