Biogas opportunities in Estonia

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Estonia – a quick look

Population of 1.3 million
Member of EU since 2004
In Eurozone since 2011
50% of forest, ....

Biogas Markets, SPIN workshop,
Leipzig 2011, Ahto Oja
Current status of biogas in Estonia

- The amount of Estonian biogas production was only around 11 million Nm³
- from 2 landfills, 2 sewage sludge and 1 slurry (liquid manure).
- 40% of the biogas produced was burned in a flare in 2007 in Estonia

The first experiences of Estonian SME-s on biogas production - landfills

- Since year 1994 biogas extracted by Terts Ltd from closed Pääsküla Landfill (Tallinn) (CHP)
- OÜ Tallinna Prügilagaas owns and operates the CHP (N=1,9MWel) in Jõelähtme Landfill close to Tallinn, which started operation in February 2010.
- OÜ Väätsa Prügilagaas collects landfill gas, burns in flare
- Uikala Landfill collects landfill gas and burns it in flare, but intends to start to use it in CHP for electricity production.
- Torma Landfill burns landfill gas in flare.
- Paikre prügila prepares to collect landfill gas for using it in CHP
The first experiences of Estonian SME-s on biogas production – sewage sludge

- **Tallinn Waste Water Treatment Plant** (AS Tallinna Vesi, Paljassaare) produces biogas in average 2.8 million Nm³/y since 1993
- Biogas is produced from sludge in Narva
- Construction of biogas plant is ongoing in Kuressaare
- The biogas production from sludge is planned in Tartu, the estimated amount of biomethane in Tartu from sludge is 440 000 Nm³/y and this is enough to run around 12 buses in Tartu city on biomethane

Biogas from agricultural inputs

- 1 is in operation Saare Economics in Saaremaa
- 4 new biogas plants on manure, developed by Baltic Biogas OÜ and 4Energia OÜ
  - got the investment subsidy from Environmental Fund (50%) in 2009 and hopefully will start to build the plant this year
  - **Precondition** to use heat in district heating
- 3 new applications are in
  - Loo on chiken manure
  - Torma on manure
  - Põlva on sludge
What is Estonian theoretical and practical biogas potential?
Why is the potential not used?
What are the future perspectives?

Renewable energy target 2020 in Estonia

- Estonian greenhouse gas emission in CO₂ equivalents per capita was **16.41 tons** in 2008
- The highest amount of CO₂ emission in Estonia is related to the **oil shale**
- European Union has set the target:
  - a share of 20% of renewable energy in gross inland energy consumption in 2020,
  - 10% share of biofuels in transport
  - next to 20% of green house gases emission reduction and
  - 20% of energy efficiency improvement by the year 2020.

<table>
<thead>
<tr>
<th></th>
<th>2005</th>
<th>2010</th>
<th>2020</th>
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<tbody>
<tr>
<td>Share of renewable energy of gross final consumption (%)</td>
<td>16.6</td>
<td>20.90%</td>
<td>25.00%</td>
</tr>
<tr>
<td>Share of renewable energy of gross final consumption (ktoe)</td>
<td>514</td>
<td>666</td>
<td>863</td>
</tr>
<tr>
<td>Incl heating and cooling (ktoe)</td>
<td>505</td>
<td>612</td>
<td>606</td>
</tr>
<tr>
<td>Renewable electricity (ktoe)</td>
<td>9</td>
<td>53</td>
<td>165</td>
</tr>
<tr>
<td>Transport fuels (ktoe)</td>
<td>0</td>
<td>1</td>
<td>92</td>
</tr>
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</table>
Hay is cut on semi-natural habitats without any use of it. 20% of it can be used for biogas production.

25% of agricultural land is not cultivated in Estonia – we estimate 20% of it for silage production for biogas plants.

Estonian practical biogas potential
biogas 392 million nm³, biomethane 235 million nm³ (110 MWₑₚₑ)
Share of renewable electricity and heat is 7-10% from total energy final consumption

Feasibility of biogas production

- Current feed-in-tariff for renewable electricity is **5.37 €cents**/kWh (+market price 3-6€cents/kWh) in Estonia – thus **8-11 €cents**/kWh in total
- **This is flat feed-in-tariff rate** for all renewable electricity (wind, wood, etc.)
- The authorities intend to **reduce** the feed-in-tariff down to flat rate of **6.39 €c/kWh**, which includes market price.
- Estonian Competition Authority stated
  - current feed-in tariff 5.37 €cent/kWh plus market price is **too profitable** for big wind energy and other renewable energy producers
  - Estonian Competition Authority **didn’t analysed the feasibility** of the biogas plants.
- At what level of renewable electricity feed-in-tariff the biogas production is feasible in Estonia?
Feasibility of biogas production

- electrical and thermal efficiency of CHP generator is 38%
- annual biogas production (60% CH₄) is 2.7 million Nm³
- working hours in CHP are 8’200 hours/a
- capital investment cost is (CAPEX) 3’500€/kW
- price for silage 32 €/t
- the cost of the slurry transport from surrounding farms is 0.26 €/t/km
- Half of the produced thermal energy was sold for district heating system of Särevere with the price of 32 €/MWh
- biogas plant own heat consumption was 35%
- operational costs (OPEX) consisted 5% from CAPEX.

