Institute for Biogas
Waste Management & Energy

Torrötning - Erfarenheter från Tyskland – fokus i mellanstora anläggningar

Frank Scholwin | Institute for Biogas, Waste Management and Energy | Weimar, Germany

Example: Energy crops in a plug flow fermenter

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Example 1: Energy crops in a garage type fermenter

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- 250 m³/h raw biogas production (12 GWh/a)
- DM concentration up to 25%
- Percolate tank
- solid manure, energy crops
- Methane yield 70-80 % of standard values
- Min 1/3 digestate to be mixed in manually for new filling
- 21-28 days retention time
- Extreme low energy consumption

Modular garage type digesters

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Example 2: Manure / energy crops in a plug flow fermenter

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- 1,250 m³/h (60 GWh/a) biogas production
- DM concentration up to 10%
- 105,000 t per year
- Methane yield 110 % of standard values
- >200 d retention time
- No plug flow
- High solids challenging
- Liquid feeding / solid feeding

Example 2: Manure / energy crops in a plug flow fermenter

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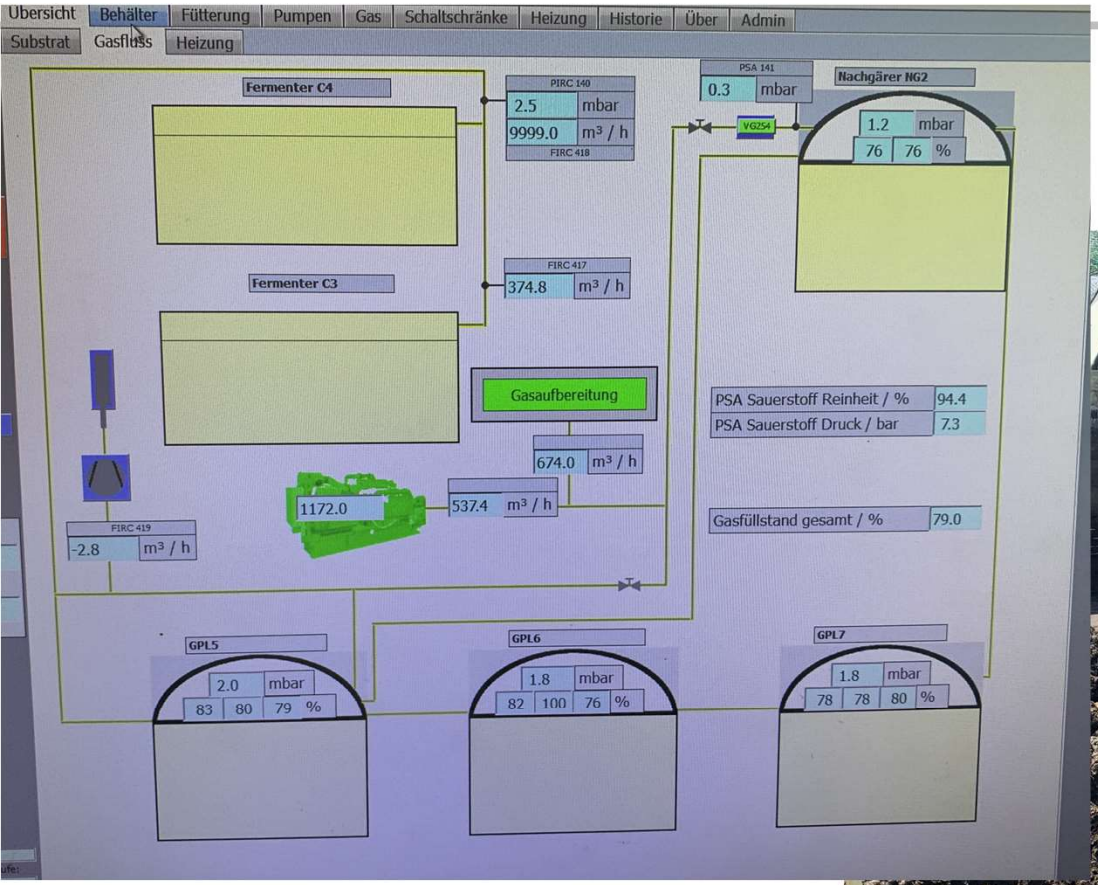

Example 2: Manure / energy crops in a plug flow fermenter – >10,000 t/a straw with Turbomaische

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Example 3: Manure / energy crops in a plug flow fermenter

