Generation and Management of EPS and XPS Waste in Germany

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Source

- Study “Generation and Management of EPS and XPS Waste in 2016 in Germany in the Packaging and Building Industries”

- conducted by: Conversio Market & Strategy GmbH, Mainz
Focus of the Study

EPS/XPS applications

Packaging (sales, transport and secondary packaging)

Building applications (insulation materials for both indoors and outdoors)

Other (e.g. mobile homes, electric refrigerators) and industrial applications etc.

Post-consumer\(^1\) EPS/XPS waste from packaging and building applications

Post-consumer\(^1\) EPS/XPS waste from other or industrial applications

Not the focus of the study

1) Post-consumer EPS/XPS waste:

EPS/XPS waste generated through private end-users (e.g. building owners) or commercial end-users (e.g. tradesmen).
Focus of the Study

Application areas Polystyrene – Survey 2015

- Packaging (4,255 kt)
- Building and Construction (2,740 kt)
- Automotive (1,260 kt)
- Electro/Electronics (725 kt)
- Others (3,085 kt)

Source: Consultic 2016
### Conversion of EPS/XPS in Major Applications 2016

#### EPS packaging/mouldings

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount (kt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPS products</td>
<td>~39 kt (100%)</td>
</tr>
<tr>
<td>for food packaging</td>
<td>~10 kt (25%)</td>
</tr>
<tr>
<td>for technical products</td>
<td>~25 kt (65%)</td>
</tr>
<tr>
<td>Other packaging (e.g. cosmetics, medicines)</td>
<td>~4 kt (10%)</td>
</tr>
</tbody>
</table>

*Within the EPS packaging, approx. 60% (~23 kt) is accounted for by household packaging / lightweight packaging and 40% (~16 kt) by commercial and industrial packaging.*

#### EPS/XPS insulation materials/components

<table>
<thead>
<tr>
<th>Type</th>
<th>Amount (kt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPS products</td>
<td>~199 kt (74%)</td>
</tr>
<tr>
<td>XPS products</td>
<td>~69 kt (26%)</td>
</tr>
<tr>
<td>Roof insulation</td>
<td>~74 kt (28%)</td>
</tr>
<tr>
<td>Thermal insulation composite system</td>
<td>~63 kt (24%)</td>
</tr>
<tr>
<td>Perimeter insulation</td>
<td>~13 kt (5%)</td>
</tr>
<tr>
<td>Floor / Ceiling (e.g. sound insulation)</td>
<td>~27 kt (10%)</td>
</tr>
<tr>
<td>Other parts (e.g. interior, door filling)</td>
<td>~22 kt (8%)</td>
</tr>
<tr>
<td>Floor / Ceiling (e.g. sanitary / wet area)</td>
<td>~1 kt (&lt;1%)</td>
</tr>
<tr>
<td>Other parts</td>
<td>~6 kt (2%)</td>
</tr>
</tbody>
</table>
Relevant Waste Streams for EPS/XPS

**Origin of EPS/XPS waste:**

- Collection by dual systems (e.g. yellow bin/yellow bag in households or near-household areas)
- Public and private collection stations: Neighbourhood container/container parks, private and public recycling centres for useful materials
- B2B EPS/XPS waste collection and recycling directly between the parties generating the waste (e.g. tradesmen or private persons) and disposal company: Service of private waste collectors or via public waste disposal companies
- Other collection and recovery systems: Possibility of take-back system in the trade (e.g. electrical goods outlets), or take-back system by manufacturers (e.g. insulation material producers)
- Disposal via residual household waste (residual waste bin, generally for non-recyclable waste)
Relevant Post-consumer Waste Streams for EPS/XPS in 2016

In which waste flows do we find EPS/XPS waste?

