European Technology Overview: Anaerobic Digestion (AD) of the Organic Fraction of the MSW

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GBB’s Waste Consulting Services

- Economic, technical and environmental reviews
- Procurements
- Due diligence third-party reviews
- Waste characterization and sourcing
- Process planning and conceptual designs
- Independent feasibility consultant

WASTE MANAGEMENT IN EU
EU 27 Municipal Waste Composition

Composition of the MSW as generated, before recycling in the U.S.

- Food Waste: 25%
- Paper and Board: 19%
- Plastic: 12%
- Textiles: 4%
- Napkins & other sanitary: 3%
- Other: 3.4%
- Wood: 6.3%
- Rubber: 6.2%
- Foamed Plastics: 6.1%
- Metals: 5%
- Other: 4.3%
- Food Scraps: 14.7%
- Yard Trimings: 11.5%
- Cardboard: 4.6%

Source: US EPA, 2014

MSW Trends in the EU (1995-2014)

- Landfilling decreased 54%
- Recycling rate increased 166%
- Composting has increased 170%
- Waste-to-Energy Has increased 100%

Source: EUROSTAT, 2016

ANAEROBIC DIGESTION PLANTS IN THE EU

Evolution of the AD

• Organic Fraction from the Municipal Solid Waste
• Initially constructed for processing the mixed MSW
• Source separation of organics started in the ‘90s following the Landfilling Directive
• Used to be considered exclusive to the composting now working together
• Higher quality of processing for a bigger price
Evolution of the AD Capacity by Country

Source: Anaerobic Digestion of the Organic Fraction of Municipal Solid Waste in Europe – Status, Experience and Prospects – Luc De Baere and Bruno Matthaeus, 2015

- Total of 244 facilities
- Cumulative capacity of 7,750,000 Tonnes/year (enough to process 5% of the biodegradable fraction generated in the EU)
- Stand alone, combined with composting facilities, or part of Mechanical Biological Treatment Facilities (MBT)
- Germany and Spain are leaders in the total AD capacity installed
- Netherlands and Switzerland have the largest capacity installed per capita

Current Status of AD in Europe
Mechanical Biological Treatment (MBT)

Source Separated Recyclables

MSW source → Mixed MSW

Source Separated Organics

Mechanical (grinding, screening, recyclables separation, palletizing)

Biological (bio-drying, aerobic composting, anaerobic digestion)

Over 330 MBT facilities in operation throughout Europe

Products: Recyclables, Compost, Biogas, Electricity, RDF/EF

Total Installed Capacity

Source: Anaerobic Digestion of the Organic Fraction of Municipal Solid Waste in Europe

→ Status, Experience and Prospects: Luc De Baere and Bruno Matthaeus, 2015

Gershman, Brickner & Bratton, Inc.
Installed Capacity per capita

Source: Anaerobic Digestion of the Organic Fraction of Municipal Solid Waste in Europe – Status, Experience and Prospects – Luc De Baere and Bruno Mattheeuws, 2015

AD TECHNOLOGIES IN EU
### Types of AD technologies in operations

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Cumulative Installed Percentage, 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>Mesophilic</td>
</tr>
<tr>
<td></td>
<td>67%</td>
</tr>
<tr>
<td>Feedstock</td>
<td>Solid Waste</td>
</tr>
<tr>
<td></td>
<td>89%</td>
</tr>
<tr>
<td>Complexity of the system</td>
<td>One Phase</td>
</tr>
<tr>
<td></td>
<td>93%</td>
</tr>
<tr>
<td>Moisture Content</td>
<td>Wet</td>
</tr>
<tr>
<td></td>
<td>38%</td>
</tr>
<tr>
<td>MSW Feedstock</td>
<td>Source separated</td>
</tr>
<tr>
<td></td>
<td>55%</td>
</tr>
</tbody>
</table>

Source: Anaerobic Digestion of the Organic Fraction of Municipal Solid Waste in Europe – Status, Experience and Prospects – Luc De Baere and Bruno Mattheeuws, 2015

### Most Commonly Installed Technologies

<table>
<thead>
<tr>
<th>AD technology</th>
<th>Number of plants</th>
<th>Total capacity, tons/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kompogas</td>
<td>26</td>
<td>533,500</td>
</tr>
<tr>
<td>Valorga</td>
<td>19</td>
<td>2,197,000</td>
</tr>
<tr>
<td>Ros Roca</td>
<td>17</td>
<td>541,000</td>
</tr>
<tr>
<td>BTA</td>
<td>17</td>
<td>300,500</td>
</tr>
<tr>
<td>DRANCO</td>
<td>15</td>
<td>627,000</td>
</tr>
<tr>
<td>Citec</td>
<td>13</td>
<td>469,500</td>
</tr>
<tr>
<td>Linde</td>
<td>11</td>
<td>459,000</td>
</tr>
<tr>
<td>Total</td>
<td>118</td>
<td>5,127,500</td>
</tr>
</tbody>
</table>

Source: IEA, 2008
Experience

• Plants are in operation 10-20 years
• Not all plants and technologies has been equally successful
• Feedstock has to match the technology installed
• Both mixed waste and source separated organics can be contaminated
• Source separated organics in different parts of Europe lead different biogas yield

Trends

• Steady increase of the capacity
• Upgrading of existing composting plants to include AD capacity
• Both composting and WTE industry has accepted the AD as beneficial solution for all
• Batch tunnel dry AD facilities
• More AD plants coming in Eastern Europe
WHY AD HAS BEEN SUCCESSFUL IN EU?

- Landfill Directive, 1999 - Limited the amount of biodegradable municipal waste going to landfills
- Feed in tariffs
- On average 80 €/t landfilling tax
- 18 EU Countries with landfilling material bans

AD Drivers in the EU

Thank you!

Questions?

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