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

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April 28, 2016
GBB Introduction
Waste Management in EU
Anaerobic Digestion Plants in EU
Anaerobic Digestion Technologies in EU
Why AD has been successful in EU?
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

Municipal Solid Waste composition EU 27

- Kitchen waste: 25%
- Garden waste: 6%
- Aluminium: 1%
- White Goods: 1%
- Steel: 2%
- Glass: 5%
- Rubble: 5%
- Other Combustible: 10%
- Nappies & other sanitary: 3%
- Textiles: 4%
- Plastic: 12%
- Paper and board: 18%
- Other: 8%

Source: Eurostat

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

- Food Scraps: 14.5%
- Yard Trimmings: 13.5%
- Plastics: 12.70%
- Metals: 9%
- Rubber, Leather & Textiles: 8.4%
- Wood: 6.3%
- Glass: 4.6%
- Paper & Paperboard: 27.4%
- Other: 3.4%

Source: US EPA, 2014

Source: Zero Waste Europe, 2012
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
EU-27 Municipal Waste Treatment, (2016, kg/Capita)

Source: EUROSTAT, 2016
The Sustainable Waste Management Ladder

Earth Engineering Center, Columbia University (based on Eurostat 2008 data)

- Netherlands
- Germany
- Sweden
- Austria
- Denmark
- Belgium
- Luxembourg
- France
- Italy
- Finland
- United Kingdom
- Spain
- Ireland
- Portugal
- Slovenia
- Hungary
- Estonia
- Greece
- Slovakia
- Czech Republic
- Poland
- Cyprus
- Latvia
- Lithuania
- Malta
- Romania
- Bulgaria

Key:
- % Recycled
- % Composted
- % Landfilled
- % to Waste-to-Energy

U.S.A.
SOG
2008
data
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 Mattheeuws, 2015
Current Status of AD in Europe

- 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
Mechanical Biological Treatment (MBT)

Source Separated Recyclables

Mechanical- Biological Treatment Plant (MBT)

Mechanical (grinding, screening, recyclables separation, palletizing)

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

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

Over 330 MBT facilities in operation throughout Europe
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 Mattheeuws, 2015
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><strong>Total</strong></td>
<td><strong>118</strong></td>
<td><strong>5,127,500</strong></td>
</tr>
</tbody>
</table>

Source: IEA, 2008
Experience

- Plants are in operation 10-20 years
- Not all plants and technologies have 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?
AD Drivers in the 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
Thank you!

Questions?

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