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Concept study for “Manure-to-Electricity” at small-scale farms: The Swiss case

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The potential from manure: Small-scale farms



Fig. 1: Geographic distribution and magnitude of yearly manure resources in Switzerland.

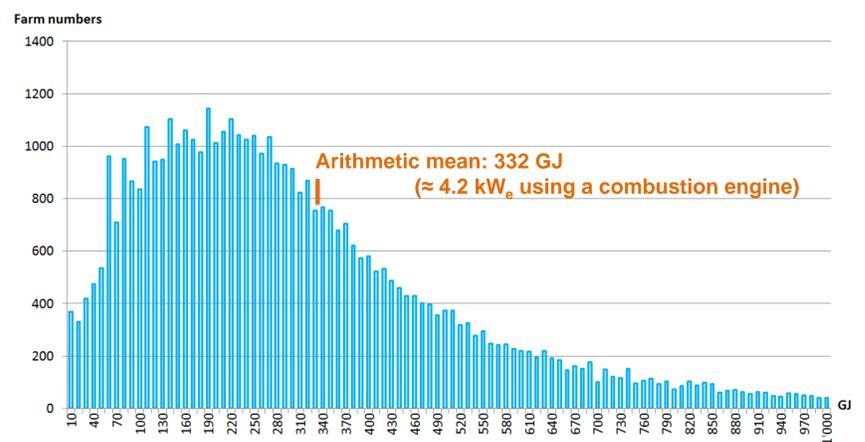


Fig. 2: Distribution of Swiss farms, by size of their yearly manure resource.

Today's problem: Costs at small scales

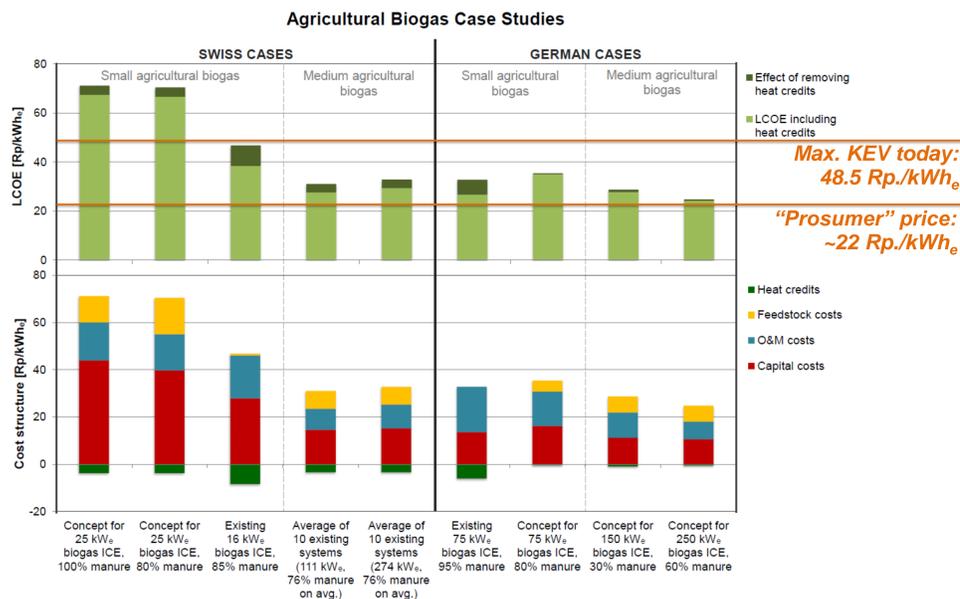


Fig. 3: Costs of electricity production from case studies of small-scale agricultural systems. ICE = internal combustion engine; LCOE = levelized cost of electricity; O&M = operation & maintenance

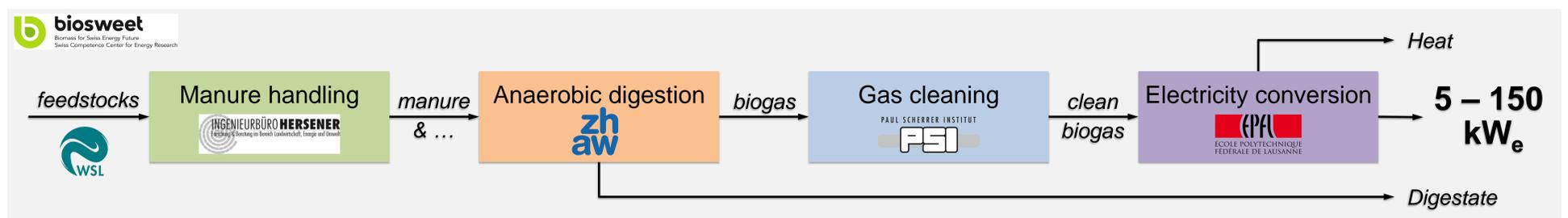
Electricity costs today are high for small-scale manure systems:

- Systems <150 kW_e exceed the “prosumer” price target (~22 Rp./kW_e)
- At very small scale (<25 kW_e), costs can be higher than the max. feed-in tariff (KEV) received today (48.5 Rp./kW_e), more than double the “prosumer” price target.

Multiple possible action lines could reduce the costs:

- Reduce per-kW_e investment cost of electricity generation unit (e.g., fuel cells instead of ICE)
- Design and market cost efficient and legally permissible small-scale digesters
- Evaluate non-electricity bioenergy options (e.g. upgrading to biomethane)
- Develop turnkey standard CHP systems and a supply chain for broad & fast deployment of such CHP systems in the agricultural sector.

Goal of the project: Identify most promising approaches



Questions of scale, cost, technological readiness and dynamic response:

- Manure resource type and relevant scale for Switzerland
- Concepts for storage/transport of manure, intermediate products, digestate
- Review on small scale anaerobic digestion
- Appropriateness of SOFC for electricity conversion vs. ICE
- Techno-economic feasibility at small to medium scale manure-to-electricity CHP (5 - 150 kW_e)