Plastics-relevant post-consumer waste flows 2015:
- of which plastics in plastics-relevant waste flows 2015:
- of which EPS/XPS content 2016:

\[
\begin{align*}
\sum &= \text{approx. 50 m t} \\
\sum &= \text{approx. 5 m t} \\
\text{approx. 110,000 t (2015: ~ 96,000 t)}
\end{align*}
\]

- **Commercial waste via private disposal companies**
  - Building and packaging waste from trade and industry; sorted and mixed: 42,000 t (38%)

- **Separately recorded sales packaging**
  - (including small quantities of waste from installation) via both near-household and container and recyclables collection: 27,000 t (25%)

- **Collection and recovery systems for commercial packaging** (especially transport and secondary packaging): ~17,000 t (15%)

- **Other collection and recovery systems** for building waste (e.g. take-back systems from producers): ~2,000 t (2%)

- **Residual household waste** ~14,000 t (13%) and commercial waste similar to household waste via public disposal companies ~6,000 t (5%)

Building waste via collection of recyclables ~2,000 t (2%)
## Relevant Post-consumer Waste Streams for EPS/XPS in 2016

**= EPS/XPS “containing” waste flows**

<table>
<thead>
<tr>
<th>Plastics-relevant post-consumer waste flows</th>
<th>Recorded plastic waste volumes in kt</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total volume 2015</td>
</tr>
<tr>
<td>Commercial &amp; industrial waste (not included, production and conversion scrap)</td>
<td>1.162</td>
</tr>
<tr>
<td>Municipal waste generated by commercial activities</td>
<td>207</td>
</tr>
<tr>
<td>ELV incl. ASR and repair shops</td>
<td>197</td>
</tr>
<tr>
<td>Commercial packaging waste</td>
<td>375</td>
</tr>
<tr>
<td>Other collection and recovery systems</td>
<td>109</td>
</tr>
<tr>
<td>Sales packaging collected by „private collection Scenes“</td>
<td>1.532</td>
</tr>
<tr>
<td>Residual household waste</td>
<td>967</td>
</tr>
<tr>
<td>Bulky waste</td>
<td>210</td>
</tr>
<tr>
<td>Separate collection by municipalities (non packaging)</td>
<td>58</td>
</tr>
<tr>
<td>WEEE waste collection</td>
<td>188</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>5.005</strong></td>
</tr>
</tbody>
</table>
Amount EPS/XPS Converted vs. Amount Waste Generated
EPS/XPS Material Flows in the Context of the Disposal Chain

**Disposal process**

**Place of generation**
EPS/XPS waste from trade and industry and private households total
~110.2 kt
→ from building and packaging

**Waste flows**
- ~38% Commercial waste via private disposal companies
- ~24% Sales packaging (dual systems)
- ~18% Residual household waste and commercial waste similar to household waste via public disposal companies
- ~15% Collection and recovery systems for commercial packaging
- ~2% Other collection and recovery systems (above all take-back systems from retailers/producers)
- ~2% Recyclable waste collection (public disposal companies) / delivery to recycling centers

**Mechanical recycling**
~36.0 kt (33%)

**Energy recovery**
~71.5 kt (65%)

**Disposal**
~2.7 kt (2%)
Material Flow: EPS/XPS Waste Recovery

EPS packaging and EPS/XPS building waste

- Recovery
  - Energy-recovery
  - Recycling
- Disposal
  - Landfill
  - Incineration without energy recovery

Material recycling as EPS/XPS
- New EPS products
- Production of lightweight concreate
- Etc.

