

Biogas tool to boost farm-scale biogas production

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Harvests from bioenergy projects



Biogas tool to boost farm-scale biogas production

What is biogas?

Biogas production potential

Biogas tool:

- Aim and users

Three technologies:

- Wet digestion
- Solid digestion
- Dry digestion

How to use the tool?

Future outlook



Photo: Lilli Frondelius

What is biogas?

Biogas is a gas mixture containing:

- ca. 60% methane
- ca. 40% carbon dioxide
- traces of other gases

Natural gas, on the other hand, is almost pure methane

Biogas can be up-graded to biomethane (>92% CH₄)

Biogas is formed when organic biomass is degraded in anaerobic conditions

Raw materials:

- municipal sewage sludge
- separately collected biowaste
- side streams from food industry
- manure
- grass, straw, crop residues

Can be used in:

- heat production
- combined heat and power production (CHP)
- traffic fuel
- replacing natural gas in industry

Biogas production potential

Total energy consumption in Finland 356 TWh (2020)

Road traffic 42,4 TWh (2020)

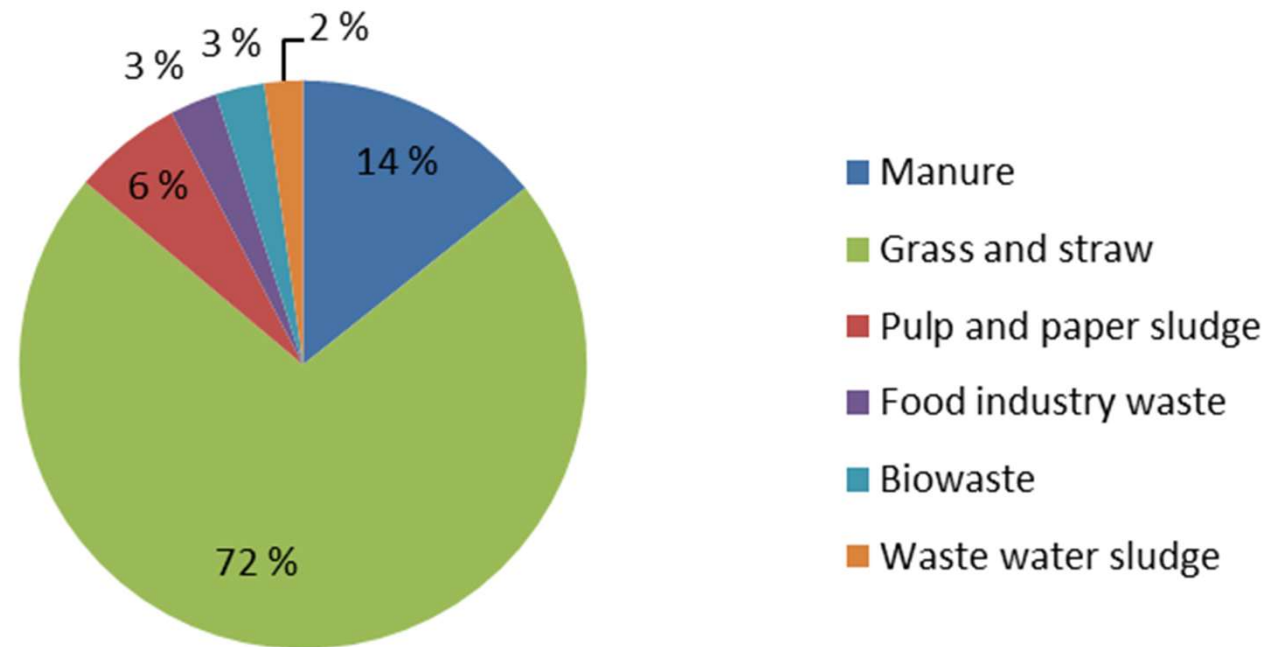
District heating 36,6 TWh (2019)

Peat 15,7 TWh (2019)

Peat 11,8 TWh (2020)

Biogas production 0,9 TWh (2020)

Total biogas production potential (10,2 TWh)



Biogas tool



HANDIHEAT - Northern Periphery and Arctic Programme

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Part of Luke's MAATALOUSINFO service

<https://maatalousinfo.luke.fi/en/laskurit/biogas>

<https://maatalousinfo.luke.fi/fi/laskurit/biogas>

<https://maatalousinfo.luke.fi/sv/laskurit/biogas>



Developed to support farm-scale (max 15 000 t/year) biogas production

Aim:

- Increase knowledge in biogas processing
- Lower the threshold for farmers to build an own biogas plant
- Improving energy and nutrient self-sufficiency on the farms
- Decreasing emissions from agriculture
- Replacing fossil fuels

Users:

- Farmers
- Energy companies interested in co-operation with farmers
- Energy advisers in agriculture
- Consultants
- Students

Three technologies provided in the tool

	Wet digestion	High dry matter digestion	Dry digestion
Feedstock mixture	Dry matter (DM) content $\leq 12\%$	DM content $\leq 20\%$	DM content $> 20\%$
Process type	Continuously stirred tank reactor (CSTR)	CSTR with raw material pre-treatment and circulation of liquid fraction	Batch process, no stirring
Reactor type	Reactor tank built from concrete, partly underground	Modular container structure, process steps take place in separate containers	Based on a leach bed reactor, percolate liquid recycled through the mass in a silo

Wet digestion

- Feedstock mixture with a dry matter content $\leq 12\%$
- Dilution with water if needed
- Continuously stirred tank reactor (CSTR), 35°C
- Optional post-digestion tank (CSTR), no heating, 30 °C
- Reactor tank built from concrete, partly underground



Photo: Sari Luostarinen

High dry matter digestion

- Feedstock mixture with a dry matter content $\leq 15\%$
- CSTR 35°C
- Pre-treatment (homogenization)
- Separation of digestate, and circulation of liquid fraction, if feed DM = 15-20%
- Dilution with water if feed DM >20%
- Modular container structure, the process steps (pretreatment, digestion, gas purification) take place in separate containers



Photo: Demeca

Dry digestion

- Feedstock mixture with a dry matter content $>20\%$
- Batch process, no stirring
- Based on a leach bed reactor, percolate liquid recycled through the mass in a silo



Photo: Erika Winquist

How to use the tool?

INPUT	OUTPUT
<ul style="list-style-type: none">• Raw materials selected from a list with given properties or using own values• Technical solutions for the biogas plant and digestate handling• Operational parameters	<ul style="list-style-type: none">• Biogas production• Biogas plant energy consumption and net energy production• Fertilizer value of the digestate• Income from net production of heat, electricity and/or biomethane• Investment and operating costs• Profitability (annuity method, payback period)

Future outlook

EU/national renewable energy and GHG emission reduction goals

- Replacing fossil fuels with biogas in heat production and as traffic fuel

Pressure for more environmentally friendly and resource-efficient agriculture

- Reducing emissions and recycling nutrients
- Combining food and energy production

Significance of 'Green consumers' increases, branding of agricultural products

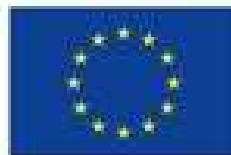
- Carbon neutral milk production
- Biogas used in greenhouse production





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Thank you!



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