Innovative and BREF proven material recycling of MSWI bottom ashes

Alain Konings, QESH manager Belgium
Content

- Indaver today
- EU ‘s long term ambition
- Waste-to-Energy plants in Belgium
- Wet treatment of bottom ashes:
  - history
  - technology
  - actual performance
- Restrictions: legal, market, socio-economical
- Conclusion
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Indaver today: strategy & core business

To run specialised facilities and to manage intelligent waste management systems focusing on sustainable material and energy management.

Core Business

Target waste

Industrial and hazardous waste

Comparative industrial waste

Biomass

Household waste

Target customer

Large-scale industry
- pharmaceutical, chemical, petrochemical, automotive industry, ...

Collectors
- small and medium-size enterprises, non-industry, private citizens

Authorities
- public authorities, provinces

Business model

Total Waste Management (TWM)

Product Sales

Public waste Partnerships (PwPS)

Target country

Presence of target customers EU

Belgium / The Netherlands / Ireland
**Indaver today: solid company**

<table>
<thead>
<tr>
<th>Solid</th>
<th>Profitable</th>
<th>Cost efficient</th>
<th>Not listed -&gt; independant</th>
<th>International player</th>
</tr>
</thead>
</table>

**Stable shareholder structure**

- 75% DELTA (multi-utility group with turnover of 1.5 bio EUR/Y)
- 16% VMH (Flemish Environmental Holding)
- 9% industry: BASF, Bayer, J&J, Borealis, Solvay, TC.

- Turnover 2010: 500 Mio EUR
- Management of 4 Mio tonnes/year
- 1,600 employees

**Values**

- Safety & quality = top priority
- Continuous improvement
- Cost leadership
- Mutual trust
- Transparency in all actions & communication

► **Sustainable long term vision**
Indaver today: sites within the EU
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EU long term ambition: strategy

Source: EU Waste Policy. The story behind the strategy. European Commission
EU long term ambition: legal framework

- Waste Frame Directive 2008/98 (former 75/442)
  - Increase **energy recovery**
    - Min. energy efficiency of MSWI required to become R1 installation
  - Increase **recycling** rates of **materials**
    - Introducing concept of “end of waste”
    - Developing EoW criteria

=> modern “RECYCLING SOCIETY”
EU long term ambition: energy recovery today
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W-t-E plants in Belgium
W-t-E plants in Belgium: recycling rates

EUROSTAT, municipal waste treated in 2008

Recycled
Composted
Incinerated
Landfilled

Recycled
Composted
Incinerated
Landfilled
W-t-E plants: Indaver plant Doel (near Antwerp)
W-t-E plant: Indaver plant Doel

- Thermal treatment of
  - MSW
  - Comparable non haz industrial waste
  - Non-infectious medical waste
  - Non haz sludges (limited quantity)

- Grate incinerator technology
  - 3 lines
W-t-E plant: mass balance Indaver plant
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Wet treatment of bottom ashes: history

Driving forces:

1. EU’s strategy and Waste Frame Directive
2. EU BREF Waste Incineration
   - Recover ferrous & non ferrous metals
   - Fractionate bottom ashes in a wet or dry process followed by natural or accelerated carbonation of the aggregates
3. Indavers strategy
   - ...sustainable material management...

Threats

- Landfill taxes (actual “non bis in idem” on bottom ashes)
- WAC landfill, ban on landfill, space, permit, ..
Wet treatment of bottom ashes: history

- **1996**: kick-off research-project

- **Targets:**
  - Converting process residues into useful “secondary raw materials” according Flemish legislation
  - Avoiding the need for landfill space
  - Replacing raw materials

- **Project-team:**
  - Indaver
  - IPAS (Industrial Processing & Analytical Systems)
  - VITO (Flemish Institute for Research)
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Wet treatment of bottom ashes: technology

- Start up facility: 2000 (capacity 165 kT/year)

- Technology: wet process

- **Washing:**
  - flotation of organics & wash out of salts

- **Sieving & separating:**
  - removing metals & stones using a robust bar-sieve
  - Granulates on granular size
  - Ferrous / non ferrous metals

- **Ageing granulates**
  - During 3 months in 5 – 10m high heaps in open air on paved floor
Wet treatment of bottom ashes: technology
Wet treatment of bottom ashes: technology
Bar sieve removing large parts of metal & stones
Sieving & washing
Sieving and washing
Magnetical removal of ferrous metals
Ageing the granulates (2-6 mm, 6-50 mm)
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Wet treatment of bottom ashes: actual performance

- High sieving efficiency
  - High quality ferrous / non ferrous metals
  - Granulates respect high environmental standards
- Organic fraction easily removed
- Soluble salts washed out
- Need for water:
  - Re-use of rainwater
  - Limited amount is “consumed”, maximum re-circulating
  - No discharge. Instead, re-use water as process water elsewhere
### Wet treatment of bottom ashes: actual performance

