Waste Management in Austria
- How to Avoid Wasting Waste

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• Waste Management Strategy
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Austrian waste arisings

- 6,800 kg waste/capita.a
- 448 kg household waste/cap.a
Problems: waste growth

Growth in Austria 1996 to 2007 in %

- GDP
- Total waste
- Household waste
Further problems

- Over 25% of fresh food => rubbish bin
- Electronic products with hazardous substances increasing
- Imported products with unknown composition increasing
Austrian metal consumption

1980 to 2006:
- Domestic metal extraction -43 %
- Metal imports +640 %

Chromium: security of supply?

- Range of known economic reserves: 8 years

- Market share of extraction companies:

<table>
<thead>
<tr>
<th>Company</th>
<th>Year 2003 market share in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xstrata</td>
<td>20</td>
</tr>
<tr>
<td>BHP Billiton</td>
<td>10</td>
</tr>
<tr>
<td>Tata Iron and Steel</td>
<td>9</td>
</tr>
<tr>
<td><strong>Top 3: Total</strong></td>
<td><strong>39</strong></td>
</tr>
</tbody>
</table>

- Market share of extraction countries:

<table>
<thead>
<tr>
<th>Country</th>
<th>Year 2008 market share in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Africa</td>
<td>45</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>17</td>
</tr>
<tr>
<td>India</td>
<td>15</td>
</tr>
<tr>
<td><strong>Top 3: Total</strong></td>
<td><strong>77</strong></td>
</tr>
</tbody>
</table>

Waste strategy objectives

Minimise impact of waste and waste strategy on public health and the environment without introducing excessive costs

- Minimise emissions
- Reduce hazardous substances in the economy
- Minimise distribution of hazardous substances
- Minimise primary resource and energy consumption
- Increase resource efficiency

Waste Management Rules

- Separate waste fractions
- Waste disposal only to sanitary landfill sites
- Only inert waste sent to landfill (Total Organic Carbon (TOC) < 5 %)
- All reactive waste must be treated

### Emission limits for waste incineration

Half-hour-average limit values for waste incineration in mg/Nm³ from
- EU directive DIR 2000/76/EC,
- Austrian Waste Incineration Ordinance AVV
- Licensing of current projects

(Selected parameters)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>EU-Directive 2000/76/EC</th>
<th>AVV</th>
<th>License of plant Linz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dust</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Organic Carbon</td>
<td>20</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>HCl</td>
<td>60</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>HF</td>
<td>4</td>
<td>0.7</td>
<td>0.3</td>
</tr>
<tr>
<td>SO₂</td>
<td>200</td>
<td>50</td>
<td>40</td>
</tr>
<tr>
<td>NOₓ as NO₂</td>
<td>400</td>
<td>100</td>
<td>60</td>
</tr>
</tbody>
</table>

Quality-assured recycling of construction material

- The concentration of hazardous substances in the material and in the aqueous extract (eluate) define the quality class and the field of application

- Example nickel

<table>
<thead>
<tr>
<th>Class A+</th>
<th>Class A</th>
<th>Class B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Nickel-concentration in material (mg/kg dry matter)</td>
<td>30</td>
<td>55</td>
</tr>
<tr>
<td>Max. Nickel-concentration in the eluate (mg/kg dry matter at a liquid/solid ratio of 10/1)</td>
<td>0.4</td>
<td>0.4</td>
</tr>
</tbody>
</table>

- Compliance is audited by independent third party

Organising the Waste Management Strategy
Historic development

- Phase 1: All waste is collected and sent to legal landfills
- Phase 2: Separate collection of paper, glass, metals and plastics
- Phase 3: Ban on landfilling reactive waste => treatment or recycling of most waste
- Phase 4: Waste prevention and recycling revisited
# Administrative Organisation of Austria

<table>
<thead>
<tr>
<th>National (Federal level)</th>
<th>1 The State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regional level</td>
<td>9 Federal Provinces</td>
</tr>
<tr>
<td>Local level</td>
<td>2,359 Regional Authorities ➔ aggregated to 85 Waste Management Associations</td>
</tr>
</tbody>
</table>
Responsibilities