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- 75 m³/h raw biogas production
- DM concentration up to 12%
- One container – first digestion phase and CHP
- Methane yield 80-90 % of standard values
- 20 d retention time plus covered digestate storage
- Never went into economic benefit
- No plug flow
- High solids challenging

Example 4: Municipal organic waste in a plug flow fermenter

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- 750 m³/h raw biogas production
- DM concentration up to 30%
- 60,000 t per year
- Methane yield 100-110 % of standard values
- 25-35 d retention time
- 2nd stage fermentation to be recommended
- Real plug flow

Example 4: Municipal organic waste in a garage type fermenter

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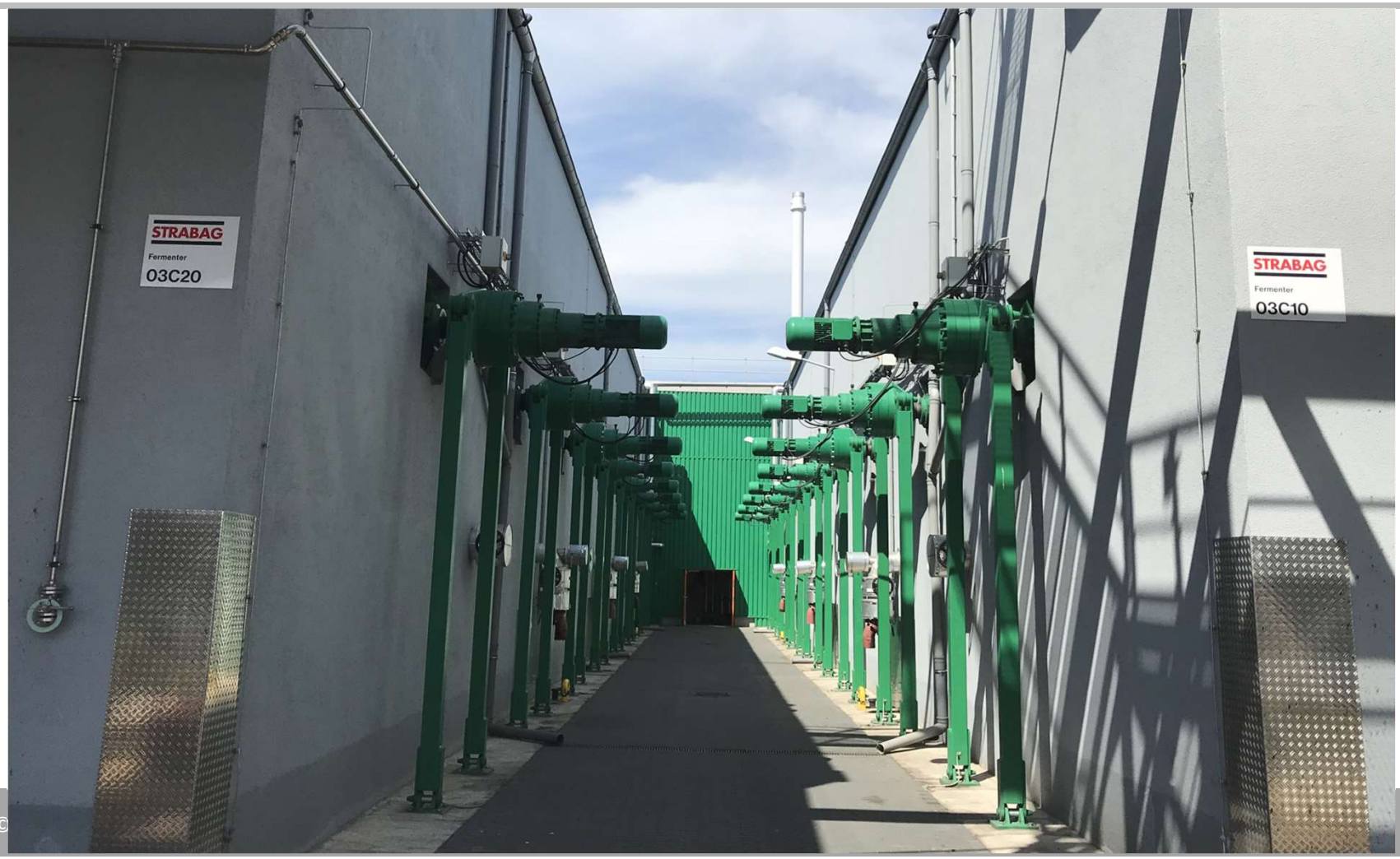

