Experience and lessons learned during construction and trial period of the MBT in Sofia, Bulgaria and it’s potential to contribute to renewable energy
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Today’s presentation

2 parts:

1. Mechanical Biological Treatment - MBT Sofia – Basis information and lessons learned
2. Potential of waste to contribute to renewable energy – a comparison of existing WtE (waste to energy) options
Part 1: MBT Sofia –
Basis information and lessons learned
Location of Plants
1. Sanitary landfill for MSW (10 ha)
2. Composting Plant for Green Waste (20,000 t/a)
3. Biogas Plant for Biowaste (24,000 t/a)
4. MBT for mixed MSW (410,000 t/a)
   - Secondary fuel (RDF)
   - Recyclables
   - Kompost
1. Landfill  Unieco (It) / Geotechmin (Bg)
2. Composting Plant  Eggersmann (D)
3. Biogas Plant  Eggersmann (D)
4. MBT  Actor-Helektor (Gr)
ICP’s tasks

SUPERVISION

1. Planning & Design
2. Construction
3. Startup
4. One year trial operation
MBT Sofia - Basis information

- Location Sadinata, about 22 km east from Sofia
- Surface Area 10.7 ha
- Construction time 19 month – completion 09/15
- One year trial period till 09/16
- Investment about 110 Mio. Euro
- Capacity 410,000 t/a (up to 1,300 t/d)
### MBT Sofia - Input/Output

<table>
<thead>
<tr>
<th>Input</th>
<th>410,000 t/y</th>
</tr>
</thead>
<tbody>
<tr>
<td>RDF</td>
<td>43.5%</td>
</tr>
<tr>
<td>Recyclables</td>
<td>9.5%</td>
</tr>
<tr>
<td>CLO</td>
<td>0.1%</td>
</tr>
<tr>
<td>Losses</td>
<td>28.5%</td>
</tr>
<tr>
<td>Residues</td>
<td>18.4%</td>
</tr>
</tbody>
</table>
Mechanical-Biological Treatment (MBT) / Example Sofia, Bulgaria
MBT Sofia, Waste reception

- Reception
  - Mechanical Separation
  - Biodrying
  - Secondary Fuel Production
  - Storage
  - Delivery

- Delivery to deep bunker
- Crane
- Movingfloor
- Shredder
- Manuel Presorting
MBT Sofia, Mechanical Separation

- Drumsieve 200 mm
- > 200 mm – Manual sorting ➔ Recycling
- > 200 mm – Waste shredder ➔ Biodrying
- < 200 mm ➔ Biodrying
Reception
- <200 mm to bunker
- 2 cranes distribute <200 mm in to boxes
- Retention time in boxes 7 days – aerated
- After biobrying ➔ RDF-production
MBT Sofia, Secondary Fuel Production

- Reception

- Mechanical Separation
  - Sieving in 3 fraction
    - > 60 mm
    - 30-60 mm
    - < 30 mm
  - Fe-Separation
  - Densimetric Tables/ Vibration sieves (separation light and heavy)
  - Optical separation NIR – Infrared / Laser
  - Eddy-Current Separation – Separation of NF-Metal

- Biodrying

- Secondary Fuel Production

- Storage

- Delivery

⇒ Aim:
  - RDF >14 Mj/kg ⇒ Baling / container
  - Extraction of Impurities and Recyclables
MBT Sofia, Storage and Delivery

- RDF
  - Baled
  - Loose transport in containers
MBT Sofia- Status today

- About 800t/d - 1,100 t/d are treated daily
- Operation carried out by Municipal company
- Heavy problems identified for operation / maintenance and repair
- Many stops/breaks and damages through operation due to
  - Insufficient maintenance & repair
  - Complicate decision structures esp. in emergency cases
  - Insufficient number of qualified staff
  - High staff fluctuation due to low salary

→ Questionable whether a municipal company under the administrative structure of municipality is able to operate such a plant
→ Are DBO (Design-Build-Operate) projects/contracts a better solution?
Part 2: Potential of waste to contribute to renewable energy

Potential of the MBT to contribute to renewable energy

a comparison of existing WtE (waste to energy) options
Key message out of Sofia’s MBT for whole Bulgaria

Existing energy potential out of waste for next 20 years

27 Million Barrel Crude Oil
Energy containing waste

Organic Waste

- Biodegradable waste
  - Paper
  - Kitchen waste
  - Garden waste

- Non degradable waste
  - Plastics
  - Synthetic Rubber
Municipal Solid Waste composition in Bulgaria

Estimated composition of MSW in Bulgaria

- Organic Waste: 40%
- Combustible Waste: 25%
- Non-combustible recyclables: 8%
- Other Waste: 27%

Energy containing waste: ~ 65%
Problem of organic waste: High water content (>60 %)

Energy containing waste: ~36 Mio. t

Total MSW in 20 years: ~55 Mio. t
Typical Waste to Energy (WtE) technology options

WtE technology

- Landfill gaz utilization
- Incineration
- Biogas Plants
- Pre-Processing (MBT)

Output: ENERGY

Output: Secondary fuel
Incineration

Requirements:
Input > 6 MJ/kg
biowaste < 50 %
capacity > 100,000 tons/y

MBT / Biodrying to increase usable energy of organic waste

- Total energy content is same
- for wet material much energy required to evaporate containing water
- If too much water, available energy is not sufficient to evaporate water
- Additional fuel required to burn wet material
- For dry total energy is usable
MBT / Biodrying to produce secondary fuel

**Biological drying**
biodegradable waste rapidly heated through initial stages of composting.

Drying increased by biological heat and forced aeration.