• Federal level
  - Regulation and monitoring of hazardous waste
  - General rules for collection and treatment
  - Transboundary shipment

• Regional level
  - Regulation and monitoring of non-hazardous waste
  - Licensing

• Local communities
  - Collection and treatment of household/municipal waste

• Industry
  - Collection and treatment of industrial waste
## Waste Collection Strategy: Households (+industries ≤ 240 l/week)

<table>
<thead>
<tr>
<th></th>
<th>Separate Household Bins</th>
<th>Recycling Bank Sites</th>
<th>Reuse &amp; Recycling Centres</th>
<th>In-Store Recycling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residual waste</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paper</td>
<td>X</td>
<td>(X)</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Biodegradable</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Hollow plastic</td>
<td>X</td>
<td>(X)</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>packaging</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metal packaging</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Glass</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Textiles</td>
<td></td>
<td>(X)</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Batteries</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Electric/electronic</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>equipment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lamps</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
Recycling Bank Site
Reuse & Recycling Centre
Reuse & Recycling Centres - Location

approx. 7,500 people/centre
Waste Recovery and Disposal Systems
(only main streams shown)

- **Residual waste**
  - High calorific value waste
  - Thermal Treatment
  - Mechanical - Biological Treatment

- **Inert waste**
  - Collection
  - Transport
  - Mechanical Separation
  - Landfill

- **Bio-waste**
  - Biogas
  - Composting
  - Recycling

- **Emulsions, acids...**
  - Chemical - Physical Treatment (Emulsion splitting, neutralisation)

- **Construction residues, Vehicles, WEEE...**
  - Special Treatment:

- **Subsurface Landfill Germany**
Location of MBT and waste incineration plants

- Waste incineration plant (operational)
- Waste incineration plant planned/under construction
- MBT Plant planned/under construction
- MBT Plant operating
## Recovery and Disposal Plants

<table>
<thead>
<tr>
<th>Plant Type</th>
<th>Capacity in Mt/a 2005</th>
<th>Number of Plants 2005</th>
<th>Change till 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sorting Plants</td>
<td>1</td>
<td>123</td>
<td>+ 10</td>
</tr>
<tr>
<td>Municipal Solid Waste incineration</td>
<td>1.7</td>
<td>9</td>
<td>+1</td>
</tr>
<tr>
<td>Other Incineration</td>
<td>2.9</td>
<td>180</td>
<td>+7</td>
</tr>
<tr>
<td>Mechanical-Biological Treatment (MBT)</td>
<td>0.8</td>
<td>16</td>
<td>+1</td>
</tr>
<tr>
<td>Composting + Biogas</td>
<td>1.4</td>
<td>780</td>
<td>Composting + 13</td>
</tr>
<tr>
<td>Physical-Chemical Treatment</td>
<td>0.5</td>
<td>37</td>
<td>+0</td>
</tr>
<tr>
<td>Treatment of Construction Waste</td>
<td>5.5</td>
<td>293</td>
<td>+48</td>
</tr>
<tr>
<td>Landfills</td>
<td></td>
<td>666</td>
<td>-118</td>
</tr>
<tr>
<td>Special Treatment + Recycling</td>
<td>2.4</td>
<td>190</td>
<td></td>
</tr>
</tbody>
</table>

## Key Austrian Waste Management Indicators

<table>
<thead>
<tr>
<th></th>
<th>Private companies (including privatised public companies)</th>
<th>Municipal and public institutions</th>
<th>Total sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Turn-over in million €</td>
<td>4,000</td>
<td>1,000</td>
<td>5,000</td>
</tr>
<tr>
<td>Employees</td>
<td>25,000</td>
<td>6,000</td>
<td>31,000</td>
</tr>
<tr>
<td>Number of companies</td>
<td>850</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: denkstatt 2009
Example of an Austrian waste collector/treater

