Industrial Experiences With Anaerobic Digestion Plants in Europe

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Ros Roca Envirotec
Structure of presentation

- Presentation of company
- Case studies AD projects in Europe with wet fermentation technology
- Biogas utilization
## Products and technologies for environmental protection

<table>
<thead>
<tr>
<th>Collection and cleaning equipment</th>
<th>Pneumatic waste collection</th>
<th>Technologies waste, biomass utilization</th>
<th>Cryogenic products and technologies</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Collection and cleaning equipment" /></td>
<td><img src="image2" alt="Pneumatic waste collection" /></td>
<td><img src="image3" alt="Technologies waste, biomass utilization" /></td>
<td><img src="image4" alt="Cryogenic products and technologies" /></td>
</tr>
</tbody>
</table>

- *RDS Roca Group Companies*
- *Distributors*
- *Sales Under License*
- *Representation*
Technologies

- Biogas plants (Wet and dry digestion technology)
- Biogas treatment (Drying, Desulphurization, Upgrading, CNG, LNG)
- Biogas utilization (CHP, Boiler, Grid injection, Filling stations)
- Composting (Tunnel, Drum, Turning machine)
- Mechanical-biological waste treatment with digestion and / or aerobic stabilization
- Mechanical sorting plants
- Manure treatment
Experiences
Anaerobic Digestion
EU requirements for increasing renewable energy production to reduce emission of greenhouse gases (CO$_2$, CH$_4$)

EU requirements for waste treatment (reduction of organics to landfills)

Regulatory conditions for renewable energy production are defined (fixed infeed tariffs for electricity and heat, tax benefits for biofuels)
**Input material for Ros Roca AD technology**

<table>
<thead>
<tr>
<th>Municipality</th>
<th>Industry</th>
<th>Agriculture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source separated organic waste (SSO)</td>
<td>Packaged food</td>
<td>Manure</td>
</tr>
<tr>
<td>Organic fraction MSW</td>
<td>Residues from food and beverage production</td>
<td>Dung</td>
</tr>
<tr>
<td>Sewage sludge</td>
<td>Food leftovers</td>
<td>Energy crops</td>
</tr>
<tr>
<td></td>
<td>Grease</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Slaughterhouse waste</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Residues from ethanol fermentation</td>
<td></td>
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<td></td>
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</tbody>
</table>

Ros Roca AD process is flexible and treats organic waste independent of humidity
Process flexibility is important

- Waste quality is subject to strong variations
- Efficient utilization of fermenter for biogas production (no feeding of non bio-degradable organic material)
- Political frameworks change (e.g. renewable energy act Germany)
- Market conditions change
New contracts recently signed: Portugal 2 MBT plants with AD, Italy 1 AD plant for biowaste, Spain 1 agricultural AD plant, UK 1 AD plant for packaged food waste
Selected bidder in Mumbay, India for AD plant treating biowaste
The AD technology of Ros Roca – Main process steps

**Wet Pretreatment**
- Adjust water content
- Separation of impurities and non biodegradable material

**Pasteurization (ABPR 1774/2002)**
- > 70 °C, > 1 h,
- particle size < 12 mm

**Minimizing wear in the plant**
- Avoid sedimentation and floating
- Production of high quality fertilizer

**Anaerobic digestion**
- Mesophilic or thermophilic operation

**Kill pathogens**
- Production of pasteurized fertilizer for direct agricultural utilization

**Completely biogas mixed digester**
- No moving elements inside
- High specific biogas production

**Dewatering**
- Separation in high quality solid and liquid fertilizer

**Reliable, efficient dewatering with centrifuges**
- Low solid concentration in process water
- Operation without polyelectrolytes possible

**Biogas utilization**
- Energy production from biogas

**Solutions with highest possible efficiency**
Efficient biogas utilization: Ros Roca solutions

Raw biogas \( \text{CH}_4 \) 55 – 70 %

- On site CHP
- Biogas upgrading
- On site heating boiler

Bio methane
\( \text{CH}_4 > 97 \%

- Natural gas grid
- Bio fuel production

- Central power plant
- Consumer
- Vehicles
Capacity: 17,000 t/y (34,000 t/y 2nd step)
Biowaste, Food leftovers, Packaged food
Co-digestion biogas plant Västerås, Sweden

Capacity: 23,000 t/y
Biowaste, Energy crops, Organic industrial waste
Co-digestion biogas plant Voghera, Italy

