Utilizing Local Bio-Resources - Biogas
Solrod Municipality, Denmark

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Chair, Danish Board of District Heating
Vice-chair, IEA DHC|CHP
Where are we?

[Map of Europe with marked locations]
Where to find Solrød and VEKS?

**VEKS**
- Partnership between 12 municipalities
- 350,000 tax-payers
- 150,000 end – users
- 9,000 TJ (2,500 GWh)

**DH in Greater Copenhagen**
- 19 municipalities
- 4 integrated systems
- 500,000 end – users
- 34,500 TJ (9,600 GWh)

40 km

Where to find Solrød and VEKS?
Who is VEKS?
Vestegnings Kraftvarmeselskab I/S

- Established in 1984.

- District heating (DH) company with the purpose to utilize and distribute surplus heat from CHP plants, waste incineration plants and surplus heat from industries.

- Involved in production, transmission and distribution of district heating.

- Investment in pipe network: € 350 mill.

- Annual turnover: € 150 mill.

- Non-profit company.
Solrød Biogas Plant
Raw materiale to the biogas plant

- Seaweed from the beach-cleaning.
- Residues from the factory CP Kelco.
- Industrial biomass.
- Manure.
Solrød Biogas Plant
Seaweed from beach cleaning

• Has for many years been a nuisance to the beach's visitors and residents of the beach area.
• Seaweed contains some nutrients, which will add value to the digested biomass.

Will be used for fertilization / soil conditioner in agriculture.
• Potential of up to 42,000 tons, however, after excluding sand it will be significantly reduced. At the moment the annual collecting of seaweed will be 22,000 tons, of which 2/3 are rated as sand discarded.
Solrød Biogas Plant
Residues from CP Kelco

- Residues from the production of pectin in the company CP Kelco, located app. 2 km from the biogas plant. The annual amount of citrus peels is estimated to be round 80,000 tons.

- What is pectin?
  - Pectin has the property to form a gel with sugar. For this reason, pectin is used in combination with sugar as a thickening agent in the food industry.
  
- Pectin is produced from citrus peels as raw material and residues consists almost entirely of organic, biodegradable material.
Solrød Biogas Plant
Other industrial biomass

- Currently there is included reception of app. 60,000 tons of industrial biomass (residue from the production of lactic acid bacteria) from a pharmaceutical company.

- The biomass is estimated to contribute about 1.0 million $m^3$ of methane out of the total annual production of 6.0 million $m^3$ of methane.
Solrød Biogas Plant
Animal manure

- The industrial residues will not be optimal to use alone in the biogas plant as they predominantly have a low pH-value.

- Addition of manure is beneficial to maintaining an appropriate degree of acidity in the digesters.

- Farmers are expected to deliver 50,000 tons of manure in the form of pig and cattle slurry, and smaller proportion horse manure.
## Solrød Biogas Plant

Raw material, methane production and contributions to the project

<table>
<thead>
<tr>
<th>Raw material</th>
<th>To the biogas plant tons/year</th>
<th>Calculated methane production 1,000 m³/year</th>
<th>Contribution to the project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manure</td>
<td>53,200</td>
<td>578.8 (9.5 %)</td>
<td>Gas production and process stability</td>
</tr>
<tr>
<td>Seaweed</td>
<td>7,400</td>
<td>31.6 (0.5 %)</td>
<td>Nutrients and improved water quality</td>
</tr>
<tr>
<td>CP Kelco</td>
<td>79,400</td>
<td>4,514.8 (75 %)</td>
<td>Gas production</td>
</tr>
<tr>
<td>Industrial residues</td>
<td>60,000</td>
<td>918.7 (15 %)</td>
<td>Gas production and nutrients</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>200,000</strong></td>
<td><strong>6,000 (100 %)</strong></td>
<td><strong>Benefits for the environment</strong></td>
</tr>
</tbody>
</table>

**Benefits for the environment**
Local benefits from the biogas plant:

- Odors: Solve problems with odors from seaweed & algae by removing the seaweed and use it in the biogas plant.

- Climate: using seaweed and organic industrial waste in a biogas plant will contribute to reduce the use of fossil fuels in the energy consumption in the area.

- Nutrients: Contributing to solve problems with marine pollution. Removing the seaweed from Køge Bay will diminish the load of nutrients, which today is a major problem of the aquatic environment.

- Fertilizer: Contribute to useful nutrients: From the biogas plant comes in addition to biogas also some residues, which can be used for fertilizer designed to replace chemical fertilizer.
Solrød Biogas Plant
Delivery and storage of digested biomass

- Liquid fraction will be transported back to the farmers as fertilizer to replace existing “normal” fertilizer.

- In addition to the use of existing tanks at farms, there will be an increased storage and handling requirements for app. 100,000 tons degassed biomass annually.
Solrød Biogas Plant
Investment

<table>
<thead>
<tr>
<th>Investments – excl. VAT Price level 2013</th>
<th>Biogas plant and CHP plant Million DKK (million €)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Biogas plant</strong></td>
<td></td>
</tr>
<tr>
<td>Installations With short lifetime</td>
<td>26.8 (3.8)</td>
</tr>
<tr>
<td>Other installations and facilities</td>
<td>53.5 (7.1)</td>
</tr>
<tr>
<td>Buildings etc.</td>
<td>6.7 (0.9)</td>
</tr>
<tr>
<td><strong>CHP plant</strong></td>
<td></td>
</tr>
<tr>
<td>Gas engine</td>
<td>24.0 (3.2)</td>
</tr>
<tr>
<td>Pipes</td>
<td>6.0 (0.8)</td>
</tr>
<tr>
<td>Connections, pumps etc.</td>
<td>1.5 (0.2)</td>
</tr>
<tr>
<td>Transport equipment</td>
<td></td>
</tr>
<tr>
<td>Storage facilities at farmers</td>
<td>15.0 (2.0)</td>
</tr>
<tr>
<td><strong>Total investments</strong></td>
<td><strong>143.5 (19.1)</strong></td>
</tr>
</tbody>
</table>

Planned commissioning of the total plant is expected by end of 2015.
Solrød Biogas Plant
Consequences for the environment

<table>
<thead>
<tr>
<th>Facts</th>
<th>Emissions</th>
<th>Consequences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual reduction of CO₂ emission</td>
<td>40,500 tons</td>
<td>Approx. 60% of the municipality's climate target</td>
</tr>
<tr>
<td>Annual <em>nitrogen</em> reduction in Køge Bay</td>
<td>62 tons</td>
<td>Approx. 70% reduction requirement for Køge Bay</td>
</tr>
<tr>
<td>Annual <em>phosphorus</em> reduction of Køge Bay</td>
<td>9 tons</td>
<td>Over 100% reduction requirement for Køge Bay</td>
</tr>
</tbody>
</table>
Solrød Biogas Plant
Summary

- The biogas plant ensures:
  - Utilization of waste from industry and agriculture.
  - Solves an environmental problem in the form of seaweed washed up on the beach.

- The biogas plant reduces the GHG emissions:
  - When removing seaweed from the beach (seaweed emits GHG methane when it rots).
  - By substitution of fossil fuels for energy production.
  - When replacing soil materials in the agriculture.

- The biogas plant generates digested biomass:
  - Better binding of fertilizers in the soil.
  - Reducing the environmental impact that can be achieved by leaching.
Thank you

Further information:
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