### Main Sites

<table>
<thead>
<tr>
<th></th>
<th>Austria</th>
<th>Other countries</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual turn-over in million €</td>
<td>200</td>
<td>94</td>
<td>294</td>
</tr>
<tr>
<td>Employees</td>
<td>1,405</td>
<td>2,049</td>
<td>3,454</td>
</tr>
<tr>
<td>Sites</td>
<td><strong>22</strong></td>
<td><strong>53</strong></td>
<td><strong>75</strong></td>
</tr>
<tr>
<td>Customer communities</td>
<td>504</td>
<td>1,140</td>
<td>1,644</td>
</tr>
<tr>
<td>Customer companies</td>
<td>17,245</td>
<td>15,783</td>
<td>33,028</td>
</tr>
</tbody>
</table>

Source: denkstatt 2009, www.saubermacher.at
Achievements
Flow & distribution of lead in Austria (2005)

- **Air**: + 0.05 kt
- **Private Households**: Stock + 1 kt
- **Waste Management Sector**: Stock + 3 kt

**Imports** 8 kt → **Industry Commerce Services**

- 2 kt → **Private Households**
- 14 kt

- 20 kt → **Water**: + 0.01 kt

**Exports** 4 kt

**Source**: Umweltbundesamt (2009): RUSCH
Separate collection of household waste 2007

Household waste arisings:
- 167 kg/cap (37.4 %) residual waste
- 281 kg/cap (62.6 %) separately collected.

Old-materials (160 kg/cap):  
- 80 % recycled  
- 17 % used for energy recovery.

Source: Federal Waste Management Plan Statusbericht 2008
Recycling material for construction

- 5 million t/a recycled as quality-assured construction material (= 63 % of the potential)
- 39 companies qualify for the quality label
Reasons for success

• Environmental concerns are important => most people want to do something for the environment

• Good working relationship between waste managers, public authorities and interest groups

• Waste is of value
The Future - Electronic Data Management (EDM)

- **Objective:** All reporting obligations (e.g. hazardous waste) should be fulfilled via internet by waste producers and waste managers

- **Status:** partly realised
Federal waste prevention and recycling strategy

**Groups Measured**

- Construction and demolition waste
- Input-/output-optimization of incineration
- Hazardous substances in products
- Full Ban on cadmium in batteries
- Multi-trip packaging
- Services instead of products

**Development/Implementation of a Building Pass**

- Promotion of waste saving construction
  - Lifetime extension
  - Selective (recycling oriented) demolition
  - Promotion of recycling
Lifecycle-Management

Material Extraction

Integrated Material Flow Management for meeting a Sustainable Demand

Consumption

Production

Economic Sphere

Environmental Sphere

Safe Sink for hazardous substances

Waste Management

Primary Material Resources

Emissions
Further Information

www.umweltbundesamt.at/en/umweltschutz/abfall/

www.bundesabfallwirtschaftsplan.at/article/articlevicapita/52746/1/13192/
Ash-Dec-process (Laboratory scale)

Mass flows in kg; n.k. = not known

Source: (HERMANN 2008).
Heavy metal concentration before and after Ash-Dec treatment compared to national limit values

Source: Schwermetallkonzentrationen im Klärschlamm, in der Klärschlammmasche und im Produkts aus der Pilotanlage des Ash-Dec-Verfahrens im Vergleich mit den schärfsten Düngemittelgrenzwerten aus der Schweiz (CH), Deutschland (D), Österreich (A) bzw. den Niederlanden (NL) (HERMANN 2008).
Raw materials - world mineral extraction

- World extraction of minerals since 2000: + 62%
- Financial crisis will slow but not stop increase

Costs of waste collection and transport

Waste from households, schools, commerce < 240 l/week

Industrial waste

HH= Households, Source: denkstatt 2009
Treatment costs

- Thermal treatment of MBT of residual waste:
  - 135 - 155 €/t

- Composting, biogas from separately collected bio-waste:
  - 40 - 60 €/t

Source: denkstatt 2009
Flow-sheet of an Austrian waste incineration plant

Limit values for co-incineration

For co-incineration, emissions are not limited, instead the concentration of 7 heavy metals in the input-material is restricted.

Example for mercury:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Limit of input-heavy metal concentration in mg/MJ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury (Hg)</td>
<td>Median*: 0.15</td>
</tr>
</tbody>
</table>

*Median: 50 % of the measurements show values below this limit

**80 Percentile: 80 % of the measurements show values below this limit

Source: AVV, Richtlinie Ersatzbrennstoffe