**Aim**
remove moisture reduce weight produce secondary fuel (RDF)
<table>
<thead>
<tr>
<th>Technology</th>
<th>Input</th>
<th>Energy Source</th>
<th>Used of Energy Recovery</th>
<th>Gas production per ton waste</th>
<th>Energy content per ton</th>
<th>Efficiency</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landfill gas utilization</td>
<td>Municipal solid waste</td>
<td>Biowaste</td>
<td>100%</td>
<td>~ 150 m³ in 15-20 years</td>
<td>0.6-0.9 MWh</td>
<td>25-50%</td>
<td>Low efficiency high amounts of GHG</td>
</tr>
<tr>
<td>Biogas Plants</td>
<td>Separated biowaste</td>
<td>Biowaste</td>
<td>50%</td>
<td>~ 120 m³ in 3-4 weeks</td>
<td>0.7-0.9 MWh</td>
<td>70-80%</td>
<td></td>
</tr>
<tr>
<td>Incineration</td>
<td>Municipal solid waste</td>
<td>Biowaste</td>
<td>100%</td>
<td>-</td>
<td>-</td>
<td>30-40%</td>
<td>Developing and emerging countries: &lt; 1.7 MWh due to high biowaste and organic content no efficient incineration possible</td>
</tr>
<tr>
<td></td>
<td>Biowaste and plastics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Developed countries: 30-40% Incineration with energy revenues possible</td>
</tr>
<tr>
<td>Pre-Processing (MBT) with sorting of secondary fuel</td>
<td>Municipal solid waste</td>
<td>Paper and plastics</td>
<td>15%</td>
<td>-</td>
<td>4.2-5.2 MWh</td>
<td>40-60%</td>
<td>High system efficiency</td>
</tr>
<tr>
<td>Pre-Processing (MBT) with biodrying+sorting</td>
<td>Municipal solid waste</td>
<td>Biowaste and plastics</td>
<td>45%</td>
<td>-</td>
<td>3.6-4.7 MWh</td>
<td>40-60%</td>
<td>High system efficiency</td>
</tr>
</tbody>
</table>
### WtE technology Options – Available energy potential

<table>
<thead>
<tr>
<th>Technology</th>
<th>waste quantity in 20 years</th>
<th>for energy recovery</th>
<th>total energy potential</th>
<th>efficiency in average</th>
<th>usable energy</th>
<th>Comparison in energy provision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landfill gas utilization</td>
<td>[tons]</td>
<td>[%]</td>
<td>[MWh]</td>
<td>[%]</td>
<td>[MWh]</td>
<td>[%]</td>
</tr>
<tr>
<td>Biogas Plants</td>
<td>55.000.000</td>
<td>100%</td>
<td>41.250.000</td>
<td>35%</td>
<td>14.437.500</td>
<td>100%</td>
</tr>
<tr>
<td>Incineration</td>
<td>55.000.000</td>
<td>50%</td>
<td>22.000.000</td>
<td>75%</td>
<td>16.264.286</td>
<td>113%</td>
</tr>
<tr>
<td>Pre-Processing (MBT) with sorting of secondary fuel</td>
<td>55.000.000</td>
<td>100%</td>
<td>104.500.000</td>
<td>35%</td>
<td>36.575.000</td>
<td>253%</td>
</tr>
<tr>
<td>Pre-Processing (MBT) with biodrying+sorting</td>
<td>55.000.000</td>
<td>20%</td>
<td>51.700.000</td>
<td>50%</td>
<td>25.850.000</td>
<td>179%</td>
</tr>
<tr>
<td>Pre-Processing (MBT) with biodrying+sorting</td>
<td>55.000.000</td>
<td>40%</td>
<td>92.400.000</td>
<td>50%</td>
<td>46.200.000</td>
<td>320%</td>
</tr>
</tbody>
</table>

![Graph showing total energy potential and usable energy for different technologies](image-url)
WtE technology Options – Available energy potential

- 27 Mio. Barrel

Barrel crude oil (1.7 MWh/barrel) [No]
Conclusions for Waste Management in Bulgaria

„Waste is a significant source for renewable energy“

- Available energy potential for next 20 y ~ 27 Mio Barrel Oil
  - Incineration in most cases not useful – waste is too wet in most cases
  - Pre-processing (MBT) with RDF production is appropriate for all sizes/waste

- Combining „Need for Energy“ with „Waste Management“ ➔ Win-Win Situation
This was my contribution for today!!!!  

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