Capacity: 27,000 t/y
biowaste, sewage sludge (Co-digestion)
Capacity: 25,000 t/y
Municipal solid waste
Agricultural biogas plant Kielen, Luxemburg

Energy crops, cow manure, cow dung, biowaste, organic industrial waste
48,000 t/y
Capacity: 150,000 t/y
waste from the potato processing industry,
vegetable organic waste
## Quality of fertilizer from biowaste

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Biogas plant Germany</th>
<th>Quality requirements for digestate Germany</th>
<th>Biogas plant Sweden</th>
<th>For the use in organic farming according to EEC 2092/91</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead (Pb)</td>
<td>(mg/kg DM)</td>
<td>44,5</td>
<td>150</td>
<td>8,9</td>
<td>45</td>
</tr>
<tr>
<td>Cadmium (Cd)</td>
<td>(mg/kg DM)</td>
<td>0,6</td>
<td>1,5</td>
<td>0,3</td>
<td>0,7</td>
</tr>
<tr>
<td>Chrome (Cr)</td>
<td>(mg/kg DM)</td>
<td>36,0</td>
<td>100</td>
<td>28,0</td>
<td>70</td>
</tr>
<tr>
<td>Copper (Cu)</td>
<td>(mg/kg DM)</td>
<td>50,0</td>
<td>100</td>
<td>50,0</td>
<td>70</td>
</tr>
<tr>
<td>Mercury (Hg)</td>
<td>(mg/kg DM)</td>
<td>0,0</td>
<td>1,0</td>
<td>0,0</td>
<td>0,4</td>
</tr>
<tr>
<td>Nickel (Ni)</td>
<td>(mg/kg DM)</td>
<td>22,5</td>
<td>50</td>
<td>17,0</td>
<td>25</td>
</tr>
<tr>
<td>Zinc (Zn)</td>
<td>(mg/kg DM)</td>
<td>216,0</td>
<td>400</td>
<td>150,0</td>
<td>200</td>
</tr>
<tr>
<td>Dry matter</td>
<td>(% wet weight)</td>
<td>31,5</td>
<td>20</td>
<td>24,2</td>
<td>-</td>
</tr>
<tr>
<td>Organic dry matter</td>
<td>(% DM)</td>
<td>58,3</td>
<td>40</td>
<td>74,4</td>
<td>-</td>
</tr>
</tbody>
</table>
Main advantages wet digestion process of Ros Roca

- Process works independent from humidity of biomass
- Treatment of liquid and solid organic biomass from municipality, agriculture, industry
- Completely automated process
- Minimum manpower requirements
- Separation of impurities in front of digester
- Low maintenance requirements
- High quality digestate / compost
- Pasteurisation of waste according to ABPR (EU directive 1774/2002)
- High biogas quality
- Modularly extendable
- Technology approved in numerous big scale industrial plants
Biogas utilization
Why biogas upgrading?


Energetic efficiency in biogas utilization is normally higher if biogas is upgraded to bio methane and utilized in off-site CHP-installations.
CO₂ – solubility rises under high pressure & low temperature
Experiences

Biogas upgrading
# References biogas upgrading plants (YIT technology)

<table>
<thead>
<tr>
<th>Location</th>
<th>Capacity, Nm$^3$/h</th>
<th>in operation since</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eskilstuna, Sweden</td>
<td>330</td>
<td>2003</td>
</tr>
<tr>
<td>Linköping, Sweden</td>
<td>1.400 (2 * 700)</td>
<td>2002</td>
</tr>
<tr>
<td>Västerås, Sweden</td>
<td>550</td>
<td>2004</td>
</tr>
<tr>
<td>Norrköpping, Sweden</td>
<td>400</td>
<td>2006</td>
</tr>
<tr>
<td>Boden, Sweden</td>
<td>250</td>
<td>2007</td>
</tr>
<tr>
<td>Altenstadt, Germany</td>
<td>1.250</td>
<td>Start-Up 2009</td>
</tr>
<tr>
<td>Kileen, Luxemburg</td>
<td>600</td>
<td>Start-Up 2009</td>
</tr>
</tbody>
</table>
Methane concentration is increased from 60 Vol.-% to 98 Vol.-%.
No biogas desulphurization is necessary.
Biogas upgrading project Altenstadt, Germany

Capacity: 1.250 Nm³/h
Biomethane quality CH₄ 97 +/- 2%
Gas injection in local gas grid
Kielen, Luxemburg

Capacity: 600 Nm³/h
Biomethane quality CH₄ 97 +/- 2%
Gas injection into local natural gas grid
LNG Trucks
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