Example 5: Municipal organic waste in a garage type fermenter

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- 500 m³/h raw biogas production
- 18 digesters
- DM concentration up to 40%
- 65,000 t per year
- Methane yield 85-93 % of standard values
- 28-42 d retention time
- After composting
- 1/3 digestate to be mixed back

Example 5: Municipal organic waste in a garage type fermenter

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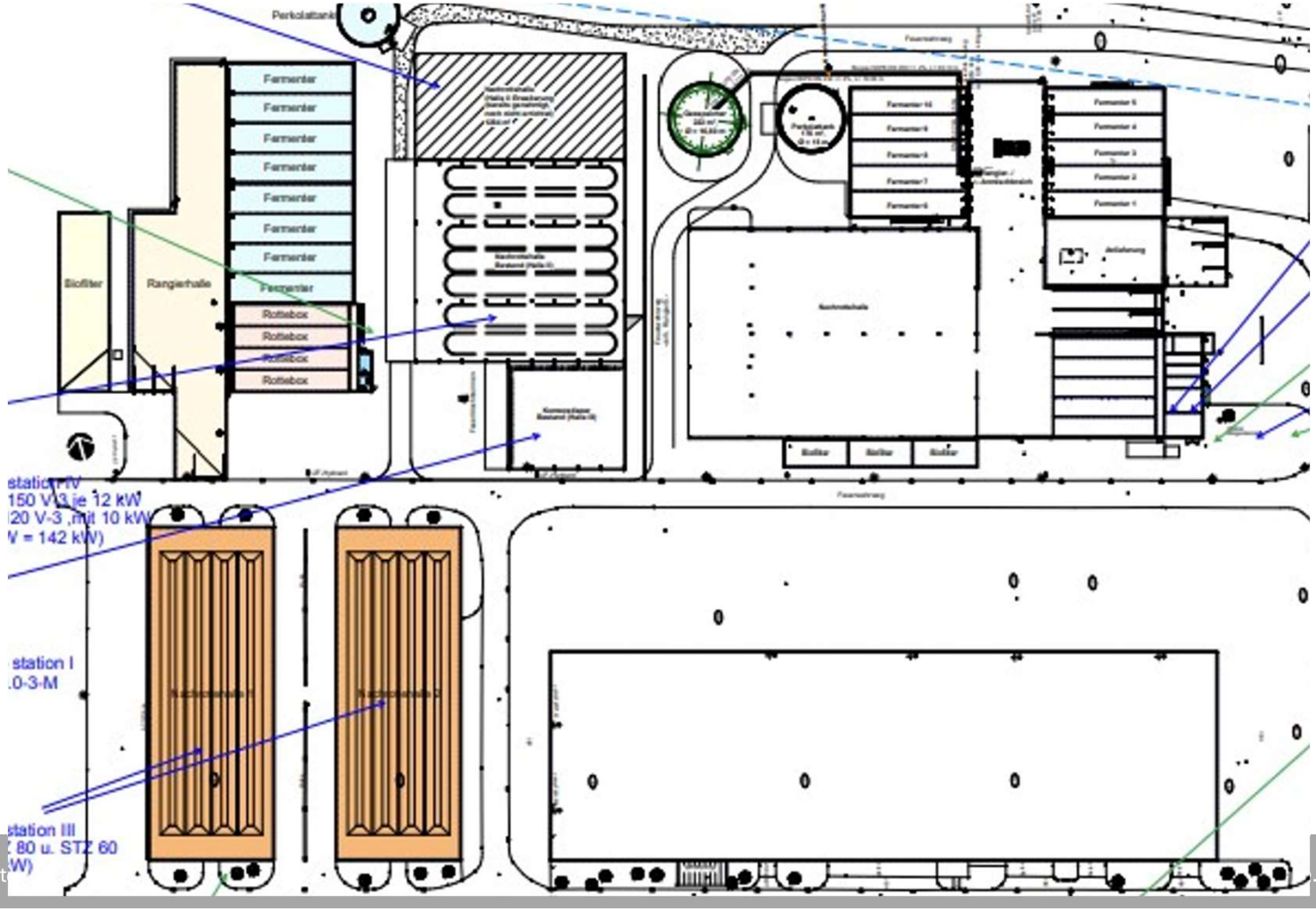