Material recycling to PS-recyclate
- Injection molding
- Extrusion
- Etc.
Material Flow: EPS/XPS Waste Recovery
Total 2016

Post-consumer EPS/XPS waste
~110,2 kt (100 %)

Recovery 98 %

Energy recovery 65 %

Recycling 33 %

Material recycling as EPS/XPS 15 %

Material recycling to PS Recyclate 18 %

Disposal 2 %

Recycling 33 %

Disposal 2 %

Post-consumer EPS/XPS waste
~110,2 kt (100 %)

Recovery 98 %

Energy recovery 65 %

Recycling 33 %

Material recycling as EPS/XPS 15 %

Material recycling to PS Recyclate 18 %

Disposal 2 %
HBCD in EPS/XPS Waste

EPS/XPS products - produced in Germany – contain no more HBCD since 2015

In Asia (in first place China, South Korea, Japan) quite large amounts of EPS/XPS, which are equipped with flame-retardant due to fire safety requests, are used for the protection of E+E goods
HBCD in EPS/XPS Waste

EPS packaging - imported from non EU countries – contribute about 30,000 t/a to packaging waste

Despite the trade and import restriction about 5-10 % of these EPS packaging contain still HBCD (maximum permissible value is < 1.000 ppm)

That results in the fact, that 1,5-3 kt of 67,7 kt/a of EPS packaging waste is still contaminated with HBCD
HBCD in EPS/XPS Waste

- Further reducing share of contaminated packaging
- Reliable phase out of contaminated material in the recycling process by QM/QS-Systems
- No HBCD contaminated material put into the market via recyclates
- No HBCD via installation scrap from building and construction

- Almost all EPS/XPS waste streams coming from the refurbishment of buildings are contaminated with HBCD (installation usually before 2015)
Post-consumer EPS/XPS out of Building and Construction and Disposal Routes

- **Without HBCD e.g. offcuts**:
  - EPS/XPS Products after 2014
  - 6% Building waste via material flow sales packaging
  - 5% Other collection centers (e.g. take-back systems)
  - 4% Residual household waste
  - 5% Commercial waste similar to household waste via public disposal companies
  - 4% Disposal

- **With HBCD e.g. from demolition**:
  - EPS/XPS: Since 01.08.2017 "non-hazardous waste"
  - 75% Commercial waste via private disposal companies
  - 5% Collection points for recyclables / Recycling centres

- **Energy recovery**
  - 86%

- **Mechanical recycling / Recycling**
  - 10%

As mixed building waste
Development of HBCD Containing Waste Streams from Building and Construction until 2050

Sources and parameters for the forecast:

Historical generation of EPS and XPS:
- Statistical surveys of IVH, FV-WDVS and GDI
  → The already published forecasts from the Fraunhofer Institute and the Federal Environment Agency are also based on these figures. These were also taken into account here and thoroughly checked.
- Our own historical calculations
- Especially for the "early" years (1960 to 1980), comparison with manufacturers' production figures

"Life expectancy" of the discharged EPS/XPS, annual demolition / renovation volumes
- Existing estimates from secondary literature
- Discussions with converters, demolition companies and associations
- Our own calculations, comparison with the waste volumes produced in recent years
Continuous Increase in the Annual Amount of EPS/XPS Building Waste

Forecast\(^1\) development of EPS/XPS building waste containing HBCD
2015 to 2050 in kt:

\(^1\) Forecast is based on a stable economic development, without political measures in the building sector
Development of Installed HBCD Containing EPS/XPS Materials until 2080

Forecast development of the HBCD used in building applications 2015 to 2080 in kt:
Conclusion I

- In total 2016 about 307 kt EPS/XPS were converted into products (87 % in building and construction sector, 13 % in packaging)

- In the same year 110 kt Post-consumer EPS/XPS waste were generated

- Thereof 98 % were recovered (material recycling: 33 %, energy recovery : 65 %)
Conclusion II

- EPS packaging waste was collected mainly by „Dual Systems“ and private waste management companies. The achieved rate of material recycling was 65-75 %

- Building and construction waste was mostly collected by private waste management companies (75%). The material was nearly quantitatively energetically recovered
Conclusion III

- EPS/XPS waste derived from in Germany produced goods are free of HBCD at the latest since 2015

- The annually amount of HBCD containing EPS/XPS insulating material in the waste will increase from today 36 kt up to 100 kt in 2050
Thank you for your attention!

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