spin Sustainable Production through Innovation in SMEs

Estonian experiences of SMEs introducing biogas technologies

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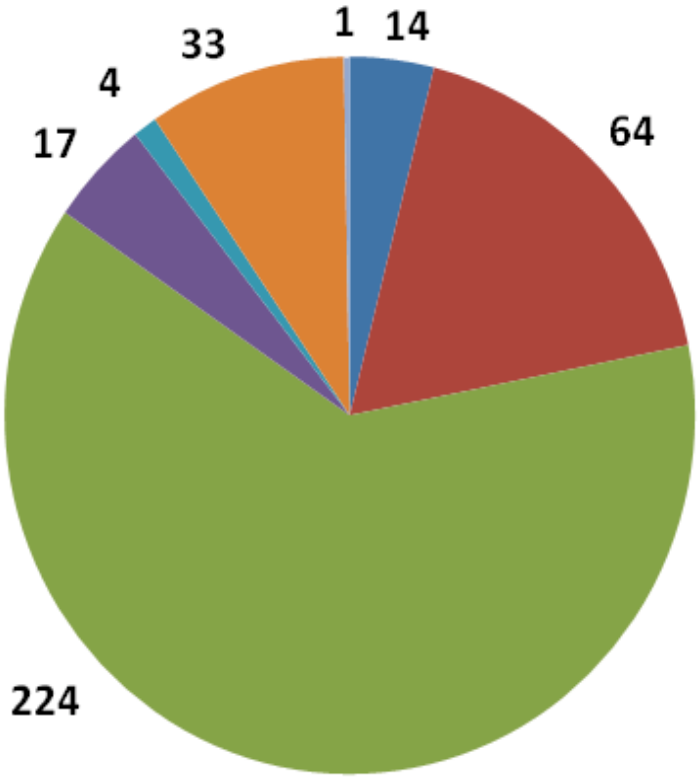
Biogas resource inputs – potential and reality

- **The theoretical** Estonian biogas potential is **544 million Nm^3/a**
- **Feasible potential is 286 million Nm^3/a**
    - **5-8 %** of total electricity consumption or 50-84 MW_{el} installed capacity of electricity production
- The amount of Estonian biogas production was only **around 11 million Nm^3/a** in 2007, originating from landfills, sewage sludge and slurry (liquid manure) .
- **Actual use:** the energy produced from biogas in 2007 accounted for:
    - **0.16 %** of the heat energy used and
    - **0.14 %** of the total electricity consumption.

Biogas 10^6 Nm^3



- 20% of the hay mowed at nature conservation areas
- 20 % of silage from unused agricultural land, in two harvests (yield 7.3 t/ha)
- 5 % of energy crops growing on usable agricultural area (830,000 ha), in two harvests (yield 20 t/ha)
- 80% of landfill gas is used for combined heat and power production
- 50% of sewage sludge is used for biogas production
- 30% of total manure and slurry can be used for biogas production
- 10% of bio waste (food industry, kitchen waste)

Setting for Estonian biogas sector

- Biogas production is **not a business case** - at the moment not profitable
- However, several reasons for developing the sector - **multidimensionality**
  - Waste management (Waste should be considered as secondary source for renewable energy, not as externality with extra cost)
  - Nature protection and landscape management
  - Regional, rural socio-economic SME development
  - Technology and knowledge transfer, R&D
- Current legal and social circumstances do not support biogas sector development in Estonia. The current development stage is characterised by the activities of a **small number of enthusiasts in an undeveloped political-legislative framework**.

Biogas production - economically irrational

- Example: in 2007 AS Eesti Energia started planning biogas production in Estonia's biggest piggery and a large agricultural company in Torma. Two years later, Eesti Energia stopped the active development of both projects: **"The company prefers to concentrate on projects that are financially profitable – and biogas projects are not."**

- **Feed-in-tariff** for renewable electricity is flat rate of **7 €c/kWh$_{el}$**
  - Corresponding only 25% of feed-in-tariff of Germany and Latvia
  - Feasibility studies indicate that for **market driven development** it should be double the current rate: **13 €c/kWh$_{el}$**
  - Estonian Government intends **to decrease** the feed-in-tariff for all renewable electricity to **6 €c/kWh$_{el}$**
- **This is the reason why many entreprenreurs & developers have stopped trying in past few years or have taken wait-and-see position.**