Economically feasible feed-in-tariff is 18 €c/kWh
(6 years pay-back time)

Feasibility of biogas plant depends from feed-in-tariff

Without 50% investment subsidy
New challenge – biomethane in transport

- Biomethane is currently not produced in Estonia
- 2 CNG refuelling stations (2 nozzles, 1 for truckes and 1 for passenger cars)
- **69 NGV** (6 buses, 3 trucks, 60 light duty)
- CNG price **0.677 €/kg**
- First diesel engine converted to dual fuel
- Pay back time app. 1 year, 40% saving

*Figure 16. The comparison of diesel and petrol fuel consumption with biomethane potential in 13 Estonian counties in 2009.*
First experiences on CNG (CBM) as vehicle fuel

- GasHighWay project calculated the feasibility of biomethane for vehicle fuel
- First private companies converted their vehicles for natural gas/biomethane
- Both gasoline and diesel vehicles were converted
- For diesel vehicles it was first time in Baltics!

Payback time less than year
3200 km in month, 50:50 city/road

<table>
<thead>
<tr>
<th>Fuel type</th>
<th>Fuel consumption</th>
<th>Cost in month</th>
<th>Cost in year</th>
</tr>
</thead>
<tbody>
<tr>
<td>petrol</td>
<td>16 l/100 km</td>
<td>575 euro</td>
<td>6909 euro</td>
</tr>
<tr>
<td>CNG/Biomethane</td>
<td>16 l/100 km</td>
<td>247 euro</td>
<td>2971 euro</td>
</tr>
<tr>
<td>Saving</td>
<td></td>
<td>328 euro</td>
<td>3938</td>
</tr>
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The reasons of not using the applicable biogas potential - 1 *(survey results)*

- lack of CNG/BM filling stations
- lack of general experiences
- lack of trust to new technology
- untrust towards the quality of the biomethane
- unknown conversion costs of dual-fuel devices
- lack of knowledge about the engine efficiency

The reasons of not using the applicable biogas potential - 2

- possible decline in traction (in horsepower)
- lack of long-term statistics
- unknown costs of maintenance and repair
- lack of state support for eco-friendly means of transport
- lack of the general information and working pilots of the compressed natural gas and biomethane vehicles.
Estonian Biogas Association

- Established in May 2009 in Tallinn
- 15 companies and 5 private persons
- To promote biogas sector among public, politicians and authorities
- To present common interests of biogas sector
- Participating in drafting legislation
- Articles in newspapers to promote biogas
- Presentations in conferences
- Proposal on biomethane use for vehicles

40% of farmers (livestock) are interested in biogas production

![Graph showing interest in biogas production among farmers with different numbers of livestock units.](image)
Projects – case of GasHighWay

- The GasHighWay activities promote gaseous fuel in transport (CNG and biomethane)
  - promoting the conversion of fleets to CNG/BM
  - mapping the optimal locations for the filling CNG/BM stations
    - GPS compatible Map of CNG filling stations at www.gashighway.net
  - technical support in form of feasibility studies and business plans to:
    - potential investors in gas refuelling infrastructure
    - organisations interested in the uptake of gas vehicle fleets
    - potential and existing biogas producers
  - communicating to key decision-makers and local authorities
  - creating a roadmap for the European GasHighWay
  - raising the awareness on the use of biomethane and CNG as vehicle fuel.

Estonian vision on CNG and biomethane filling stations
Future perspectives

- Working group under Ministry of Communication and Economy to propose an Estonian model to promote methane fuels (CNG and Biomethane) in transport
- Biomethane for transport fuel will remain without fuel excise tax
- University of Tartu and Estonian Biogas Association will study the public benefits of biogas/biomethane production
- Feed-in-tariff unlikely will increase

Conclusions

- Estonian biogas potential is 7% electricity and 10% heat of total final energy consumption and 33% of annual natural gas consumption can be replaced.
- Economically usable amount of biogas is 392 million Nm³ (900 GWhel/a, 110 MWel)
- The low economic feasibility of biogas production for CHP is the main reason for not exploiting the Estonian biogas potential.
- The use the biomethane (235 mln nm³) as vehicle fuel seems to be feasible
- Biomethane is not produced, CNG comes from Russia, fear of dependency
Thank you for your attention!

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