Example 5: Municipal organic waste in a garage type fermenter

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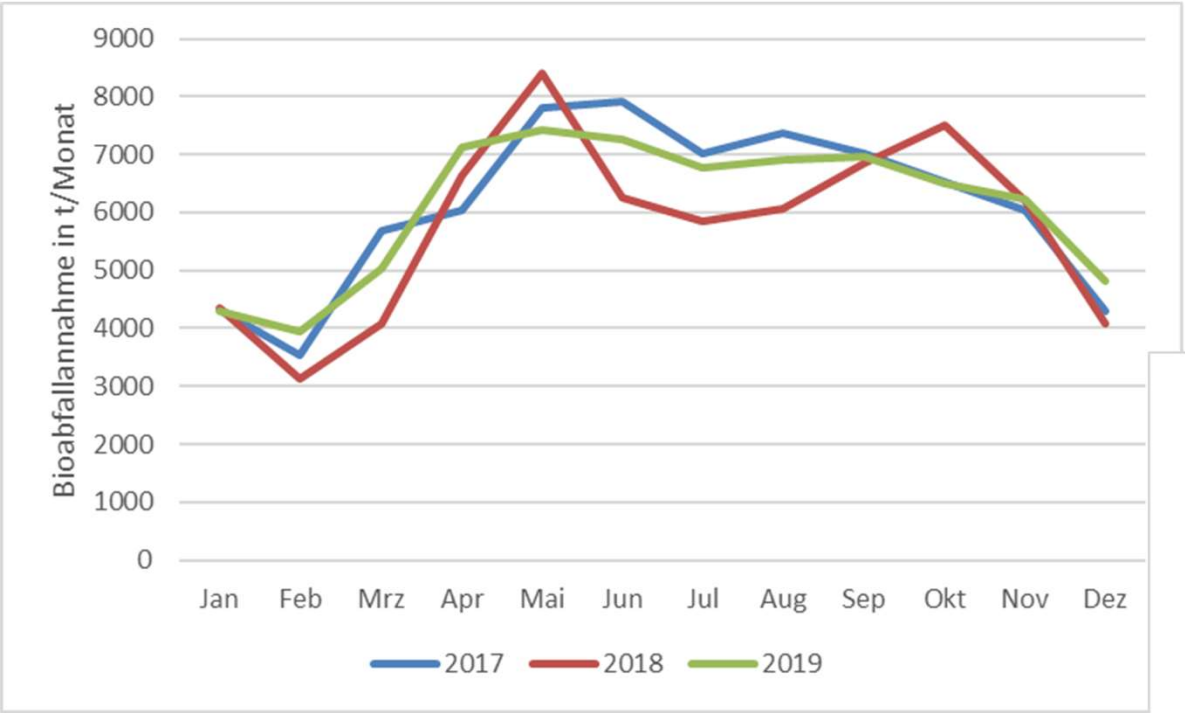