<table>
<thead>
<tr>
<th>Fraction</th>
<th>Application</th>
<th>% (w/w) of bottom ash</th>
</tr>
</thead>
<tbody>
<tr>
<td>F – metal</td>
<td>Recycling, highest quality</td>
<td>8.5</td>
</tr>
<tr>
<td>NF- metal</td>
<td>Recycling, highest quality</td>
<td>1.0</td>
</tr>
<tr>
<td>Granulate 2 – 6 mm</td>
<td>Granular or monolithic applications in constructions</td>
<td>14</td>
</tr>
<tr>
<td>Granulate 6 – 50 mm</td>
<td></td>
<td>27</td>
</tr>
<tr>
<td><strong>Total of “free use” application</strong></td>
<td></td>
<td><strong>50.5</strong></td>
</tr>
<tr>
<td>Sand 0.1 – 2mm</td>
<td>Controlled application in construction on landfill (covering)</td>
<td>32</td>
</tr>
<tr>
<td><strong>Total of application with further monitoring</strong></td>
<td></td>
<td><strong>32</strong></td>
</tr>
<tr>
<td>Sludge &lt; 0.1 mm</td>
<td>Landfill</td>
<td>8</td>
</tr>
<tr>
<td>Organic</td>
<td>Returned to grate furnace</td>
<td>1</td>
</tr>
<tr>
<td>Others</td>
<td>Landfill</td>
<td>8.5</td>
</tr>
<tr>
<td><strong>Total to be disposed of</strong></td>
<td></td>
<td><strong>17.5</strong></td>
</tr>
</tbody>
</table>
Wet treatment of bottom ashes: actual performance

Raw bottom ashes

Sand 0.1 - 2 mm
Granulate 2 - 6 mm
Granulate 6 - 50 mm
Use of the granulates has to be approved by authorities

- Certificate of re-use (OVAM, Flemish Waste Agency)
  - Scope: use as a granular application (foundation material)
  - the granulate has to fulfil all VLAREA requirements
    - is on the list of waste streams that can become secondary raw materials
    - has to meet up specific limits concerning:
      - leaching of metals
      - total concentration of organic components
      - total concentration of metals (= target values)

Wet treatment of bottom ashes: actual performance
### Fraction granulate

<table>
<thead>
<tr>
<th></th>
<th>2 – 6 mm</th>
<th>6 – 50 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dioxins (PCDD / PCDF)</td>
<td>&lt; 5 pg TEQ/g</td>
<td>&lt; 5 pg TEQ/g</td>
</tr>
<tr>
<td>PAH (individual values)</td>
<td>&lt; 0.03 mg/kg DM</td>
<td>&lt; 0.03 mg/kg DM</td>
</tr>
<tr>
<td>Leaching metals (mg/kg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arsenic (As)</td>
<td>&lt; 0.025</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>Cadmium (Cd)</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Chromium (Cr) (total)</td>
<td>&lt; 0.03</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>Copper (Cu)</td>
<td>0.17 – 0.50</td>
<td>0.04 – 0.49</td>
</tr>
<tr>
<td>Lead (Pb)</td>
<td>&lt; 0.03</td>
<td>&lt; 0.10</td>
</tr>
<tr>
<td>Nikkel (Ni)</td>
<td>&lt; 0.025</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>Zinc (Zn)</td>
<td>&lt; 0.03</td>
<td>&lt; 0.10</td>
</tr>
</tbody>
</table>
Some comments:

- **dioxins & PAH concentrations**: Very low

- **leaching criteria** (column test NEN7343 / two step leaching EN12457-3):
  - Cu is the only critical parameter
  - Leachability influenced by content organic matter (fulvic acids ?)
  - Ageing necessary

- **total amount of metals** (not mentioned in the table):
  - Zn and Cu > target value
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Restrictions: legal

- EoW status within EU
  - Flemish approach on “secondary raw materials” limited within own region
  - Depending on member state, granulate is still waste or ???

- No harmonization on environmental standards between member states
  - leaching conditions
  - Parameter set: metals, organics, POP’s, ...
  - Limit values
Restrictions: market

- Perception on the use of W-t-E granulates still negative
- Demand for huge amounts for construction works
  - Granulates play minor role, compared to C&D granulates
  - Negative prices
- Good market prices on ferrous / non ferrous necessary to keep facility economically feasible

As a result of that: granulates mainly used for end capping of Flemish landfills for non haz waste
Restrictions: socio - economical

- Need for further facilitating role of authority
  - Take the lead in the re-use of granulates in construction works
  - Developing legal framework for long temporary term storage to obtain huge amounts
  - Avoid taxes or restriction on permit conditions for the use of granulates as construction material on landfill sites, as long as alternatives are not mature and/or available
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Indaver has invested in a BREF proven technology, according:

- EU BREF Waste Incineration, 2006
- VITO BAT on ash treatment, 2008

Technology based on the wet process and integrated in the plant of Doel to optimize the use of water

BUT.....
Conclusion

- Local authorities should take the lead in using W-t-E granulates
- EU should set technical & environmental criteria as a End of Waste material
- Construction industry should be encouraged
Further background information

**BW2E**
- Belgian Waste to Energy
- Representing all Belgian WtE plants
- [www.bw2e.be](http://www.bw2e.be)

**CEWEP**
- Confederation of European Waste-to-Energy Plants (niet gevaarlijk afval)
- Representing 380 WtE plants in EU
- [www.cewep.com](http://www.cewep.com)

**EURITS**
- European Union for Responsible Incinerators & Treatment of Special waste
- 26 members with 36 plants for industrial (haz) waste
- [www.incineration.info](http://www.incineration.info)