The creation of strategic vision, legislative framework and financial support system

- Transfer to bio-energy, especially using biogas, will not take place without a political decision and subsequent financial methods
- Political influence of biogas sector is minor when comparing to other renewable fuels (e.g. wind, pellets etc.) – relates to the novelty of the sector
- At the moment biogas is the **least regulated renewable fuel** (no regulation relating to using biogas as a gaseous fuel, no standards and support mechanisms
- Gaseous methane vehicle fuels: first steps, no biogas **upgrading** facilities

Need for international knowledge transfer:

To examine, which have been the **most efficient support mechanisms** (best practices of different types of subsidies and support mechanisms that might be transferable to Estonia) for bioenergy + dissemination

Technology needs – soft+hard

Missing or insufficient local know-how available in

- Design
- Construction
- Construction supervision
- Operation

} of biogas plants ⇨

step to address: **TRAINING**

The management of biogas stations' work and corresponding training in Estonia has so far taken place **only according to the requirements of the supplier of the technology**, and within its competences and possibilities.

Need: to promote the transfer of know-how in the following areas: **design, construction, quality requirements, standards, norms, legislation, and construction supervision of biogas plants** and the training of biogas station operators.

Technology needs – steps to address

- Need for knowledge transfer of technologies
  - of biogas plant (digestion process) **control and automatic technologies, considering** regional climatic and resource-based differences
  - relating to **pre-treatment of biomass** for biogas production to increase efficiency
  - of **dry fermentation** technologies available in BSR
  - Demonstration plants for biogas production, **upgrading** and as use of **vehicle** fuel
  - Regulation and quality control of biomethane for **injection** to natural gas grid

- The solutions that have proven efficient in some other countries **cannot be copied one-on-one but must be adapted** to Estonian needs and condition. The most difficult task in biogas production is ensuring **the reliability of biogas plant and the mixer**, also organising the **tuning and maintenance** that are context-related -> an example of Jööri

Case of Jööri biogas plant in Saaremaa

- First biogas plant in Estonia working on slurry, was completed in March 2006
- Estonian experts were not involved in the design phase, little research was made. It is claimed that in the beginning plant was not equipped with a gas burning device – when process stopped methane was emitted to atmosphere.
- A design mistake – hydrogen sulfide was not extracted from biogas, water+ H2S=sulfuric acid that ruined the generator of CHP
- Also problems with waste water treatment – never started to operate well. Mistakes were probably made in both design and construction phase.
- The story resulted in lawsuits between developers and technology providers.
- The plant started to operate more or less properly in 2008

Many biogas resource owners highlight the Jööri case as a negative example that has reduced their motivation and enthusiasm to invest in biogas plants.

Biogas, agriculture and rural development: Ääsmäe Bioenergy Region concept

- Investment **subsidy** support **limit** is a clear **obstacle** for farmers to become active in producing biogas
- Export support schemes: joint actions via **bioenergy cooperatives**
- The concept of **Ääsmäe Bioenergy Village** via biogas **producers and consumers cooperatives**
- Small towns and regions **are unable** to invest in the transfer to bio-energy - there is **need for incentives** that would encourage smaller boiler houses to shift to using bio-energy.
  - Mainstream technology - burning wooden based fuels restricts biogas development
  - Legal restrictions, smaller bioenergy producers were not supported

Conclusion (1)

- Biogas sector is not profitable in current economic situation in Estonia, differently from Latvia, (feed-in-tariff differs 4 times)
- But biogas has clear public needs and advantages, because its multidimensional character and remarkable potential as renewable energy source

To become profitable, it needs:

- Eco-innovation, knowledge transfer and testing and piloting sustainable production technologies and
- Improving economic, legal, attitudinal and social conditions to become favourable for biogas sector development

Conclusion (2)

Estonia has potentially emerging market for biogas, which:

- needs political strategic agenda, consensus and support
- needs technological, legal, economic and social knowledge transfer
- Positive properly working biogas productions and upgrading demontration plants, which
  - Are tested and adopted to Baltic conditions
  - Follow sustainable production principles
  - Ensures SME and best existing Estonian knowledge involvement