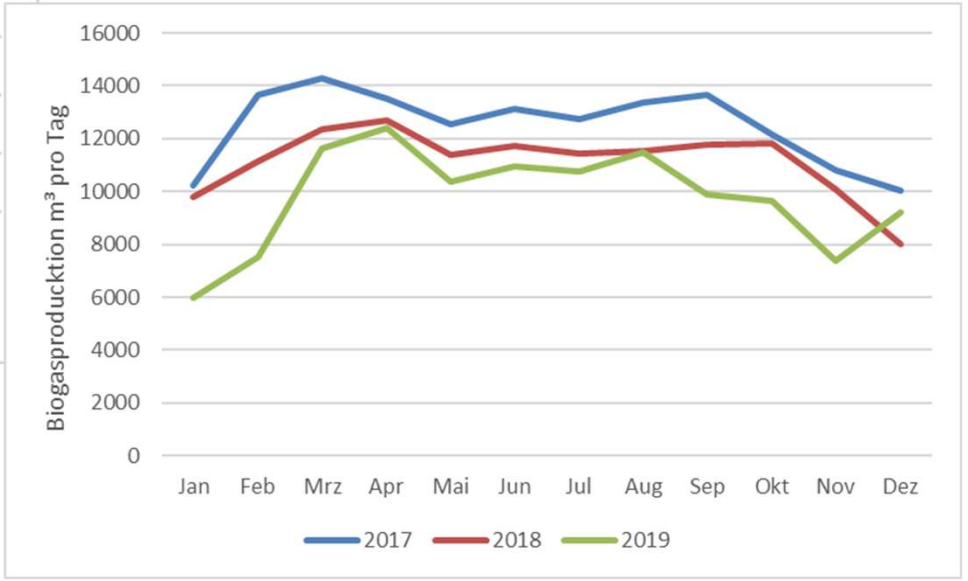

Example 5: Municipal organic waste in a garage type fermenter

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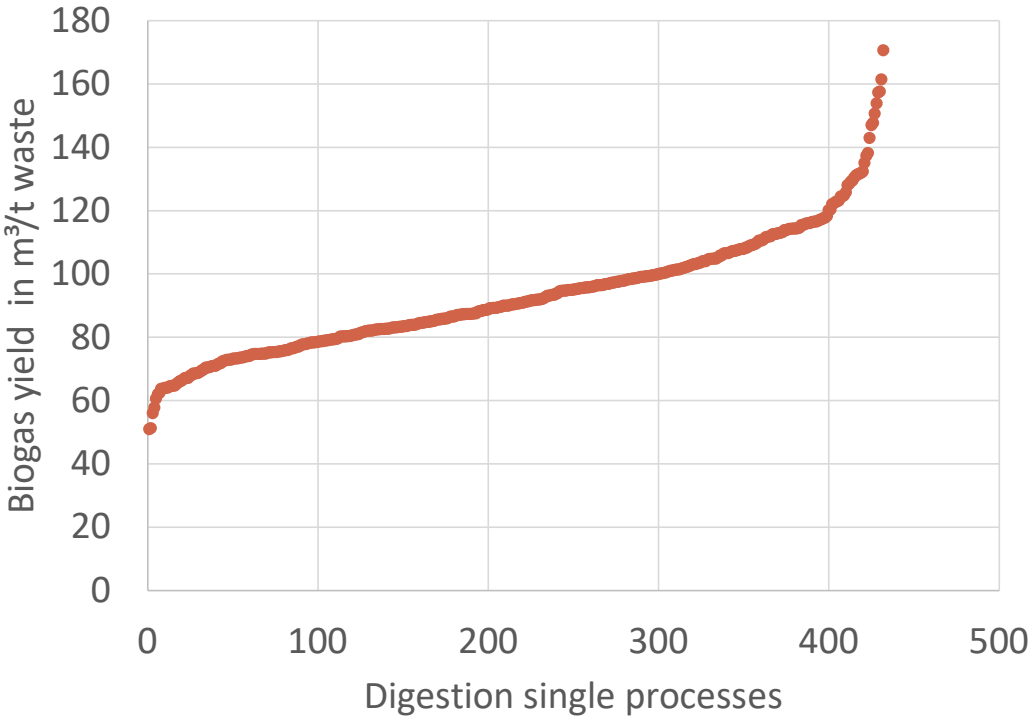
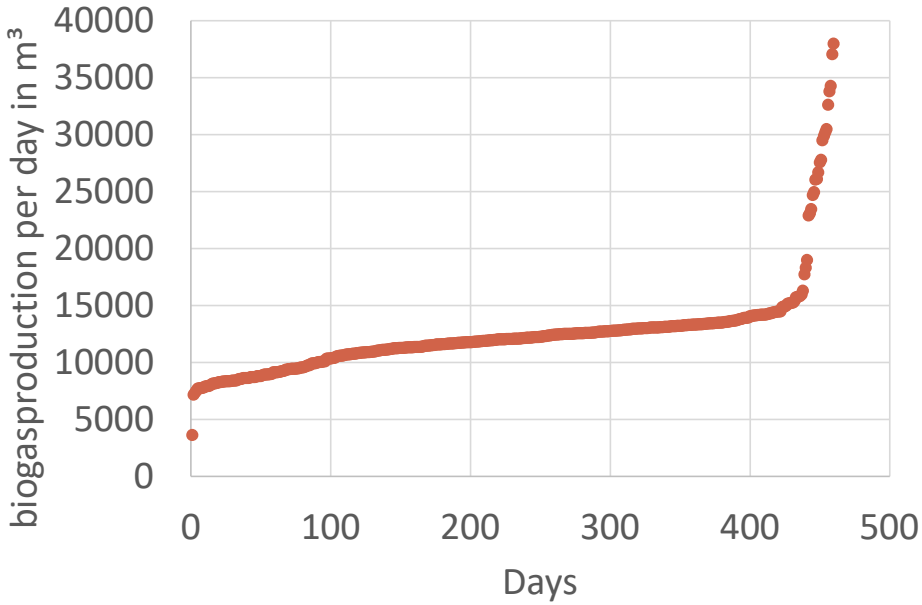
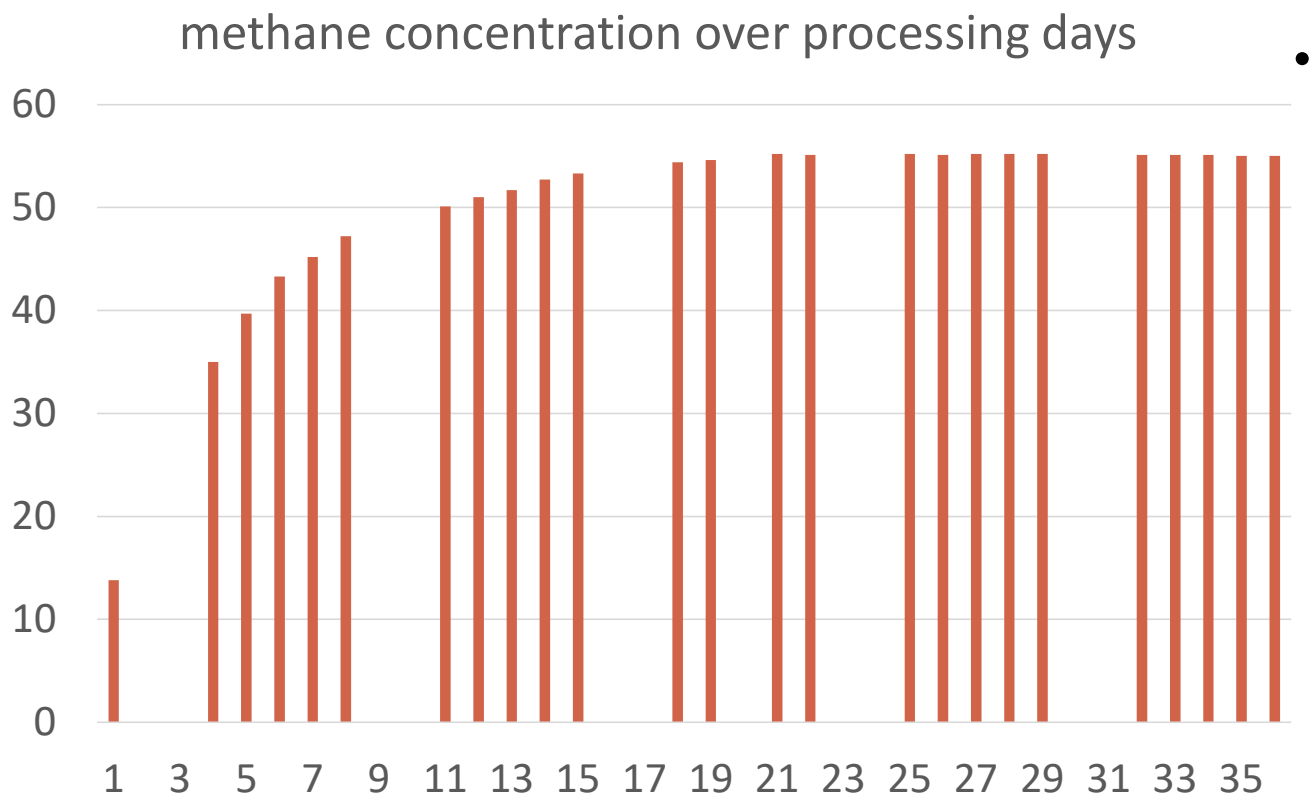




Example 5: Municipal organic waste in a garage type fermenter



- Challenge:
  N_2 and O_2 in the gas

Example 6: Energy crops in a high solids CSTR

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- 150 m³/h raw biogas production
- DM concentration up to 20%
- OLR up to 12 kgODM/m³d
- Energy crops, solid manure
- Slow mixers with large blades
- Biological monitoring suggested

Example 7: Solid manure in a high solids CSTR

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- 500 m³/h raw biogas production
- DM concentration up to 15%; OLR up to 7 kgODM/m³d
- solid manure, chicken manure, energy crops
- Methane yield 120 % of standard values
- Slow mixers with large blades
- Biomix, Disruptor, liquid feeding

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- Dry fermentation – needs to be defined and seems to be no specific type of technology.
- High solids fermentation – quite good experiences, stable process biology and in some cases a really defined hydraulic retention time can be achieved without short circuit flow
- High solids fermentation in plug flow and CSTR at high process efficiency possible
- Garage type digesters: allow throughput of waste, but do not reach very good biogas yield and usability of the gas

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